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## Where There Is No Engineer - Designing for Community Resilience

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# Where There Is No Engineer

## Designing for Community Resilience





**Where There Is  
No Engineer  
Designing for  
Community Resilience**

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Dublin Institute of Technology**

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# Contents

<b>01 - Introduction</b>	<b>5</b>
<b>02 - WTINE Sponsors and Partners</b>	<b>8</b>
<b>03 - Development Education</b>	<b>15</b>
3.1 Development Aid	15
3.2 Development Education	17
<b>04 - Global Development Concepts</b>	<b>22</b>
4.1 Core Concepts	22
4.2 What were the Millennium Development Goals (MDGs)?	25
4.3 What are the Sustainable Development Goals (SDG'S)	28
4.4 SDG 11 Make cities and human settlements inclusive, safe, resilient and sustainable	31
4.5 What is the Habitat for Humanity SOLID GROUND Project?	37
<b>05 - WTINE Programme Areas</b>	<b>38</b>
5.1 Climate Resilient Infrastructure	39
5.2 Self Supply Water and Sanitation	55
5.3 Community Participatory Health	71
5.4 On and Off (Micro) Grid Energy Systems	80
5.5 Food Security	91
5.6 Applying Big Data in the Community	97
<b>06 - Where There Is No Engineer - Learning Outcomes &amp; Programme Rules</b>	<b>104</b>
6.1 Who can participate?	106
6.2 What are the categories?	106
6.3 How can I participate?	106
6.4 What project area can I choose?	107
6.5 What are the Submission Requirements?	108
6.6 Report Review Process	108
6.7 National Finals Day	108
<b>Appendix A</b>	<b>110</b>
Where There Is No Engineer Final Submission	110
<b>Appendix B</b>	<b>113</b>
Adapted from Atlas of Sustainable Development Goals 2017	113



# 01 – Introduction

**“Where There Is No Engineer – Designing for Community Resilience”** is a design initiative coordinated by the Development Technology in the Community (DTC) Research Group, Dublin Institute of Technology (DIT) and Engineers Without Borders (EWB) Ireland.

The programme is delivered in partnership with various development partners and Engineers Ireland. It provides participants with the opportunity to learn about design, teamwork and communication through real, inspiring, sustainable and cross-cultural development projects.

By participating in the programme, students and professionals will have the opportunity to design creative solutions to real life development projects. This initiative formed part of the DIT team submission which received the Inaugural Engineers Ireland Education Award Best in Class 2017.

[www.wherethereisnoengineer.org](http://www.wherethereisnoengineer.org)



From Left: Dominic MacSorley, Concern, Sean O Hogain DTC/DIT, Gerry Tobin, Davies Ireland, Ms. Joan Burton T.D., Liam McCarton DTC/DIT.



# Exploring the Relationship between People, Technology and The Environment



The design brief is based on a set of six global development themes;

- **Climate Resilient Infrastructure**
- **Self-Supply Water and Sanitation**
- **Community Participatory Health**
- **On and Off (Micro) Grid Energy Systems**
- **Food Security**
- **Applying Big Data in the Community**

Each theme explores the relationship between People, Technology and the Environment. The setting for this programme varies on an annual basis. The programme is open to students and professionals across

the disciplines of engineering, architecture, urban planning, science, business, social science, arts, media etc. Organisations participating within other development challenges in Ireland and UK may also enter their submissions for consideration in this design initiative.

Each Institute may nominate up to four submissions for external review. The project can run over semester 1 or 2 depending on the course requirements. A professional design initiative will run parallel to the undergraduate programme whereby individual companies or consortiums will be invited to participate in teams to develop an innovative solution for the communities within the programme country selected. For professionals participating in the programme Continued Professional

Development (CPD) hours can be allocated for time spent on this project.

The “Where there is no Engineer” design initiative submission process closes on 1st May each year. Outstanding undergraduate teams, together with professional teams from each region will be invited to participate in the National Finals where their work is reviewed by a multidisciplinary panel of judges.

The National showcase event is held in June each year. There is an overall award sponsored by Davies Group Ireland. The Davies Award funds the

winning team to travel to the country to implement their design concept with a local development partner.

There are four Innovation Awards sponsored by the ARUP Trust. These awards provide funding to teams to develop their concepts to prototype design stage with continued support from DIT / EWB.

A micro-irrigation project in Madowadi, northern Kenya is bringing a much needed alternative means of food production to the pastoralists. Here DarmiSora collects water from a pan built by CIFA, Concern’s partner agency in the region. The water will be used to help irrigate the land on which she is now growing vegetables.

Source: Gideon Mendel, Concern, 2013



# 02 – WTINE Sponsors and Partners

## Programme Funders



**DEAR** is an EU program on Development Education and Awareness Raising. The objectives of the program are to inform EU citizens about development issues and provide EU citizens with tools to engage critically with development.



### Irish Aid

An Roinn Gnóthaí Eachtracha agus Trádála  
Department of Foreign Affairs and Trade

**Irish Aid** provides funding through an Annual Development Education Grant and Strategic Partnership programme for organisations engaged in promoting understanding of, and engagement with, global development and justice issues.

## Programme Co-ordinators



Development  
Technology in the  
Community (DTC)  
Research Group

**The Development Technology in the Community Research Group (DTC)**, was established for the promotion of Sustainable Environmental, Water and Sanitation Technologies. It is supported by the School of Civil & Structural Engineering, Dublin Institute of Technology, Ireland.

The programme co-ordinators are:  
Liam McCarton (liam.mccarton@dit.ie)  
and Dr. Sean O'Hogain (sean.ohogain@dit.ie).

[www.dit.ie/dtc](http://www.dit.ie/dtc)



EWB Ireland

**Engineers without Borders (EWB)** Ireland are committed to bridging the gap between academia, industry and NGOs to give Irish engineers opportunities to learn about and contribute to sustainable development globally.

[www.ewb-ireland.org](http://www.ewb-ireland.org)

## Programme Partners



**Habitat for Humanity** is a global housing organisation to fight poverty by partnering with communities to help build a safe home. Their Global Village volunteering programme invites volunteers to travel overseas to help a family build a home, strengthen their community, and enrich both their lives and your own.



**Concern worldwide** are an international humanitarian organisation working in partnership with communities to help people to achieve major and long lasting improvements in their lives.



**The ARUP Charitable Trust of Ireland** supports a diverse range of projects in the general education and engineering education field. The aim of the Trust is to achieve as wide a reach as possible with their donations.



With almost 24,000 members from every discipline of engineering, **Engineers Ireland** is the voice of the engineering profession in Ireland. They have built strong and mutually beneficial relationships with many Irish companies and organisations through our professional and educational initiatives.



**Nepal Ireland Society** aims to strengthen ties between Nepal and Ireland. It achieves this through the promotion of tourism and cultural exchange between Nepal and Ireland, and supporting development education and charitable organisations working in Nepal.



**DAVIES** sponsor the International WTINE Award. Davies is a specialist plumbing, heating and drainage business with a 40,000 sq ft facility on the north side of Dublin. Davies team work closely with its partner customers to provide solutions to some of the most prestigious project undertaken in Ireland.



**WTINE Davies Award Winners with local communities in Nepal 2017.**

**Of course the main programme partners are the communities of the selected countries.**



# Engineers Without Borders Ireland

EWB-Ireland is a volunteer led organisation which is dedicated to bridging the gap between academia, industry and NGOs to give Irish engineers opportunities to learn about and contribute to sustainable development globally.

The mission of the organisation is to partner with disadvantaged communities to improve their quality of life through education and implementation of sustainable engineering projects, while promoting global experience and development education for engineers, engineering students, and similarly motivated non-engineers.

More information on the members can be found at [www.ewb-ireland.org](http://www.ewb-ireland.org)

## Education Sector

EWB-Ireland operates as an educator and facilitator of development education through its university chapters and through the annual "Where there is no Engineer" competition. Currently, EWB-Ireland has university chapters in QUB, UCD and UCC with plans to expand further over the coming years. The organisation also collaborates with university and school groups on Science, Technology, Engineering and Mathematics (STEM) events around Ireland. This includes hosting information stands, education sessions, event speakers, and interactive workshops.

## Professional Sector

EWB-Ireland also hosts various information and educational events throughout the year for students and professionals, for those in the engineering sector or related fields. EWB Ireland's annual conference is held in Engineers Ireland in March and brings together students and experts in development engineering from around the world.

## Partnerships

In November 2017 EWB-Ireland announced a new three year partnership with ARUP, a multi-national professional services with offices in 35 countries with over 13,000 employees around the world. Every year, ARUP employees volunteer their skills and services through thousands of hours of community engagement projects. This new partnership with EWB connects ARUP branches in Ireland, Italy and the Netherlands with the local EWB chapters, with the hope of expanding to additional countries in Europe.

## Future Plans

EWB-Ireland wishes to build on its existing work and projects with the addition of a structured volunteer program, as part of the EU DEAR goals. This will involve students or professional staff travelling overseas to work on a specific project for a number of weeks.

## How to Get Involved

EWB-Ireland is always looking for new volunteers! Members of the public can get involved by joining our national committee, by joining or starting a new regional chapter, or by coming along to national events. There is no requirement to be an engineer, anyone with an interest in design, innovation, development education, or global citizenship is welcome to join. For more information please follow us on Facebook, Twitter or LinkedIn, sign up to our newsletter, or contact us by email at [info@ewb-ireland.org](mailto:info@ewb-ireland.org) or [katie.mahon@ewb-ireland.org](mailto:katie.mahon@ewb-ireland.org).



**Creating a community of  
global engineers.**





## 03 – Development Education

### 3.1 Development Aid

Development aid was generally considered to be financial aid given by governments and non government agencies (NGOs) aimed at supporting the economic, environmental, social, and political development of developing countries. The concepts of development aid were spelt out by Harry Truman in 1949 when he said what is needed globally is *“a bold new programme for making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas. More than half the people of the world are living in conditions approaching misery. Their food is inadequate. They are victims of disease. Their economic life is primitive and stagnant. Their poverty is a handicap and a threat both to them and to more prosperous areas. For the first time in history, humanity possesses the knowledge and skill to relieve the suffering of these people.”*

Development Aid was in the early days very much linked to economic development. The theory was that increased production was a fundamental necessity to escape the

poverty trap and that all countries would benefit automatically from increased output. This did not always happen. Development aid began to split into different types.

Bilateral aid refers to the situation where finances or resources are donated by a country but with conditions attached. These conditions will often favour the donating country. Charitable aid refers to non government organisations (NGOs) whose presence and projects in developing countries are funded by donations from the public through charitable organisations such as Oxfam, Concern Worldwide or Care International. Multilateral aid is aid given by international organisations such as the World Bank rather than by individual countries. Development aid is different from humanitarian aid in that the latter tends to be a short term response dealing with emergency situations, while the former is more long term, focusing on the alleviation of poverty within a region with the long term goal of achieving a self-sustainable community, no longer dependant on aid.

Development is now concerned with

**“If you think you are too small to make a difference, try sleeping with a mosquito in the room.”**

Dalai Lama XIV

so much more than economics. It has come to focus on issues such as access to and control of resources, and access to services. As a result development aid finds itself addressing poverty and its core causes. It also finds itself confronting inequality. Research has shown that more equal societies do better on a range of social indicators, with better social cohesion, lower crime levels and stronger economies.

Development aid is essential in helping the very poorest and most under developed countries to reach a stronger, more stable position in order to travel their own sustainable development journey. Equally essential is the part that aid plays in educating and enabling citizens of developing countries to self-organise in order to demand that their governments use their finances wisely and accountably, ensuring that all people, including the poorest and most marginalised, achieve equal rights and access to freedom of expression, education and advancement. The words of another President are apt to describe this, *“Development is the possibility of flourishing in one’s community and culture, and access to the means to do so is not simply a gift to be meted out by a gracious benefactor; it is both a right and a moral obligation”*, Michael D. Higgins, President of Ireland.

Poverty exists on a global scale as well as existing here in Ireland. There are 700 million people worldwide living in extreme poverty. Those living in extreme poverty - defined by the World Bank as those living on less than \$1.90 per day - do not have the basic needs for survival. Extreme poverty can take many forms; many face

starvation, many more do not have access to clean, safe drinking water, others do not have adequate housing and still more do not have access to proper healthcare and medicine. 795 million people do not have enough food to lead a healthy active life. That is roughly one in nine people on earth. The majority of the world’s hungry live in developing countries, where 12.9 percent of the population is undernourished. Hunger and malnutrition are the number one risk to health worldwide. While on a different scale it is interesting to note that according to Social Justice Ireland in Ireland roughly 750,000 people are at risk of poverty. To be at risk of poverty in this country is to live on less than €202 a week ([www.socialjustice.ie](http://www.socialjustice.ie)). Those at risk of poverty do not enjoy the same standard of living as everyone else; they often cannot afford to heat their homes, they might not eat regular meals, and they cannot participate in everyday social and economic activities. Food poverty – the inability to afford or access healthy food – impacts on low income groups but children, lone-parent families and the unemployed are particularly at risk. One Irish child in five goes to school or to bed hungry.

Inequality is also a global problem. Across the Developing World there are groups of people such as rural women, ethnic minorities and indigenous peoples that encounter entrenched inequalities such as limited or interrupted education, the right to own land or livestock, access to land, resources or finances. Denial of these people’s rights to education, ownership of land and access to finances and technology is damaging

and harmful not only to the people themselves but to wider society and to the economy generally.

Climate Change is also a global issue. Global temperatures have been rising since records first began over 100 years ago. Between 1880 and 2012 the average global temperatures increased by 0.85 degrees Celsius meaning annual yields from maize wheat and other major crops are dropping significantly in recent times.

Both inequality and climate change are also issues of growing importance in Ireland. Women are still, on average, paid less than men. They are also more likely to work in work that is precarious, which is work that is uncertain, unpredictable and risky. The Travelling Community is one of the most marginalised groups in Irish Society, facing an 84% unemployment rate. 2,700 people from the Travelling Community do not have access to running water. Members of the Travelling Community also have a lower than standard life expectancy and are at a greater risk of dying by suicide. Climate change has seen temperatures in Ireland also increasing annually. An increase in rainfall has been recorded on the north and west coasts. With more seasonal flooding and rising sea levels, and with 60% of Ireland living within 10 km of the coast, areas of eastern coast line under serious threat.

Conflict and violence worldwide are also a development issue. There might be fewer wars occurring in the past couple of years, but intensification of violence means a greater number of fatalities. Intense fighting in Syria, Iraq,

Afghanistan and elsewhere resulted in 180,000 deaths in 2015. Civilians continue to suffer as a result of conflict and displacement. The International Red Cross have stated that more than 70 million people have been forced to leave their homes because of conflict. Many of these people have migrated to other neighbouring countries that may also be struggling with their own issues of poverty and adversity. 51% of the global refugee population are children under 18 years of age. In 2017, most refugees and Internally Displaced People (IDPs) were from Syria, followed by Libya, Afghanistan and Somalia, along with other countries in Saharan Africa.

## 3.2 Development Education

Development Education aims to promote an increase in awareness and understanding of the interdependent and unequal world in which we live. Development Education strives to do this through a process of interactive learning, debate, action and reflection. It challenges perceptions of the world and encourages us to act for a more just and equal society at a national and an international level – creating global citizens who can feel empowered to act and engage in a practical manner within their community, as well as with national and international governments, to facilitate a continuous process of learning, improvement, progress and potential policy change.

## POVERTY

### POVERTY ON A GLOBAL SCALE

Those living in extreme poverty - that is living on less than \$1.90 a day (as defined by the World Bank) - do not have the basic needs for survival. There are 700 million people worldwide living in extreme poverty. Extreme poverty can take many forms; many face starvation, many more do not have access to clean, safe drinking water, others do not have adequate housing and still more do not have access to proper healthcare and medicine.

## HUNGER

### GLOBAL HUNGER STATISTICS

795 million people do not have enough food to lead a healthy active life. That is about one in nine people on earth.

The majority of the world's hungry live in developing countries, where 12.9 percent of the population is under-nourished. Hunger and malnutrition are the number one risk to health worldwide.

## INEQUALITY

### GLOBAL INEQUALITY

Across the Developing World there are groups of people such as rural women, ethnic minorities and indigenous peoples that encounter entrenched inequalities such as limited or interrupted education, the right to own land or livestock, access to land, resources or finances.

Denial of these people's rights to education, ownership of land and access to finances and technology is damaging and harmful not only to the people themselves but to wider society and to the economy generally.

### POVERTY IN IRELAND

In Ireland currently, roughly 750,000 people are at risk of poverty. To be at risk of poverty in this country is to live on less than €202 a week.

Those at risk of poverty do not enjoy the same standard of living as everyone else; they often cannot afford to heat their homes, they might not eat regular meals, and they cannot participate in everyday social and economic activities. According to Focus Ireland there are approximately 9,652 people homeless (April 2017).

### HUNGER STATISTICS IRELAND

While the poverty line has fallen by 16% since 2008, nearly one in seven people in Ireland are still in consistent poverty. Food poverty – the inability to afford or access healthy food – impacts on low income groups but children, lone-parent families and the unemployed are particularly at risk. One in five children goes to school or to bed hungry (Health Behaviour in School Aged Children 2012).

### INEQUALITY IN IRELAND

Women are still, on average, paid less than men. They are also more likely to work in work that is precarious, which is work that is uncertain, unpredictable and risky.

The Travelling Community is one of the most marginalised groups in Irish Society, facing an 84% unemployment rate. 2,700 people from the Travelling Community do not have access to running water. Members of the Travelling Community also have a lower than standard life expectancy and are at a greater risk of dying by suicide.

# CLIMATE CHANGE

## GLOBAL CLIMATE CHANGE

Global temperatures have been rising since records first began over 100 years ago. Between 1880 and 2012 the average global temperatures increased by 0.85 degrees Celsius. This means annual yields from maize, wheat and other major crops have been dropping significantly in recent times.

# CONFLICT and VIOLENCE

## WORLDWIDE CONFLICT

There might be fewer wars occurring in the past couple of years, but intensification of violence means a greater number of fatalities. Intense fighting in Syria, Iraq, Afghanistan and elsewhere resulted in 180,000 deaths in 2015. Civilians continue to suffer as a result of conflict and displacement.

# MIGRATION

## MIGRATION WORLDWIDE

There are currently over 65 million refugees and IDPs (Internally Displaced Persons) worldwide. That is 65 million men, women and children who have fled their homes because of conflict, violence or oppression. Most of these people are in the developing world which means that they've left their home countries for other countries that might also be struggling with poverty and adversity. 51% of the global refugee population are children under 18 years of age. (UNHCR and ECHO)

In 2015, most refugees and IDPs were from Syria, followed by Afghanistan and Somalia.

## CLIMATE CHANGE, IRELAND

Temperatures in Ireland are also increasing annually. An increase in rainfall has been recorded on the north and west coasts. With more seasonal flooding and rising sea levels, and with 60% of the population living within 10 km of the coast, areas of the eastern coast line are under serious threat.

## CONFLICT IN IRELAND

Ireland is a safe place to live with regard to violence and conflict. Apart from burglary, crime rates are significantly lower than in previous years, particularly drug and gun related incidents. But on the domestic front, 14% of women in Ireland have experienced physical violence from a partner.

## MIGRATION IN IRELAND

The Direct Provision system was established in Ireland in 2000 to house asylum seekers entering the country in search of international protection. This replaced the previous social welfare scheme. It was initially described as an "interim" system, providing accommodation for 6 months while asylum seekers awaited an outcome on their application. In reality, most people spend on average of 3 years in Direct Provision (DP), with many spending up to 10-12 years there. In July 2018, there were 5,138 people living in DP centres in Ireland.

Residents are provided with just €21.60 a week per person, and live in hostel style accommodation. They are usually prevented from cooking their own meals (relying solely on canteen meals), are unable to study beyond post-primary school, and are unable to work unless a long list of strict conditions are fulfilled. They are 5 times more likely to experience mental health issues.

Ireland committed to taking 4,000 refugees under the Irish Refugee Protection Programme (IRPP) by the end of 2017, but to date has welcomed only 859 of the 4,000.

**Development Education is being aware of things around you, being aware of your environment and your community, being aware of yourself and your place in the world. It involves questioning why things are the way they are and asking how they can be better, how can poverty, hunger, inequality and even climate change be addressed to benefit all of humankind.**

It is being conscious of your power as a consumer and a citizen, as a voter, as a parent, or student, as a member of society. This responsibility and awareness extends to your environment and your community. It extends beyond your community, to your county and your city, beyond your home country, it extends to the whole world. Because when you become aware of your power as a voter and a citizen then you start to ask questions. Why is a child in a slum or refugee camp thousands of miles from here,

or a child in single parent family flat around the corner from where you live, any less worthy or any less valuable than one of our own family, our own daughter or little brother? Linking local to global issues is the very essence of Development Education and Global Citizenship.

The concept of Development Education grew out of the increasing involvement of Non-Governmental Organisations', Churches' and Trades Unions' movements in the problems of developing countries and the problems with development aid. It aims to raise awareness of conditions in developing countries and also to show how these problems are interlinked with how we in the developed world live our lives. It promotes equality, sustainability, resilience and empowerment as these are issues that will serve to improve the world we live in. It has since become mainstream and is now supported mostly by governments through their aid organisations or via government departments and ministries. In Ireland for example, most Development Education is supported through Irish Aid, the Irish Government's programme for overseas development, this is managed in turn by the Development Co-operation Division of the

**"Everytime you spend money, you are casting a vote for the kind of world you want"**

Anna Lappé

Department of Foreign Affairs and Trade. Internationally it has also been incorporated, in some countries, into the education curriculum at first, second and third levels. Development Education can now be said to focus on global citizenship. This is clearly stated in **Goal 4.7 of the Sustainable Development Goals**. This states that "By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development."

One in every six people in Ireland supports volunteers or is active in his or her local community on social issues. The most successful campaigns are those that fired people's imaginations.

What is it about these movements that made them so successful? Some were slow burners, others were bright flashes that lit a flame. Some were considered and thoughtful, taking years of planning and lots of funding, and others were a spontaneous reaction to injustice.

### **How can I become an Active Citizen?**

Get involved in a campaign or cause that interests you. Whether it's literacy, the aged, animal welfare, gender equality, LGBTQ rights, justice, the environment, a cause

that's close to your heart and that inspires you will keep you interested and engaged. It may even be **"Where there is no Engineer – Designing for Community Resilience"**.

As well as doing something that you're passionate about, do something you're good at! The combination of passion and skills is a sure-fire winner. If you can utilise your skills as an educator, as a good listener, as a journalist, as a cook, as a speech-writer, as a cartoonist, to further the aims of your chosen cause then you're well on your way to becoming an active global citizen. If you are unsure about what skills or attributes you can use to contribute, fear not! There are plenty of ways to get involved. Join online groups and campaigns, add your signature and your voice and your presence to petitions, and international campaigns. Vote with your feet and join marches or demonstrations on issues you feel strongly about.

### **Use your mind and your voice**

Just by speaking about an issue which you feel passionate about, you may change the mind of one person close to you, which might motivate them to get involved. In this simple way, you have already made a difference to someone's life.

You can check out the Development Education courses and agencies in further detail on

[www.wherethereisnoengineer.org](http://www.wherethereisnoengineer.org)

The choices we make every day make us potential activists and educators.



# 04 – Global Development Concepts

## 4.1 Core Concepts

### 01 VULNERABILITY



#### WHAT IS VULNERABILITY?

Vulnerability comes from the Latin word for “wound,” *vulnus*, and may be defined as *being susceptible to being damaged or harmed*.

In terms of cities, vulnerability is used to denote weaknesses that expose the city to harm.

This harm can be inflicted on the infrastructure, the population or the food supply.

These weak/vulnerable points can be due to climate change, the location of the city, poor planning and law enforcement or poor infrastructure.

### 02 RESILIENCE



#### WHAT IS RESILIENCE?

Resilience comes from the Latin word *resilio*, which means to spring back, and may be defined as *the ability of a system or city to cope with disturbing or destabilising forces*.

These forces may be climate change, natural disasters or human induced events.

Therefore resilient cities are designed and built to cope with disturbance and destabilisation and to absorb these events and continue as near to normal as possible.

## 03 DIVERSITY



### WHAT IS DIVERSITY?

Diversity is derived from the Latin word "diversus" meaning various or different ways.

In order to increase diversity we need to develop a robust infrastructure system which is a mix of high tech engineered infrastructure together with diverse nature based solutions.

## 04 SUSTAINABILITY



### WHAT IS SUSTAINABILITY?

Sustainability involves the long term maintenance of well-being, which in turn depends on the well-being of the natural world and the responsible use of natural resources.

Therefore we can reduce vulnerability in cities by sustainably promoting resilience, i.e. improving the ability of the city to resist disturbance in a resource efficient manner.

**REDUCED  
VULNERABILITY**



**INCREASED  
RESILIENCE**



**INCREASED  
DIVERSITY**



**Sustainable  
Cities**

## 4.2 What were the Millennium Development Goals (MDGs)?

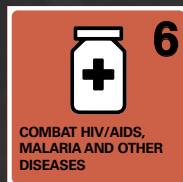
In 2000 a Millennium summit took place at the UN Head Quarters in New York. It addressed issues such as poverty eradication, environmental protection, human rights and protection of the vulnerable.

An agreed Millennium Declaration asserted that every individual has dignity; and hence, the right to freedom, equality, and a basic standard of living that includes freedom from hunger and violence and encourages tolerance and solidarity. The Millennium Development Goals emerged from this Declaration and set concrete targets in order to achieve the rights

outlined in the Declaration. They comprised eight time bound and measurable goals and targets for combating poverty, hunger, disease, illiteracy, environmental degradation and discrimination against women. Progress towards achieving each goal was tracked against 21 targets and 60 indicators. Supporters claim the MDGs galvanized efforts to meet the needs of the world's poorest communities. Critics on the other hand, note that there was very uneven progress on the goals by topic, country or world region. You can review for yourself with a snapshot of each specific goal together with a summary of progress shown in the table overleaf. You can also check out each country's journey towards the MDG at the following interactive website: [www.mdgtrack.org/](http://www.mdgtrack.org/)

# Millennium Development Goals (MDGs)

Eight time-bound and measurable goals and targets for combating, poverty, hunger, illiteracy, environmental degradation and discrimination against women.



# MDGs - 2015 Progress Chart

Goals and Targets	Africa		Asia				Oceania	Latin America and the Caribbean	Central Asia Caucasus and
	Northern	Sub-Saharan	Eastern	South-Eastern	Southern	Western			

## GOAL 1 | Eradicate extreme poverty and hunger

Reduce extreme poverty by half	low poverty	very high poverty	low poverty	moderate poverty	high poverty	low poverty	—	low poverty	low poverty
Productive and decent employment	large deficit	very large deficit	moderate deficit	large deficit	large deficit	large deficit	very large deficit	moderate deficit	small deficit
Reduce hunger by half	low hunger	high hunger	moderate hunger	moderate hunger	high hunger	moderate hunger	moderate hunger	moderate hunger	moderate hunger

**MDG 1:** The number of people living on less than \$1.25 a day has been reduced from 1.9 billion in 1990 to 836 million in 2015, although the target of halving the proportion of people suffering from hunger was narrowly missed.

## GOAL 2 | Achieve universal primary education

Universal primary schooling	high enrolment	moderate enrolment	high enrolment	high enrolment	high enrolment	high enrolment	high enrolment	high enrolment	high enrolment
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**MDG 2:** Primary school enrolment figures have shown an impressive rise, but the goal of achieving universal primary education has just been missed, with the net enrolment rate increasing from 83% in 2000 to 91% this year.

## GOAL 3 | Promote gender equality and empower women

Equal girls' enrolment in primary school	close to parity	close to parity	parity	parity	parity	close to parity	close to parity	parity	parity
Women's share of paid employment	low share	medium share	high share	medium share	low share	low share	medium share	high share	high share
Women's equal representation in national parliaments	moderate representation	moderate representation	moderate representation	low representation	low representation	low representation	very low representation	moderate representation	low representation

**MDG 3:** About two-thirds of developing countries have achieved gender parity in primary education.

## GOAL 4 | Achieve universal primary education

Reduce mortality of under-five-year-olds by two thirds	low mortality	high mortality	low mortality	low mortality	moderate mortality	low mortality	moderate mortality	low mortality	low mortality
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**MDG 4:** The child mortality rate has reduced by more than half over the past 25 years - falling from 90 to 43 deaths per 1,000 live births - but it has failed to meet the MDG target of a drop of two-thirds.

## GOAL 5 | Improve maternal health

Reduce maternal mortality by three quarters	low mortality	high mortality	low mortality	moderate mortality	moderate mortality	low mortality	moderate mortality	low mortality	low mortality
Access to reproductive health	moderate access	low access	high access	moderate access	moderate access	moderate access	low access	high access	moderate access

**MDG 5:** The global maternal mortality ratio has fallen by nearly half - short of the two-thirds reduction the MDGs aimed for.

## GOAL 6 | Combat HIV/AIDS, malaria and other diseases

Halt and begin to reverse the spread of HIV/AIDS	low incidence	high incidence	low incidence	low incidence	low incidence	low incidence	low incidence	low incidence	low incidence
Halt and reverse the spread of tuberculosis	low mortality	high mortality	low mortality	moderate mortality	moderate mortality	low mortality	moderate mortality	low mortality	moderate mortality

**MDG 6:** The target of halting and beginning to reverse the spread of HIV/AIDS by 2015 has not been met, although the number of new HIV infections fell by around 40% between 2000 and 2013.

## GOAL 7 | Ensure environmental sustainability

Halve proportion of population without improved drinking water	high coverage	low coverage	high coverage	high coverage	high coverage	high coverage	low coverage	high coverage	moderate coverage
Halve proportion of population without sanitation	moderate coverage	very low coverage	moderate coverage	low coverage	very low coverage	high coverage	very low coverage	moderate coverage	high coverage
Improve the lives of slum-dwellers	low proportion of slum-dwellers	very high proportion of slum-dwellers	moderate proportion of slum-dwellers	moderate proportion of slum-dwellers	moderate proportion of slum-dwellers	moderate proportion of slum-dwellers	moderate proportion of slum-dwellers	moderate proportion of slum-dwellers	—

**MDG 7:** Some 2.6 billion people have gained access to improved drinking water since 1990, so the target of halving the proportion of people without access to improved sources of water was achieved in 2010 - five years ahead of schedule. However, 663 million people across the world still do not have access to improved drinking water.

## GOAL 8 | Develop a global partnership for development

Internet users	moderate usage	low usage	high usage	high usage	low usage	high usage	low usage	high usage	high usage
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**MDG 8:** Between 2000 and 2014, overseas development assistance from rich nations to developing countries increased by 66% in real terms, and in 2013 reached the record figure of \$134.8bn (£80.3bn).

The progress chart operates on two levels. The text in each box indicates the present level of development. The colours show progress made towards the target according to the legend below:

■ Target met or excellent progress ■ Good progress ■ Fair progress ■ Poor progress or deterioration ■ Missing or insufficient data

For the regional groupings and country data, see [mdgs.un.org](http://mdgs.un.org). Country experiences in each region may differ significantly from the regional average. Due to new data and revised methodologies, this Progress Chart is not comparable with previous versions.

**Sources:** United Nations, based on data and estimates provided by: Food and Agriculture Organization of the United Nations; Inter-Parliamentary Union; International Labour Organization; International Telecommunication Union; UNAIDS; UNESCO; UN-Habitat; UNICEF; UN Population Division; World Bank; World Health Organization - based on statistics available as of June 2015. Compiled by the Statistics Division, Department of Economic and Social Affairs, United Nations.

### 4.3 What are the Sustainable Development Goals (SDG'S)

A United Nations working group was formed in 2013 with the task of crafting a new set of development goals to succeed the MDGs and to cover the period 2015 – 2030. In September 2015, 193 member States of the United Nations met in New York to adopt the 17 Sustainable Development Goals (SDGs) with the overall aim of making the world more prosperous, inclusive, sustainable and resilient. The SDGs are a universal call to action, aimed at getting humanity to make choices now, to sustainably improve life for future generations. The 17 Goals are built on the successes of the Millennium Development Goals, but also include such topical issues as climate change, economic inequality, innovation, sustainable consumption together with peace and justice. The goals are also very much interconnected

as they strive to promote an end to poverty and protect the planet. The sustainable development goals now form the framework for both developed and developing countries.

The SDGs set out concise guidelines and targets which all countries can adopt in accordance with their own national priorities. The following table gives a snapshot of the 17 SDGs.

The biggest change is that the MDGs applied only to countries in the developed world. The SDGs, in contrast apply uniformly to all countries, in both the developed and developing worlds alike. They also apply to businesses and organisations. You can explore each SDG in more detail in the appendix at the following link: [www.theguardian.com/global-development/ng-interactive/2015/jan/19/sustainable-development-goals-changing-world-17-steps-interactive](http://www.theguardian.com/global-development/ng-interactive/2015/jan/19/sustainable-development-goals-changing-world-17-steps-interactive)

# SUSTAINABLE DEVELOPMENT GOALS



GOALS 1 – 6	GOALS 7 – 12	GOALS 13 – 17
<p><b>POVERTY</b> End poverty in all its forms everywhere</p>	<p><b>ENERGY</b> Ensure access to affordable, reliable, sustainable and modern energy for all</p>	<p><b>CLIMATE CHANGE</b> Take urgent action to combat climate change and its impacts by regulating emissions and promoting developments in renewable energy</p>
<p><b>HUNGER AND FOOD SECURITY</b> End hunger, achieve food security and improved nutrition and promote sustainable agriculture</p>	<p><b>ECONOMIC GROWTH</b> Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all</p>	<p><b>OCEANS</b> Conserve and sustainably use the oceans, seas and marine resources for sustainable development</p>
<p><b>HEALTH</b> Ensure healthy lives and promote well being for all at all ages</p>	<p><b>INFRASTRUCTURE</b> Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation</p>	<p><b>BIODIVERSITY, FORESTS, DESERTIFICATION</b> Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss</p>
<p><b>EDUCATION</b> Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all</p>	<p><b>INEQUALITY</b> Reduce income inequality within and among countries</p>	<p><b>PEACE, JUSTICE &amp; STRONG INSTITUTIONS</b> Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels</p>
<p><b>GENDER EQUALITY &amp; WOMEN'S EMPOWERMENT</b> Achieve gender equality and empower all women and girls</p>	<p><b>SUSTAINABLE CITIES &amp; COMMUNITIES</b> Make cities and human settlements inclusive, safe, resilient and sustainable</p>	<p><b>PARTNERSHIPS</b> Strengthen the means of implementation and revitalize the global partnership for sustainable development</p>
<p><b>CLEAN WATER &amp; SANITATION</b> Ensure availability and sustainable management of water and sanitation for all</p>	<p><b>RESPONSIBLE CONSUMPTION &amp; PRODUCTION</b> Ensure sustainable consumption and production patterns</p>	

# Is everyone happy with the SDGs ?

There has been a mixed response. The Economist recently called the SDG targets “sprawling and misconceived”, in fact they went further to call the SDGs “worse than useless....a betrayal of the world’s poorest people (<https://www.economist.com/news/leaders/21647286-proposed-sustainable-development-goals-would-be-worse-useless-169-commandments>). The main critics accuse the SDGs of being “vague and aspirational”. William Easterly,

author of “The White Man’s Burden” is one of the more outspoken critics of the SDGs calling them “Ideals masquerading as targets.... unmeasurable or unattainable.... voluntary and country led... unactionable & unquantifiable”. They prefer the MDGs which were more targeted and focused on absolute poverty. However, supporters of the SDGs point out that they have arisen from an inclusive process which includes the world’s poorest countries in their formation unlike the MDGs which were imposed by the western countries. Many supporters and critics alike agree that there are too many targets and that indicators need to be refocused.

Helema Guy, left, and Kula Roba, right, stand with some of their sheep at a Concern Worldwide off-take programme in the village of Sidama in the Badasa locality of northern Kenya, near Marsabit.

Source: Phil Moore, Concern, 2013







# Make cities and human settlements inclusive, safe, resilient and sustainable

1. ADEQUATE, SAFE AFFORDABLE HOUSING & BASIC SERVICES & UPGRADE SLUMS

2. SUSTAINABLE TRANSPORT SYSTEMS

3. INCLUSIVE & SUSTAINABLE HUMAN SETTLEMENT PLANNING

4. CULTURAL & NATURAL HERITAGE

5. DRR - WATER RELATED DISASTERS

6. AIR QUALITY, MUNICIPAL & OTHER WASTE MANAGEMENT

7. UNIVERSAL ACCESS TO SAFE, INCLUSIVE GREEN & PUBLIC SPACES

1 1A. SUPPORT POSITIVE ECONOMIC LINKS BETWEEN URBAN / PERI-URBAN / RURAL

1 1B. INTEGRATED POLICIES FOR CLIMATE CHANGE

1 1C. SUPPORT LEAST DEVELOPED COUNTRIES

## 4.4 SDG 11 Make cities and human settlements inclusive, safe, resilient and sustainable

In 2015 almost 4 billion people (54% of the world's population) lived in cities and that number is projected to increase to 5 billion people by 2030. Almost three quarters of the EU population already live in urban areas, cities and towns with over 40% residing in cities alone. The urban population of Europe is projected to rise to over 80% by 2050. Such rapid urbanization brings enormous challenges for basic infrastructure services and unplanned urban sprawl, which also makes cities more vulnerable to disasters. If we are going to manage as a human race, we need to make sure cities work for us. They have been seen as attractive places for jobs and opportunities, and

that means that assets and people are concentrated – so, if there is an event like an earthquake or a storm, the losses can be huge. SDG11 is focused around a set of targets (as shown in the above figure) that seek to make the world's human settlements and urban spaces more inclusive, safe, resilient and sustainable.

Building safety into cities is key, particularly as the world faces an uncertain future with climate change. Jo da Silva, the founder and leader of ARUP International Development which works with organisations committed to improving human development outcomes says that "Cities will always experience shocks and stresses, that is normal – but the things that make cities work are the infrastructure such as water supplies and energy. Put simply, a hospital isn't just a building, it's a

critical asset within the healthcare system that serves society. We need to think about the social outcomes of our projects, not just physical outputs. It's important that we build cities that are as resilient as they can

be." This focus on resilience and the urban/peri urban (i.e. city outskirts) environment is also a focus of the Sustainable Development Goals, in particular SDG 11.

## What is a slum ?

A slum is the term given to a highly populated urban residential area. A slum is characterised by closely packed poorly constructed housing units with inadequate or no formal infrastructure and generally populated by people living on or below the poverty line. Most lack

basic services such as clean water, sanitation, electricity, and basic levels of security of tenure. Slums were common in the 18th century in Europe and the United States due to rapid urbanization. Today slums are predominantly found in undeveloped countries.

## Slum Populations in the Developing World

Figures given for slum populations are percentages of the urban population as a whole



# Life in a Slum in Freetown

Freetown is the capital of Sierra Leone, one of the poorest countries in West Africa. Freetown's population surged during a decade long civil war (1991-2002) when people left the countryside to seek refuge in the capital. In latter years many people have moved seeking better jobs and education prospects. However, poverty and lack of affordable housing have forced many to live in

slums. In a city where the population is set to double to nearly 2 million by 2030, it is estimated that 74% are living in slums. Over three quarters of the population of Freetown live below the international poverty line of \$1.25 per day. Life in a slum in Freetown is characterised by a number of key challenges:

## Inadequate access to safe water



The Freetown water supply is in a critical condition. The main supply is from Guma Dam which was built in the 1960s and is sized to supply 800,000 people. The current population is approx. 2 million.

Inadequate water from the municipal system forces communities to seek informal sources, increasing the risk of disease.

The photo shows the only source of water for some of the residents of Waterloo, Freetown.



## Inadequate access to sanitation

There is no formal wastewater collection and / or treatment system in most of the city slums. The photo shows a “hanging latrine” in Kroo Bay slum in Freetown.

In this informal system people have to defecate directly into the river which leads to high rates of diarrhoea and sickness. Outbreaks of cholera, a deadly water borne disease, frequently occur during the annual rainy season.



## Poor Waste Management Infrastructure

Lack of a formal municipal waste management infrastructure results in residents resorting to informal dumping.

The photo shows accumulation of waste adjacent to the main water supply river serving many thousands of residents in Mabella Slum in Freetown.





## Poor housing structures

Houses are typically made of locally sourced materials which are vulnerable to rainy season.

The photo above shows a typical home in Portree Wharf, a fishing slum on the west of Freetown.



## Overcrowding and high density

Nearly a million people in Freetown live in a slum. Life in a slum has no place for modesty.

Typically more than 8 people live in one house meaning most activities take place in the street, eating, washing, cooking.

The photo shows a young family living in a slum in Hill Street, Freetown.

## Insecure Residential Status

Most slum dwellers are living in informal houses and have no right to either the house and / or land. This means that they live a precarious life in which they are vulnerable to eviction and loss of all possessions.



## Vulnerable to Climate Change and Extreme Weather Events

Freetown is in a beautiful setting with steep mountains reaching down to the Atlantic ocean. Most slums are located on the edge of the city on land reclaimed from the sea. This means that the slums are vulnerable to flash floods from the mountains upstream. During the rainy season most slum dwellers were used to such flooding events and it became just one more challenge to their daily existence. However their vulnerable setting was cruelly exposed in 2015 when the seasonal rains caused a massive landslide which killed several hundreds of people and left thousands more homeless.





**Building Critical Understanding and Active engagement for Sustainable Development Goal “SDG” 11 and the “New Urban Agenda” (Habitat III), promoting global housing, land rights, resilient and sustainable cities.**

## **4.5 What is the Habitat for Humanity SOLID GROUND Project?**

Build Solid Ground is a project implemented by a consortium of 14 organisations in seven EU countries over the next three years. Solid Ground is a global advocacy campaign managed by Habitat for Humanity Europe, Middle-East & Africa (EMEA) which focuses on Sustainable Development Goal (SDG) 11. It aims to educate Europeans on current urban and housing challenges and inspire city authorities, governments and citizens to work together to find solutions to urban problems in both

developed and developing countries. The EU DEAR Solid Ground project specifically focuses on land rights, disaster resilience, slum upgrading and equality. Dublin Institute of Technology (DIT) is a technological partner in this project. The role of DIT is the promotion of Hybrid infrastructure. Hybrid infrastructure is a combination of high technological human built (Grey) infrastructure with Nature Based (Green) infrastructure. As part of the project, EWB-Ireland will also work alongside DIT, on a number of research programmes which look at the design of nature-based solutions for infrastructure provision.

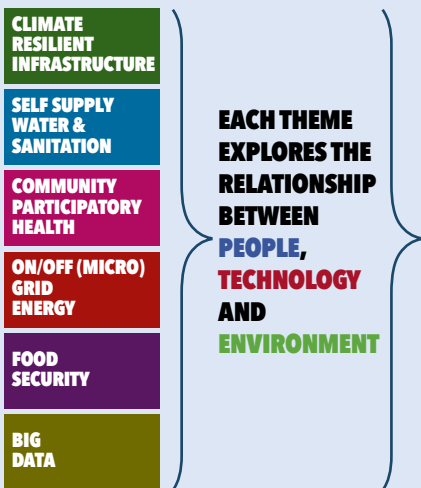
# 05 – WTINE Programme Areas

In order to adapt to a post climate change environment our traditional approach to design needs to be radically altered. Traditionally the engineering sector is not as active as other professions in driving public debate. Engineers are traditionally seen as problem solvers not opportunity finders. Scientists by contrast are often involved in life-changing discoveries which can have a lasting impact on global development. Within our post climate change world, we are forced to identify, define and solve problems at the boundaries of traditional disciplines. Enhanced globalization means that most of the worlds’ growth areas are now in so called developing nations.

This design initiative is an opportunity to challenge participants to create change and find opportunities to improve communities across a range of spectrums. Each theme will explore the relationship between people, technology and the environment whilst focusing on appropriate resilient systems using locally sourced materials.

## WTINE and the SDGs

The themes of the Where There Is No Engineer (WTINE) challenge fit well with the SDGs. Each of the themes of the competition explores the relationship between people, technology and environment. These themes are also the aims of the SDGs, particularly goals 2, 3, 4, 6, 7, 9, 11, 13 and 17. Therefore, the SDGs are important in not alone forming a framework for nations and governments but they also form the platform upon which the WTINE challenge is based. Further, an understanding of, and acquaintance with the SDGs, is of great benefit in understanding both local, national and global problems. While serving as goals to be achieved, the SDGs also serve to give an understanding of the situation at the three levels. The problems of poverty, education, health, gender, energy, water, sanitation, climate change and biodiversity are all addressed. The problems of cities and urban settlements is also dealt with, a problem which is, arguably, the most pressing problem in the coming years.







## **5.1 Climate Resilient Infrastructure**

The post climate change era is upon us and already vital infrastructure such as road and rail networks, water and energy systems are threatened. However designers are still struggling to understand and plan for a greater variability in climate. Many developments are still being constructed on the assumption that the climate in future will be similar to that of the present.

**Projects within this theme will take a different approach. By making these infrastructures more climate proof, this will add an additional level of complexity, but will also add a new level of resilience for communities within developing countries.**

[www.wherethereisnoengineer.org](http://www.wherethereisnoengineer.org)

# Climate Resilient Infrastructure

## Case Study: Tsunami 2004

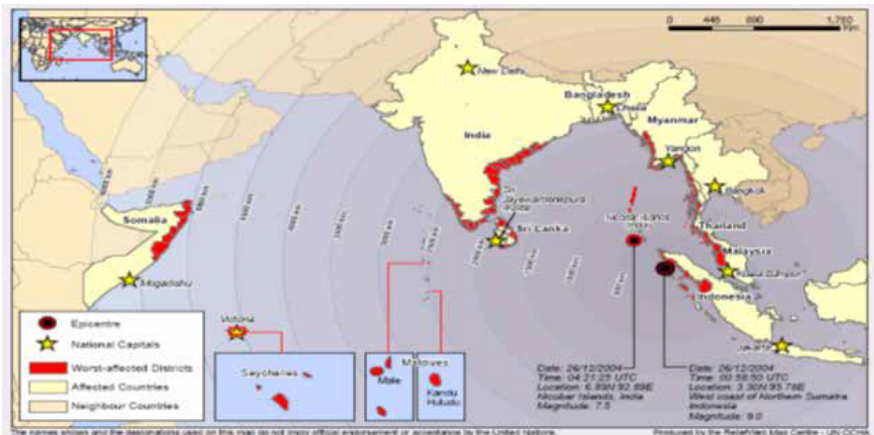
### The Earthquake

On 26th December 2004 a magnitude 9 earthquake occurred off the west coast of northern Sumatra, Indonesia. The sudden and violent vertical displacement of the sea floor caused a disturbance which generated waves (tsunami) that propagated rapidly across the whole of the Indian Ocean. Typically, in open ocean waters, these waves have long wavelengths of the order of 200km and low trough to crest amplitudes which allow them to conserve energy as they propagate over large distances. As the waves enter the shallower waters of coastal areas, their amplitude increases dramatically and their velocity reduces, resulting in violent wave impacts and extensive flood inundation inland. Unprepared for such a natural disaster and with no warning systems in place, more than 225,000 people died in South and

Southeast Asia, and several million were left homeless.

### Sri Lanka

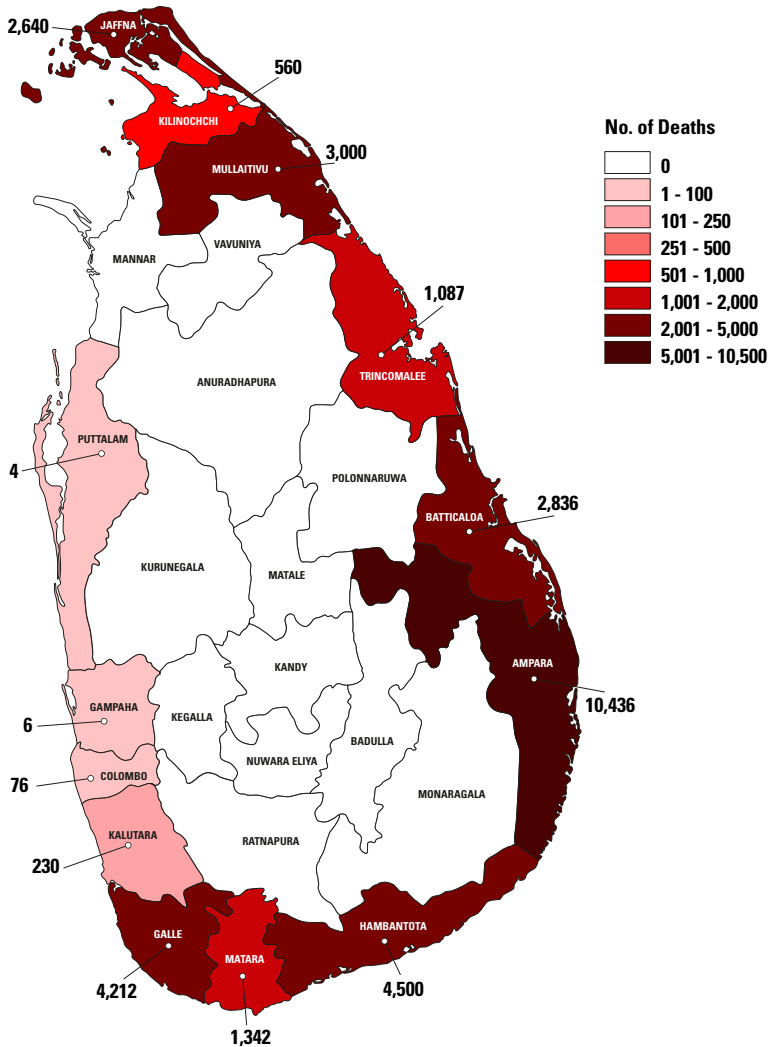
In Sri Lanka, the waves which ravaged a comparably narrow flat coastal strip caused an unprecedented loss of life and property. The effects were increased due to the high density of population distribution within the coastal regions of Sri Lanka. The immediate effect was the deaths of 31,000 people. According to government statistics 92,000 homes were destroyed or damaged causing over 400,000 people to be displaced. Roads, electricity, communication, water supply and other community services were effectively destroyed or rendered unusable. Seawater flooding further disrupted agriculture, fauna, flora and sources of drinking water. The fishing industry was severely affected whilst others such



AREAS AFFECTED BY TSUNAMI 2004

# Tsunami 2004 Disaster - Number of Deaths by District

Data from NDMC, 15th January 2005



as small scale farmers, craftsmen, shopkeepers, etc. suffered losses to crops, tools, premises and stock. Women active in fish processing, small scale vegetable production, food preparation & sale were

bereaved of their income. Adding to their plight was the loss of important documents including title deeds, and national identity cards. The following photos illustrate the devastation resulting from the tsunami impact.



Before and after images showing the devastating impact of the 2004 tsunami.



# Humanitarian Response

The tsunami post disaster programme was implemented in three phases:



## Phase 1: Rescue and Relief

- Initial stage after tsunami
- Provision of medical treatment and food to the displaced
- Provision of temporary shelters in schools, tents, temples etc.
- Provision of water and sanitation facilities.



## Phase 2: Transitional

- Transitional shelters.
- Provision of potable water from tankers.
- Provision of squat toilets with pit latrines.
- Restoration of transport links, water pipelines, water treatment and communications infrastructure.
- Debris clearance.



## Phase 3: Reconstruction and Rehabilitation

- Permanent housing.
- Permanent water and sanitation
- Environmental sustainability
- Waste management



## Phase 1 : Rescue and Relief

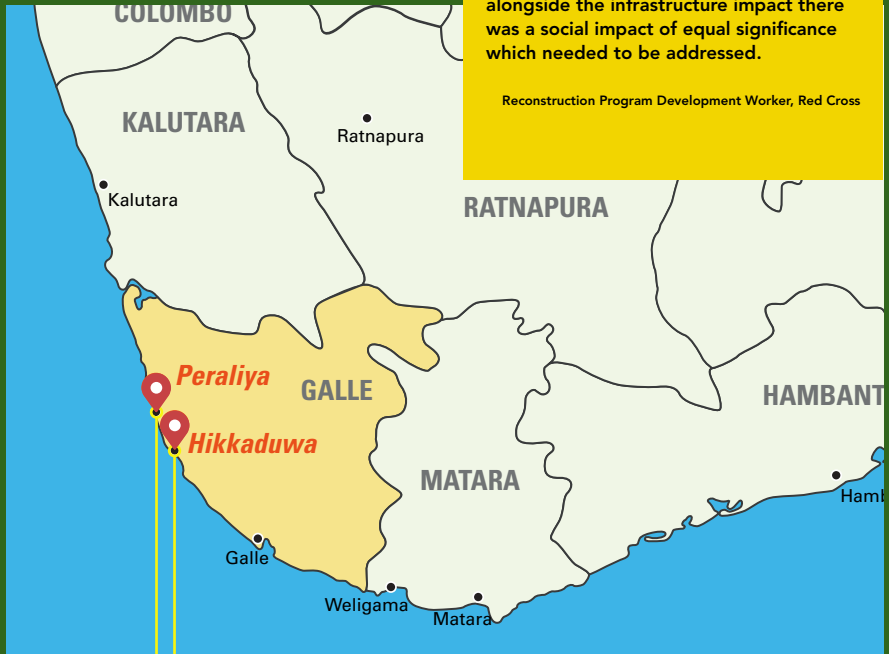
This is the initial stage after any major disaster. Disaster Response teams are on call across the world and they normally arrive in country within hours of a disaster. The initial stage is focused on providing medical treatment to survivors and providing food to the displaced. This initial stage also focuses on short term accommodation, in this case providing temporary shelter in the form of tents or in school buildings, temples, churches. A major displacement of the population also requires infrastructure facilities for water, sanitation and energy to be established. Unfortunately, recovery and identification of bodies also forms a component of the initial stage of a disaster.

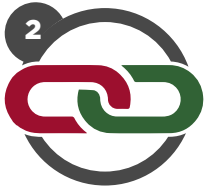


# A Human Tragedy

This was the first location we visited after the tsunami. In this location over two thousand, mainly women and children were killed in the tsunami. Working with this community one realised that alongside the infrastructure impact there was a social impact of equal significance which needed to be addressed.

Reconstruction Program Development Worker, Red Cross





## Phase 2 : Transitional

In Sri Lanka, the next stage of the recovery programme involved the construction of over 65,000 temporary shelters, comprising two or three rooms, with 3 foot high walls completed to roof level with timber planks and roofed with corrugated sheets. Potable water was provided in accordance with sphere standards (a set of minimum standards applicable to international development, [www.sphereproject.org](http://www.sphereproject.org)) at a number of central taps, supplied by water tankers. Wastewater treatment typically consisted of squat toilets with pit latrines. Temporary shelters were planned as a short to medium term measure with the intention of rehousing people in permanent houses as soon as possible. This phase also involved the restoration of transport, water, & communication infrastructure and debris clearance.



**Over  
65,000  
temporary  
shelters  
were  
constructed**



Phase 1 and 2 were carried out in the first six months after the tsunami. It is generally agreed that the rescue and relief phase was completed with no deaths due to starvation or lack of medical care, no observation of malnutrition and no outbreak of diseases.





## Phase 3 : Reconstruction & Rehabilitation

The longer term reconstruction phase was coordinated by the Sri Lankan Government working with many hundreds of International Non-Governmental Organisations (INGOs). A number of priority areas were identified including: Get people back into homes, restore livelihoods, restore and improve health, education facilities and upgrade national infrastructure.

### Sri Lanka Government Targets

**GET PEOPLE BACK INTO HOMES**

All affected communities restored by end of 2006

**RESTORE LIVELIHOODS**

Improved health and education for all affected by end of 2006

**RESTORE/IMPROVE HEALTH, EDUCATION AND FACILITIES**

Improved health and education for all affected by end of 2006

**UPGRADE NATIONAL INFRASTRUCTURE**

Improved national infrastructure by end of 2007

## Structural Damage

An assessment of the structures affected by the tsunami waves indicated that the most severely damaged structures were those constructed close to the sea. Although the degree of damage correlates to the magnitude of wave pressure, factors such as structural form, shape of buildings and orientation in relation to the wave direction also had significant bearing on the extent of damage. Buildings with load-bearing walls, especially those that were perpendicular to the direction of the waves had shown less resistance to the ocean waves and had been completely destroyed, whereas framed structures with reinforced concrete columns and beams as well as load bearing walls that are parallel to the direction of the waves showed a higher degree of resistance. This review was compiled by a team of local and international engineers and was used to prepare a design manual to assist designers to plan developments to minimise the risk of structural failure in future natural disasters.

## Reconstruction Programme: Construction Issues and Constraints

Post tsunami housing construction programmes were completed throughout Sri Lanka, either as Donor Driven programmes, where contractors were employed directly by national and international donors to construct houses, or Owner Driven programmes, with grants provided to the family to manage their own rebuild. Pre-tsunami annual housing construction in Sri Lanka averaged 5000-6000 units. The post tsunami demand for 92,000 houses placed

demands for construction services and materials which far exceeded the capacity within the existing industry. Some of the main issues experienced by those managing the reconstruction process were as follows:

## Construction Institutional Capacity

The national construction industry lacked capacity in terms of numbers of contractors, equipment, size and skills of the labor force, management practices and access to finance. Architects often lacked resources to supervise and manage contracts effectively.

## Land identification and acquisition

Initially after the tsunami the Sri Lankan government declared a "setback zone" within which no building could be reconstructed. This was 100m in the South and 200m from high water mark in the North and East of the country. A programme of relocation of tsunami affected families from coastal areas to inland sites was initiated by the government. The high population density within the coastal zone and scarcity of available land resulted in significant problems in identifying appropriate relocation sites. In many cases this land was several kilometers from the sea and the families did not wish to relocate away from the source of their livelihood. The result of these land issues was a delay in the planning and construction phase of projects. The government subsequently revised its initial buffer zone to 45m. This has allowed donors to assist families to start a reconstruction programme on the sites of their former homes.

## Skills Shortage

Tsunami reconstruction exacerbated the existing skills shortage within the construction industry. Contractors use of non skilled labour in some cases resulted in poor construction. This was evident in particular where donors awarded construction contracts with no provision for professional independent supervision of the works. In some cases this resulted in buildings unfit for habitation.

## Access to Materials

There was a shortage of construction materials in Sri Lanka post tsunami. While many materials can be readily imported the procurement procedures for such purchases excluded many small and medium contractors. It was very expensive to import bulk materials such as building sand and quarry products. The contractors approach to securing sand was to send a team to manually dive to river beds with a bucket and extract sufficient

quantities to build. The potential environmental damage caused by the continued extraction of pit sand and river sand has not been quantified. Large scale quarrying and crushed aggregate production does not exist in Sri Lanka. All concrete (with the exception of slab pours) was batched on site. Use of traditional coconut timber in construction was banned after a significant percentage of the islands coconut timber resources were used in the building of transitional shelters. All timber had to be sourced abroad, typically from Malaysia.

## Inflation

Construction costs in Sri Lanka inflated by between 30% - 50% post tsunami. Indications are that the combination

### Access to Materials

Sand was sourced by local youths diving to the bottom of rivers and excavating by hand, then brought to shore in boats. The sand was then graded on site



of contractor capacity shortages, scarcity of materials, technical skills, construction machinery, and the reluctance of companies and individuals to work in the north east had a significant impact on costs.

### Provision of Utilities

Provision of water, energy and appropriate sanitation solutions to unserved lands in remote locations posed both engineering and social challenges. Many of the families had no previous experience of utility bills and the tradition was for communal bathing practices, not household connections. In many sites the developments were completed in advance of provision of these basic needs.

### Landmines

The conflict within the North and East of the country has left large areas of the land mined with explosives. Prior to any construction activity taking place this land had to be assessed and declared free of landmines by a special taskforce.

### The interaction of People, Technology and the Environment

In the initial stages of the reconstruction program it was decided that large scale construction companies would be involved in the construction process and would deliver the infrastructure required. This resulted in the homeowners having little or no say in the selected location and design. Many communities were asked to relocate many kilometres inland and they refused to accept these houses. Other houses were provided which were not constructed in accordance with local beliefs and families refused

### Provision of Utilities

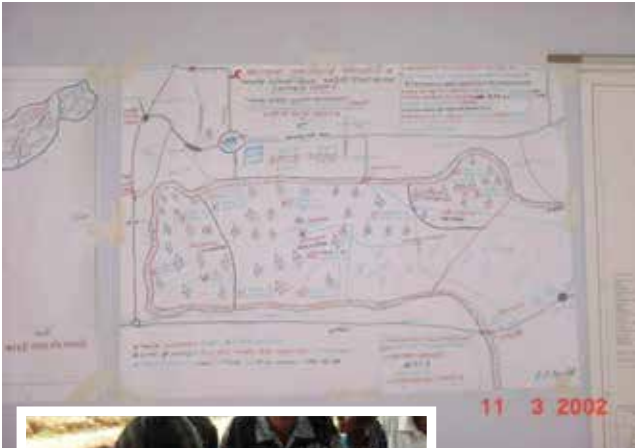
Rainwater Harvesting Tanks installed by local masons





## Landmines

UN landmine clearance of an area prior to reconstruction



## Community Development

A graphic representation by all members of the community of the services within and outside the community such as employment, education, health, water supply, wastewater, irrigation, etc.



to move in. After 12 months many of the INGOs changed their approach. Communities were asked to become involved in the development of a master plan for their own areas. They were given a role in the design, construction, finance and operation of the infrastructure provision. This

programme became known as the community participatory approach and was more successful in infrastructure delivery than the contractor approach.

### Meeting challenges through innovative technology

In order to meet the increased post tsunami construction demand innovative solutions were required. Several key objectives were identified;

- Minimise usage of scarce resources such as sand & timber.
- Minimise skilled labour requirement by using newer construction methods.
- Reduce of on site wastage & achieve better build quality.
- Minimise construction programme time and cost.

The Sri Lankan body for conducting research for the construction industry, National Engineering Research Development Centre (NERDC), had conducted research into using pre-cast standardised building components within the Sri Lankan industry. They had carried out pilot projects pre-tsunami and the results of their studies showed that by mass producing building components in a controlled environment using new and cheaper raw materials and adopting size reduction of components by optimising structural design, significant savings in terms of resources and cost could be achieved.

## Case Study

### Thimbilli tsunami development in the western coastal town of Panadura is an example of how designers and contractors incorporated new technology (in Sri Lanka) in the tsunami reconstruction programme.

This development consisted of 120 three storey apartment units in blocks of 6. The traditional Sri Lankan design and construction method for a development of this type would consist of random rubble foundations with insitu columns and beams, insitu reinforced concrete slabs and blockwork walls.

This development was designed to minimise the use of scarce resources and skilled labour. The design incorporated plinth beam foundations to minimise excavation by hand and use of stone. Ground floor columns comprised precast prestressed columns on precast pocket foundations. This allowed mass production of the components on site using less skilled labour, less material and by eliminating formwork, the erection programme was quicker.



Above: Innovative Slip Form wall construction with team of three unskilled labourers

Below: Finished apartments in Panadura



The traditional blockwork walls were replaced by slip form walls. These type of walls comprised 1:12 cement and quarry dust / sand mix with 2% coconut coir fibres included in the mix. The walls were constructed using steel shutters in lifts of 3 feet. The high quality finish eliminated the requirements for plastering. All windows and door frames consisted of pre cast concrete frames manufactured by a local NGO. This resulted in a cost saving over imported timber of 70% and eliminated the need for lintels.

The floor slabs comprised 2" thick composite slabs with pre-stressed beams. This eliminated the need for formwork and insitu steel and concrete pours. Significant savings on labour and time were effected. The roof comprised a tile roof on precast concrete rafters.

The contract was awarded to one main contractor with ten nominated subcontractors. Each sub contractor was trained in the proposed construction methods using teams of one skilled mason to 9 unskilled labourers. Overall sand savings in the project were from 40% - 70%. Overall resource savings were 40%. Overall cost saving over traditional in-situ apartment projects were up to 40%.

## Conclusion

"Tsunami" now a terrifying household word that destroyed thousands of lives, caused extensive destruction of property and traumatised many more thousands, still haunts this beautiful island paradise of Sri Lanka. As a developing country, Sri Lanka was initially paralyzed by the extent of the damage.

Due to a weak economy and lack of technical resources, the Sri Lankan state requested assistance. Unprecedented donations of aid from the Irish people, enabled INGOs to mobilise technical teams quickly and by working with local engineers and architects to make a significant contribution to the rebuilding of the devastated coastal regions.



A painting by a five year old showing their experience of the tsunami

Liam McCarton, IRC, 2005





## 5.2 Self Supply Water and Sanitation

A safe and sustainable water supply, basic sanitation and good hygiene are fundamental for a healthy and productive community. However many of the world's rural communities lack access to an improved water supply (900 million) and improved sanitation facilities (2 billion). Chronic diarrheal diseases and malnutrition induce a negative spiral into poverty. Rapidly increasing urban populations, together with a post climate change era will increase the vulnerability of already stressed communities and regions.

This theme supports urban and rural livelihoods by promoting food security, health and productive activities and demands innovative approaches to the provision of urban and rural water, sanitation and hygiene.

# Self Supply Water & Sanitation

## Case Study : Village Technology Resource Centre, Sierra Leone

Sierra Leone gained its name from the Portugese explorer Pedro de Sintra who, in 1462, named the hills surrounding what is now Freetown Harbour, "Serra Leoa" (Portuguese for Lioness Mountains). The capital, Freetown, was founded as a home for repatriated former slaves in 1787. It had become a British area of interest a few years earlier and would continue as a colony until independence in 1961. Early independence saw democracy gradually undermined and finally dissolved with the first of many military coups, in 1967. A one party state existed until the civil war started in 1991. The country's modern history

has been overshadowed by this brutal civil war that ended in 2002. The country is rich in diamonds and other minerals. The trade in illicit gems, known as "blood diamonds" for their role in funding conflicts, perpetuated the civil war. Mining and agriculture are also important economic activities.

Sierra Leone has experienced substantial economic growth in recent years, although the effects of the civil war continue to be felt. It has also suffered more recently from an outbreak of the Ebola virus. This resulted in approximately 3,000 deaths and the spread of the disease

### Football Game in Freetown, 2008

Rebels in the decade long civil war for control of the diamond industry in Sierra Leone used maiming of local communities to terrorise the population into submission.

This photo shows a local team in Freetown in 2008 to help youths recover after this period.



# Sierra Leone



**Terrain:** coastal belt of mangrove swamps, wooded hill country, upland plateau, mountains in the east.

**Climate:** tropical, hot, humid, rainy season (May to December), dry season (December to April).

**Natural Resources:** diamonds, titanium ore, bauxite, iron ore, gold, chromite.

**Religions:** Islam (60%); remainder traditional and Christian.

**Languages:** English (official), Temne, Mende.



countrywide. More recently, in 2017, mudslides resulted in 1,000 deaths in Freetown. Sierra Leone can be said to be a country suffering from the curse of resources, where the rich natural wealth is poorly managed.

The population (as of 2017) is 7,557,212 which is mostly young, with an estimated 42.09% under 15. The majority of the population are located in rural areas, with an estimated 62% of people living outside the cities. As a result of migration to cities, the population is becoming more urban with an estimated rate of urbanisation growth of 2.9% a year. There is high unemployment, particularly among the youth.

Sierra Leone has the 5th highest maternal mortality rate in the world. According to a 2013 UNICEF report, 88% of women in Sierra Leone have undergone female genital mutilation. As of 2014, Sierra Leone was estimated as having the 11th highest infant mortality rate in the world. Education in Sierra Leone is legally required for all children for six years at primary level and three years in junior secondary education, but a shortage of schools and teachers has made implementation impossible. It is estimated that two thirds of the adult population of the country are illiterate. The following photos show the maternity hospital serving a population of 40,000 in one of Freetown's coastal areas, Kroo Bay.

## Maternity Clinic, Freetown, Sierra Leone



- One in four children will die before their fourth birthday
- One in eight women will die in childbirth
- **Ireland:** 3.3 deaths per 1000 live births. **Sierra Leone:** 35 deaths per 1000 live births.



## The Morning Ritual

Water supply in Sierra Leone is characterised by limited access to safe drinking water. Approximately 84% of the urban population and 32% of the rural population have access to an improved water source. Those with access in rural areas are served almost exclusively by protected wells. The 68% of the rural population without access to an improved water source rely on surface water (50%), unprotected wells (9%) and unprotected springs (9%). Only 20% of the urban population and 1% of the rural population have access to piped drinking water in their home.

## DIT Self Supply Water Programme, Gendema, Sierra Leone

It is against this background that a rural water self supply project was set up in the area of Gendema in the Pujehun district, in the south of the country on the border with Liberia. Self Supply

## The Morning Ritual

The Search for Clean Water





may be defined as the improvement of household or community water supply through investment by the user in water treatment, supply construction and up-grading. It may also involve other sanitation technologies such as Solar disinfection (sodis), rainwater harvesting and constructed wetlands. It is based on incremental improvements in steps which are easily replicable, with technologies affordable to users. This self-help approach is complementary to conventional communal supply.

Self Supply at household or

community level generally implies strong ownership but also a sharing of the supply with those households nearby, often at no charge, offering effectively a privately managed communal service. All of the 'unserved' population use Self Supply, as do an unknown proportion of those regarded as served.

Owners and users of self supply are encouraged to aspire to further improvements to supply in the same way as they implement progressive improvements to their houses, building on what they have already done, copying ideas from neighbours and from what they see in urban and peri-urban areas. This creates a marketing dynamic found throughout the commercial world where people find ways of accessing funds for a commodity they really regard as a priority and from which they gain obvious social and financial benefit. This is the concept of



DTC – DIT Project, Gendema, Sierra Leone

added value. It may be explained by considering a light bulb or a mobile phone. The bulb in your room is not much different than a candle. But electricity can also allow a fridge, TV, radio, computer etc to be installed. This is the added value. It also creates a positive dependency. A mobile phone is similar to electricity. It has the added value of communication, work, education etc. It also creates a positive dependency. An individual family water supply with pressure allows the added values of showers, hot water, washing facilities, latrines to be included in the home. This type of system will also create a positive dependency, where, if the constituents of the water system break down the householder will prioritise it for repair.

The project in Gendema involved the adaption of a school classroom to a Village Technological Knowledge Centre (VTKC). Here, in a large room, were tactile examples of

low technology pumps, rainwater harvesting collection systems, water storage tanks, latrine moulds and latrine caps, solar disinfection (sodis) installations and a water testing laboratory. The classroom served as a teaching aide to the local health promotion team set up as part of the project.

These leaders ran courses for the local villagers in the promotion of self supply. They visited the villages promoting the technologies and assisting the villagers with the installation of the various self supply applications. Villagers were encouraged to visit the technology centre in the school and take apart and play with the technological exhibits on display. This hands on experience created a greater understanding of the technologies for the villagers and helped them comprehend construction problems and system characteristics.



Village Technology  
Resource Centre (VTKC)

## The technologies promoted were:

### Pumps

The materials and fabrication methods to design, manufacture and maintain low cost pumps for open wells were taught in the resource centre. Audio visual displays together with tactile demonstration rigs as shown above were used to teach masons and carpenters the skills involved. Students quickly learnt the skills and started to produce and replicate the designs in the resource workshops.



## Richard Cansdale Canzee Pumps

### 1. Pump Head



### 2. Pump Handle



### 3. Pump Valves







A typical training session showing how to combine the pump parts. The students quickly start producing their own pumps and testing prior to installation.



**Solar disinfection (SODIS).**

Lack of access to safe water sources together with an absence of a reliable method of water treatment results in high mortality rates due to water borne diseases. The VTKC gave courses on water treatment using UV, called SODIS. Tactile demonstration rigs were used to illustrate the concepts and application. Students then applied the technique on their own. Water samples were then tested by the students in the resource centre laboratory to quantify the effectiveness of SODIS as a water treatment method.



Water samples being tested by the students

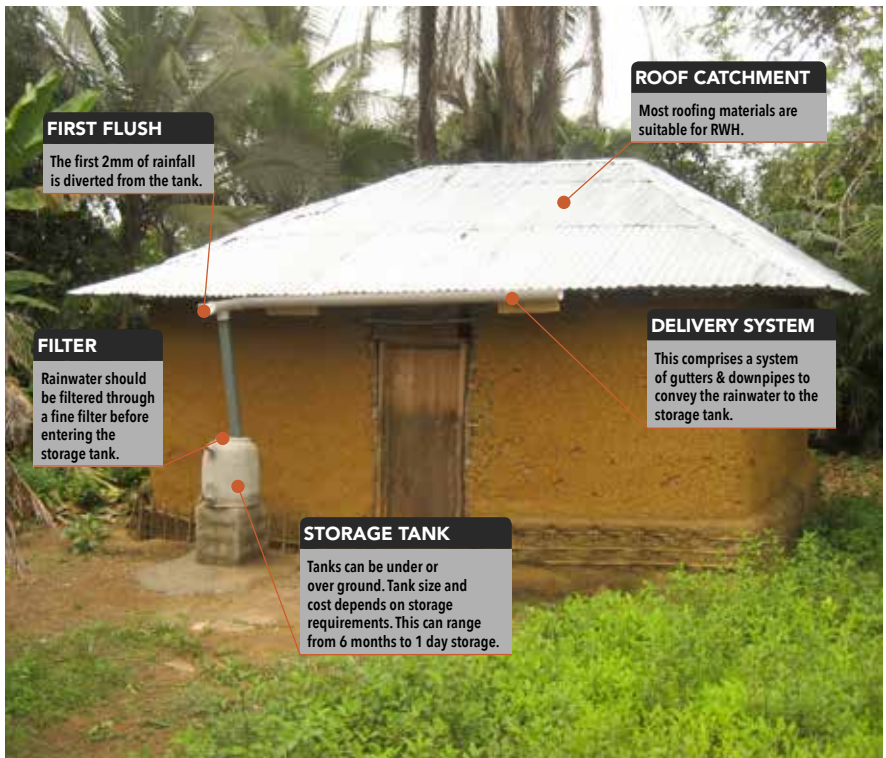
## Rainwater Harvesting (RWH).

Students in the VTKC were given a basic course in how to design, construct and maintain a typical rainwater harvesting system. The photo on the right shows the tactile demonstration rig which formed the basis for the course. Students were then taught how to fabricate each component in the system.

Students quickly progressed to fabricating water storage tanks in the VTKC. These were tested for quality and water tightness before installation in the villages.



# The Rainwater Harvesting System





Water storage tanks fabricated by the students in the VTKC are tested for quality and water tightness before installation.

Below: A rainwater harvesting filter tank in village.



## Latrines.

Production of latrine components also formed one of the VTKC modules. Again, the teaching started with a tactile display which the students could assess and use to explore how to fabricate themselves.

Students then quickly adapted the process and started a practical session on how to manufacture the components for a latrine in the resource centre workshops.



Students started to reproduce latrine components in the workshop.





VTKC graduates latrine installed in village



### **Water and Wastewater Analysis.**

The availability of water testing, to the health and sanitation promotion and to the villagers, resulted in a better understanding of the requirements of safe water collection, storage and supply. The promotion team benefited in that they were able to demonstrate to the users in the villages, using laboratory equipment and scientific tests, the properties that distinguish poor water from healthy water. The testing procedure and the results reinforced the concepts of sanitation and good water quality for the villagers.

Self supply is particularly applicable to small communities applicable to small communities, communities with a diffuse population, communities with poor or no community management structures, communities in remote areas where access to maintenance services and spare parts is difficult, communities in areas where potable ground and surface water are lacking.

### **Barriers to the adoption of Self Supply.**

Governments in almost all countries identify water and sanitation as their responsibility. NGOs in many countries also prioritise water and sanitation as one of their core responsibilities. This creates an expectation amongst communities that water supply and sanitation will be provided by external agencies. This is one of the core challenges to be overcome by appropriate technology/self-supply programmes. As a result communities are reluctant to install the technologies themselves.

Lack of knowledge of appropriate technologies/self supply is common



to all water, sanitation and hygiene (WASH) sectors including government agencies, NGOs, universities and professionals. This underlines the importance of university courses in the science and engineering of appropriate technology/self supply. This will lead to diffusion of a proper understanding of appropriate technology amongst government agencies, NGOs and professionals. The common impression of appropriate technology amongst sector stakeholders is that they don't work.

**Failure is important for technology transfer to occur. Higher types of technologies have to fail until communities are open to appropriate technology/self supply. They have to fail a number of times. Failure of these technologies is important to bring communities to accepting appropriate/decentralised technologies. This pattern of higher forms of technologies repeatedly failing, leads to recognition by communities that they have to do it for themselves.**

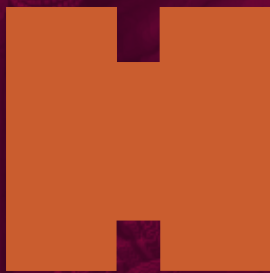
The importance of added value and the positive dependency it creates is not fully integrated into most sanitation projects. This allows the added values of showers, hot water, washing facilities, latrines to be included in the home. This type of system will create a dependency, if the constituents of the water system break down the householder will prioritise it for repair.

Finally, Self Supply contributes to the SDGs, including those for water. Added value in self supply projects allows householders to move to a point of reliability and safety in water quality through community and/or household solutions.

**“When services are affordable and delivered in a cost-effective manner the benefits become very significant and will in most cases provide an increased demand from the households for services which can be made available by the private sector. Through this mechanism there is a strong relationship between cheap and affordable services, private sector development and the likeliness of services to become sustainable”.**

(DANIDA,1998)





## 5.3 Community Participatory Health

Traditional health management approaches have often failed to mobilise grassroots groups. Causes are varied but the more common are a lack of understanding by the receiving community of the need for the programme, no sense of ownership of health development projects, lack of understanding on the part of development workers of local indigenous characteristics and beliefs and the fact that some projects do not have the support of all of the community. Community participatory health involves the participation of the community in the identification and management of their own health issues.

**Projects within this theme will focus on different levels ranging from medical diagnosis and treatment of new diseases, to community education techniques and software for preventative and management of health issues.**

# Community Participatory Health

## Case Study: Niger

The Country: Niger is a vast arid country on the edge of the Sahara desert. Niger is rated by the UN as one of the world's least developed nations. Today the country struggles in the face of frequent droughts, insurgency and wide-spread poverty. Niger has significant resources including oil, uranium and gold. But basic rights issues, such as slavery - which was only banned in 2003 and still remains a problem - and a high rate of illiteracy and disease are frequent challenges.



### The People

The main ethnic groups in the area are: Hausa, Djerma-Songhai, Tuareg and Fulani amongst others. The Hausa and Djerma-Songhai are predominantly sedentary agriculturalists, while the Tuareg and Fulani usually combine agriculture with pastoralism or contract herding. While the Tuareg and Fulani are monogamous, the Hausa operate a system of polygamy, with men having up to four wives. All three groups practise Islam, and Islamic faith and practice underpin many aspects of social life.



### The Environment:

The southern half of Niger is in the Sahel, a semi-arid area, with one short rainy season per year (June/July – Sep). The Northern half of Niger is dominated by the Sahara desert. The main subsistence systems are rain-fed agriculture and pastoralism. Recent instability in the neighbouring countries has affected Niger which borders Mali, Libya, Algeria and Chad.

### Health

Life in Niger is a constant struggle with the uncertainty of climate change in the region leading

# Niger

**Terrain:** About two-thirds desert and mountains, one-third savannah.

**Climate:** Hottest country in the world, dry and dusty. Short rainy season June - September.

**Ethnic Groups:** Hausa 56%, Djerma-Songhai 22%, Fulani 8.5%, Tuareg 8%, Beri Beri 4.3%, Arab, Toubou, Gourmantche 1.2%

**Religions:** Islam (97%); remainder traditional and Christian.

**Languages:** French (official), Hausa, Tamachek, Arabic.



to frequent food shortages and droughts. Poor harvests result in increased prices for the food that is available in the markets forcing many families to borrow to buy food. Typically one sack of millet might have to be repaid with four or five sacks later that year creating cycles of debt. 50% of the population have no access to basic health services. Only 43% have access to clean water and 18% to basic sanitation. One in four children die before the age of 5 years.

### Community Participatory Health Approach

Within this extreme environment, provision of health care to communities, particularly in remote regions is an enormous challenge. Community Therapeutic Care (CTC) is a community-based model for delivering care to malnourished people. CTC seeks to provide fast, effective and cost efficient assistance in a manner that empowers the affected communities and creates a platform for longer-term solutions to the problems of food security and

public health. All CTC programmes aim to treat the majority of severely acutely malnourished people in their homes. The aim is to utilise and build on existing capacities, using only a few highly trained staff to facilitate the process, rather than using large external teams and creating parallel structures.

### Emergency Community Therapeutic Care

The emergency CTC approach requires that treatment centres are decentralised, located near to where the target population lives. The aim is for over 90% of the target population to live within a one day return walk of a point of access. The approach uses mobile teams that rotate between points on a weekly or fortnightly basis to facilitate the delivery of the protocols, either directly themselves or where possible, supporting local clinic staff to do so. In order to catch cases of severe malnutrition before they develop complications, people must have good access to sites and must understand and



have confidence in the programme. When carers and children have made great effort to attend a distribution, a failure of the mobile team to turn up undermines this confidence, decreases attendance in subsequent distributions and increases barriers to early presentation and treatment. Such problems are partly responsible for the relatively low coverage rates of under 50% in the South Sudan programmes in 2003. In times of severe malnutrition, a stabilisation centre (SC) becomes an integral part of a CTC program, providing inpatient facility for severely malnourished children with medical complications that cannot be treated in their home.

### Life on the Edge: Niger 2005

Increased uncertainty of rainy seasons over the last few decades has led to poor harvests, depletion of livestock and increased reliance of communities on off farm activities in order to survive. A large number of

mainly young men leave annually to work either in surrounding countries, or take the long arduous journey to Europe. Harvests in 2004 in Niger were poor due to reduced rainfall and locusts destroying what little crops there were. Families were forced to sell off livestock and take on more debt.

Over time, these coping strategies undermine the communities' resilience to withstand shocks and can lead to relatively normal situations having a worse than expected



The search for water, Niger.



Niger villages have traditionally used community seed banks, as shown in the top left of this photo, to use as a buffer for years which may have droughts and resulting poor harvests. With the increased uncertainty of climate change in the region, several consequent years of poor harvests, leading to high debt levels can undermine a community's ability to withstand minor shocks and can lead to severe malnutrition as happened in Niger in 2005.

outcome. This is what happened in 2005 in Niger. The harvest in 2005 was reasonable, however the debt incurred in 2004 was required to be repaid by selling off millet at low prices in 2005 and sending more men abroad to send remittances back home.

In this environment where foods are nutritionally poor, there is a high prevalence of diarrhoea and malaria and poor access to health services. It only takes a small shock to push

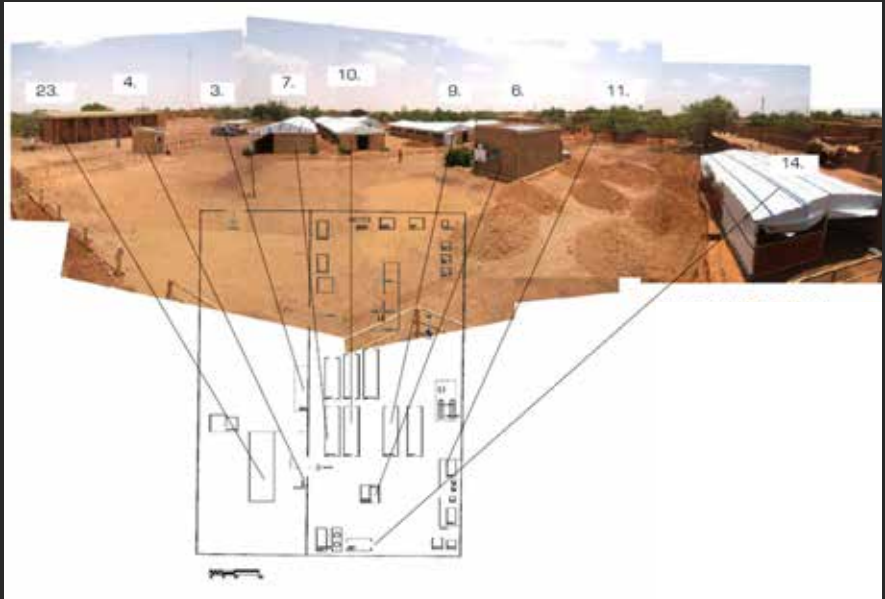
a child into a downward spiral of illness and potential death. Thus in mid 2005, what started with a few malnourished children arriving at health posts quickly became hundreds arriving daily. A major crisis was declared and a number of stabilisation centres (SC) were quickly established.

Medical staff visit villages where mothers present their children for the screening process that assesses the child's health status based on



# Stabilisation Centre, Tahoua, Niger 2005

A Stabilisation Centre (SC) is an integral part of a CTC programme, providing an inpatient facility for severely malnourished children with medical complications that cannot be treated in their homes.



Plan of Stabilisation Centre, Tahoua, Niger 2005 (Source Concern Worldwide)

- |   |                              |                             |
|---|------------------------------|-----------------------------|
| 1. Entrance                                 | 8. Phase I                   | 16. Water Tanks             |
| 2. Pharmacy                                 | 9. <b>Intermediate Phase</b> | 17. Latrines                |
| 3. <b>Vehicle Shelter</b>                   | 10. <b>Phase II</b>          | 18. Showers                 |
| 4. <b>Guards' Hut</b>                       | 11. <b>Isolation</b>         | 19. Kitchen                 |
| 5. Vehicle Gate                             | 12. Generator                | 20. Waste                   |
| 6. <b>Doctors' Office and Dressing Room</b> | 13. Morgue                   | 21. Incinerator             |
| 7. <b>Admission</b>                         | 14. <b>Meeting Room</b>      | 22. Washing Area            |
|   | 15. Container Stores         | 23. <b>State-Run Clinic</b> |

A standard SC project includes medical wards (Admission, Phase 1, Transition, Phase 2 and an Isolation unit for infectious diseases), administration buildings, treatment rooms, pharmacy, kitchen, stores, latrines and shower blocks, laundry facilities, incinerator and waste disposal facilities, morgue, generator rooms, playgrounds, guard houses and perimeter fencing.

The provision of water, electrical and sewerage infrastructure systems are an essential component to efficient and safe service delivery.



(Source Concern Worldwide)

calculations of height/weight ratios and other factors such as age, medical history and general well being. Of those who are judged to require treatment, many will receive bi-weekly distributions of either Plumpy-nut or Unimix for the child and his or her family from a

local distribution centre. Children presenting with more severe symptoms of malnutrition that may be complicated by factors such as malaria and/or dysentery will be transported immediately to the Stabilisation Centre (SC).





Phase 1: Upon arrival at the Stabilisation Centre infants will be admitted to the first stage of treatment and all of those undergoing Phase I treatment are housed together. Progress is monitored continuously each day.



Phase 2: After a satisfactory response to the treatment has been achieved they will continue on to phase 2 where the child will be fed with plumpy nut, a highly nutritious food supplement made from peanuts.



Phase 3: If the first two phases of treatment are successful, mother and child will return home where treatment continues in the form of food distribution and health check monitoring.



## 5.4 On and Off (Micro) Grid Energy Systems

Many countries lack access to a continuous power supply. The lack of access to energy services dramatically affects and undermines health, limits opportunities for education and development. The problem of energy access for the poor has become even more acute because of the increased vulnerability brought about by climate change, the global financial crisis and volatile energy prices.

**Projects within this theme, will explore solutions to energy supply using both on and off/ micro grid systems.**

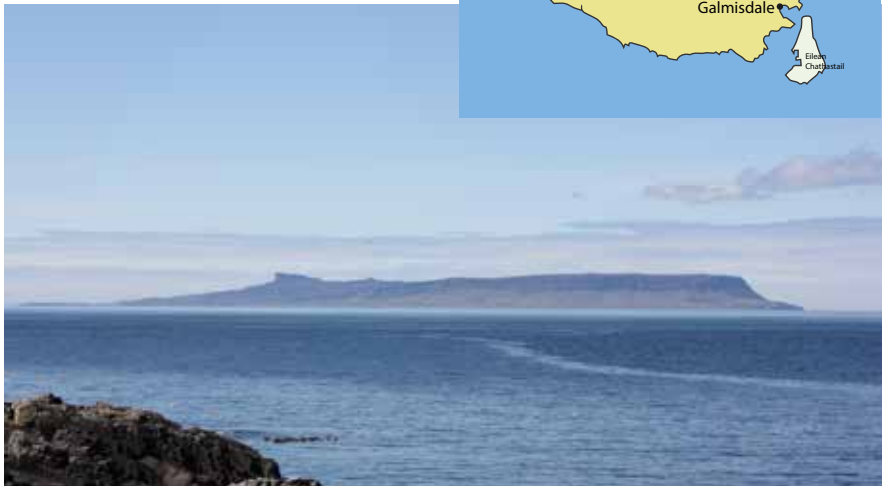
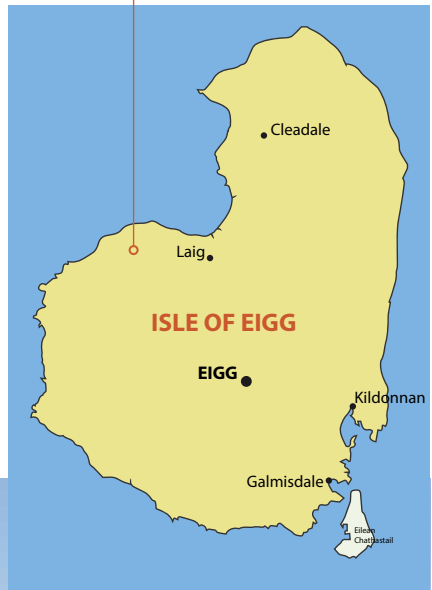
[www.wherethereisnoengineer.org](http://www.wherethereisnoengineer.org)

# Case Study:

## Off Grid Power and Community organisation - Eigg

The island of Eigg is one of the Inner Hebrides off the north west coast of Scotland. It is 9 kilometres long from north to south, and 5 kilometres east to west. It occupies an area of 3,049 hectares, has an elevation of 393 metres and, presently a population of approximately 100 people.

The main settlement on Eigg is Cleadale, in the north west. This is a fertile coastal plain which was/is the centre of crofters/crafting on the island. The island had a population as high as 500 in the 19th century, relying on an economy of potatoes, oats, cattle and kelp. The land was cleared in the 1850's to facilitate sheep farming. This clearance of fourteen families, reverberated down through the years.





The movement towards community organisation of the Eigg islanders was facilitated by the creation in 1977 of Community Councils which gave the people of Scotland a greater say in local government. One of the main grievances of the community on Eigg was land reform. The island was still privately owned, the Landlord being Keith Schellenberg who bought the island in 1973. In 1983 The Isle of Eigg Residents Association was founded and through this were channeled the early community efforts to influence their own affairs, campaigning successfully for a resident doctor, services for the elderly and social housing. After a brief period of hopeful expectation that the new landlord would prove progressive and mindful of the tenants, the relationship settled into polarisation that gradually slipped into open hostility.

For the residents of Eigg, both born islanders and newer residents of the island, community organization was

something that the latter had gone to Eigg to get away from or, in the case of the former, was something they had never known. It was a slow process changing community meetings round from shouting matches into a forum where the community could learn to express itself, exchange different points of view and resolve genuine differences of opinion into a common view, reflecting all shades of opinion. Training sessions in community organisation and assistance from a variety of groups were very helpful in the community becoming more independent and more coherent. There then followed a complicated series of events, both on Eigg and in Scotland that saw control of the island become a live issue for the residents of Eigg. A bizarre divorce case meant the landlord had to sell, this resulted in a resale after the first sale proved unacceptable to the residents. The new owner had development plans for the island and no plans for the residents. It was at this stage that the Isle of Eigg Heritage Trust (IEHT)

was set up when the islanders came together with the Scottish Wildlife Trust (who were managing the most significant of the wildlife sites on the island) and the Highland Council, to draw up a blueprint for a new island partnership. An action plan was put in place to raise money to buy the island should it come up for sale again. This plan was launched on Eigg, in the old school, with full national and international publicity. The campaign had started to buy Eigg. At the same time, in a separate development on the mainland the North Lochinver Estate was divided into seven lots and put on the market. The proposed break-up of the estate alarmed the crofters as the boundaries of the lots cut across grazing land. This raised the possibility of complications for some crofters as they might have to deal with more than one landlord. There was also the fear that these lots could be run by the new owners. A company limited by guarantee, the Assynt Crofters' Trust (ACT), was formed and membership consisted of crofters on the estate. They succeeded in purchasing the estate in 1993. This inspired the islanders of Eigg to bid for their island.

The price for Eigg was set at £2 million. The amount of money raised by the islanders stood at £1.5 million. After tense and protracted negotiations on Friday 4th April 1997 news came through that the bid had been accepted with a closing date of June 12th. The final successful bid of £1.5 million was made up of approximately 10,000 donations that all came from the public except £15,000 from the Highland Council. The IEHT had a good internal network that grew over the years into a resilient internal organization. Records were kept of all

donations, most of the islanders were involved in community and fundraising organisation. The confidence and skills acquired in the buy out were palpable. The external network set up by the trust was also impressive. From the press to Local Authorities to the European Community, all levels of decision making were recruited in the cause of Eigg. All were supportive and some gave freely of their advice and time, and of course money. This left Eigg with a powerful internal and external resource.

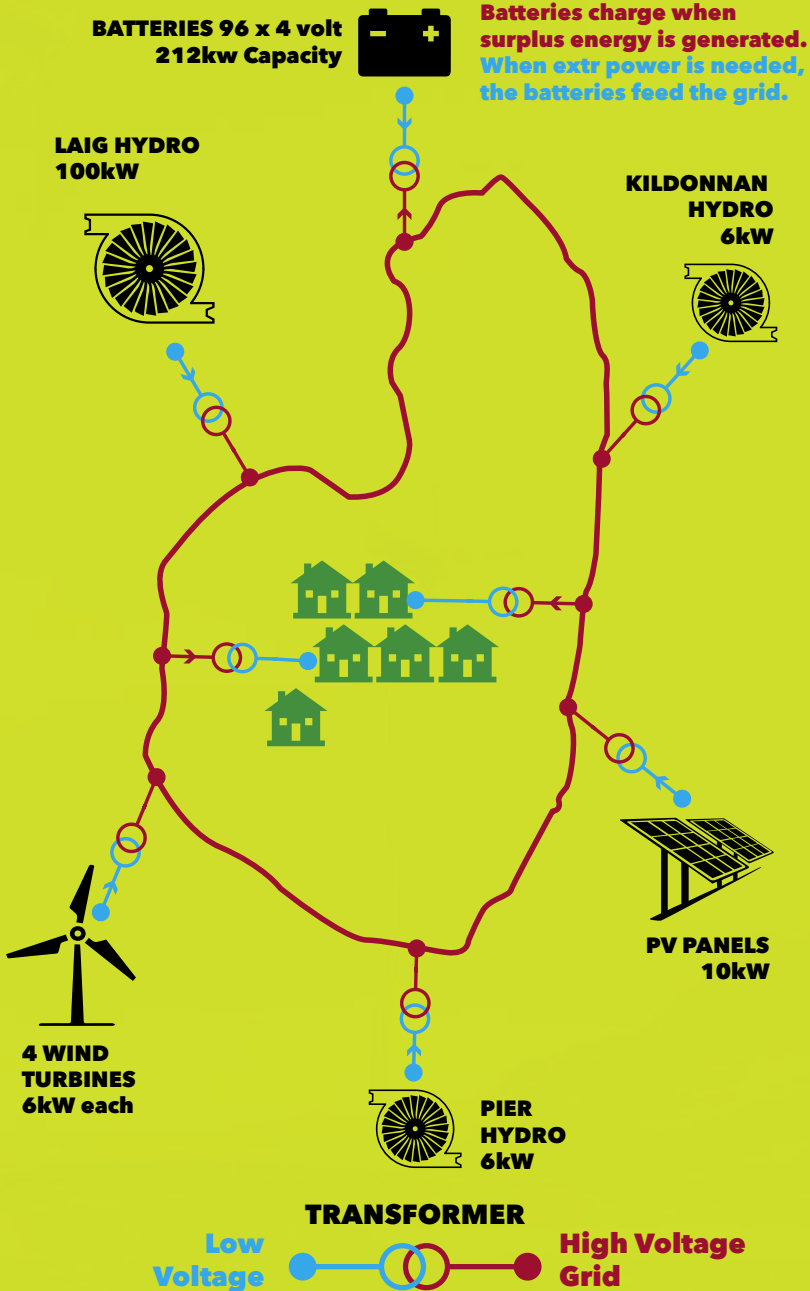
### **The Case for a Grid**

The island was not served by mains electricity and individual croft-houses had privately installed wind, hydro or diesel generators. However, after the success of the buy out of the island by the trust the next project was to develop a mains electricity grid for the island, powered by renewable energy. The project considered three sources of power, photo voltaic, hydro power and wind power.

The IEHT formed a local company, Eigg Electric Limited, to facilitate building the Grid and this was part funded by the National Lottery, and the Highlands and Islands Community Energy Company. The capital cost of the project was £1.6 million.

The suitability of the island for hydro was seen early, the centre of the isle of Eigg is moorland plateau that rises to 393 metres and sites were looked at and surveyed for best returns. Existing hydro power systems were incorporated into the plans. The new plant installed was a 100 kW system, which together with the original two systems gave a combined output of 112 kW.

# The Eigg Electric Grid





The new system involved damming the river high above the north western part of the island, and piping water down to a housed turbine. By using the moorland plateau a head for the water of 100 m was achieved.



A solar photo voltaic array was also installed, generating 10 kW.





Finally a 24kW wind farm was installed consisting of four Proven turbines of 6 kW each.



All the renewable energy is fed into a high voltage grid which runs the length of the island. The grid is in effect a three phase grid. The whole system is backed up with 96 batteries. The solar and wind can vary in power generation, the hydro is steady enough. The batteries make up for the fluctuating power available and guarantee 24 hr power.



The island is a leader in efficient use of electricity, with household use half of the UK average and CO<sub>2</sub> emissions 20% below the UK average. This is achieved by capping domestic energy use at 5 kW and business use at 10 kW. If usage goes over this limit, the electricity supply is cut off and the maintenance team must be called out to switch it on again. Households and businesses are equipped with energy monitors to show consumption and warn if it is close to the cap level. Demand is also managed by warning the entire island when renewable generation is lower than demand and the diesel back up generators are operating. This is referred to as a "red light day" as opposed to "green light days" when there is sufficient renewable energy. When the red light occurs islanders take steps to temporarily reduce electricity demand further, or postpone demand until the green light, and renewable energy, have been restored.



A programme of insulation of homes and the upgrading of heating systems was carried out. Solar water heating was also installed in over 20% of island households while "green grants" were given to islanders to purchase more efficient white goods to improve their homes and reduce carbon emissions. New energy supplies are also being developed. These include sustainable harvesting of the forests to supply wood for heating.

It has been the combination of demand management, behavioral change and renewable energy that has resulted in the reduced electricity consumption on the island.

The two developments that took place on the island of Eigg, the purchase of the island and the installation of renewable energy and the electricity grid, did not take place independent of each other. The experience gained, abroad in the community, from organising and running meetings, dealing with local and government authorities, empowered the islanders and led them to believe that they could organise and buy the island. The confidence which resulted from the successful buy out enabled them to investigate the options for sustainable electricity generation on the island.

Before the buy out, there was no community organisation worth talking of. Most households used diesel generators to supply electricity, generating significant carbon emissions. Homes were poorly insulated using old inefficient oil burning boilers or coal for heating.



Since the buy out and the installation of the Grid system, significant reductions in carbon emissions have been achieved. These are estimated to have fallen from 8.4 to 4.45 tonnes/year. This compares with UK household emissions of 5.5 to 6 tonnes per year. The emissions on Eigg should fall further in the coming years as the supply of wood for heating increases.

The community on Eigg have taken control of their own environment. They have become the design team, who with outside expert advice designed their own community structure and energy system. They have become the finance team, organising the £1.5 million buy out of the island and the funding of the island's grid system. They have become the operation and maintenance team, running and maintaining the grid on the island.



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## 5.5 Food Security

Food security involves access to healthy food and optimal nutrition for all. Food access is closely linked to food supply, so food security is dependent on a healthy and sustainable food system. Climate change will affect all aspects of food security. It will impact on food availability, food accessibility, food utilization and food systems stability. Regions which are already vulnerable to food insecurity face immediate risk of increased crop failure, new patterns of pests and diseases, lack of appropriate seeds and loss of livestock. It is necessary to strengthen the resilience of communities to help them cope with the additional threat to food security.

**Projects within this theme will seek to address the shifting vulnerabilities in both developing and developed countries.**

[www.wherethereisnoengineer.org](http://www.wherethereisnoengineer.org)

# Food Security

## Case Study: Peru

Peru is a country of 29 million people stretching from the pacific coast, through desert to the high Andes and into the Amazonian jungle. It is one of the most biodiverse countries in the world but is also home to some of the poorest regions in the world. 53% of Peruvians live below the national poverty level and 25% live in extreme poverty. Agrarian reform (which began in the late 1960's) centred on the redistribution of land to local campesinos, and allowed the local indigenous population to produce crops such as cotton, nuts, fruit and vegetables, based on the use of groundwater recharged from the seasonal waters from the mountains. However political change in the late 80's led to the promotion of large agribusiness, resulting in the return of a few economic groups taking charge of land ownership along the Pacific coast. These interests saw Peru's economic future as supplying international markets by means of high value export crops produced in the dry coastal belt between the Andes and the Pacific Ocean. These crops, most notably asparagus, also included artichoke, chillies, paprika, avocado, legumes and grapes. The coastal situation allowed easy access to the capital Lima and to an airport, an important part of the export strategy.

As part of this export economy



the Ica region of Peru has specialised in the production of asparagus. The Ica valley is fed by the Ica river, which rises in the mountains of Huancavelica.

The Huancavelica region is the poorest in Peru, with much of it situated above 4,000 metres, and 86% of its population living below the poverty line. The Ica region sees the river flow through it and enter the Pacific. The Ica region has an average rainfall of less than 1 mm per annum and is officially defined as hyper-arid, an extension of the Northern Atacama desert. High quality asparagus can be produced in Ica all year round, due to its climate, which sees warm temperatures and little rain. These two conditions ensure that the asparagus does not enter a dormant phase.

Asparagus is grown in the Ica valley in large blocks of land reclaimed from the desert, which is irrigated by drip irrigation groundwater supplied by pipelines hundreds of kilometres long. Starting in the 1990's asparagus cultivation for the export market has expanded from near zero to 100 square kilometres in 2008. The growth of the fresh asparagus trade has resulted in an almost zero unemployment rate in the Ica area. It is estimated that 40% of the region's economically active population are employed in asparagus production.

The increase in asparagus production has seen Peru dominate the world asparagus trade and almost 95% of this originates in the Ica region.

As a result of this expanding production the desert began to be irrigated and water resources were consumed at an ever increasing rate. Starting in 2002 the irrigation of asparagus began to have serious effects on the valley's aquifer. Gradually the extraction of water



began to exceed the amount of water recharge. The water table in the valley dropped significantly, on average by between half a metre and two metres a year, while in some places it fell by as much as eight metres each year, one of the fastest rates of aquifer depletion in the world.

Therefore while the asparagus boom is an opportunity for economic and social development in the valley, extreme increases in water use have started to erode a lot of these benefits. The over use of the aquifer is having a severe impact on the industry itself as a result of the increasing costs of irrigation water. Some of these costs include deepening existing wells, buying up old wells to increase supply and piping water across great distances. These acquisitions are having a knock on effect on indigenous small and medium scale farmers as water becomes scarcer due to the drying of wells and increasing salinity. These traditional farmers are also facing higher costs for water and are thus forced into debt or into selling their lands and wells to the large dominant agribusinesses.

Water levels in wells used for domestic supply have also fallen dramatically. Two wells providing water to 18,500 people in Ica have already dried up and it is estimated that if current rates of water exploitation continue a third of the water supplies of Ica will be dried up within 25 years.

However it is those living in the valley on the outskirts of Ica who are feeling the water shortages. The severe earthquake that hit the valley in 2007

damaged water infrastructure. The state of this infrastructure was poor, as years of underinvestment in water services saw some of the communities in the Ica valley surviving on 10 litres of water per person per day, where the minimum needed for basic health maintenance is set at 50 litres per head per day proposed by the World Health Organisation. This has resulted in the Agribusiness companies buying up local wells, as they seek to control the use of water in the region. As a result the local communities are forced to watch as the large Asparagus farms consume the same amount water per day as the entire city of Ica.

As an export crop the asparagus is dependent on the developed world and the demands of that market. These markets insist that the crops are irrigated with a high quality water, to offset the risk of disease to the consumer in the developed world. This has resulted in a higher quality water being used to irrigate the asparagus than is available to the vast majority of locals via the public potable water supply. A further irony is that nitrates and other fertilisers used on the asparagus are polluting the groundwater, the same groundwater that supplies the potable water locally.

The water that flows through the Ica valley has its source in the mountains. It is here that the water scarcity is felt most. This water scarcity affects some of the poorest communities in Peru. This scarcity is due to government supported investment that has seen the extension of a water transfer scheme, that had already proven disastrous for communities in the



mountain region. The new scheme involves diverting drainage from 329 square kilometres of the upper Amazon basin.

As a result the local alpaca herders, some of the poorest people on the planet, have taken to the Latin American Water Tribunal to seek justice. They base their claim on the fact that the water required to keep their pastures and animals healthy is being diverted to Ica, thus reducing their resilience in the face of climate change. They claim that less snow falls in the area, less rainfall (yet

more intensive) and more extreme temperatures. The herders argue that faced with the realities of climate change the transfer of water to Ica alters the ability of the community to resist climate. This reduction in the resilience of the communities limits their options to escape the severe poverty that exists in the mountains.

The overexploitation of the aquifer in the Ica valley, will eventually consume the water resources within the city of Ica. As a result the population of Ica, at present in the region of a third of a million, will find it difficult to survive



Utilising groundwater to grow crops in the arid coastal deserts of Peru.

in the region. The end result maybe the survival of the most powerful farmers, as others, including the cities inhabitants, will be forced out of the region as water becomes scarcer and more expensive to access.

The example of water use in the Ica valley shows the complexity of the term Food Security and the issues involved. The WHO refer to the following points when talking of food security:

1. All people at all times have both physical and economic access to enough food for an active, healthy life;
2. The ways in which food is produced and distributed are respectful of the natural processes of the earth and thus sustainable;
3. Both the consumption and production of food are governed by social values that are just and equitable as well as moral and ethical;
4. The ability to acquire food is ensured;
5. The food itself is nutritionally adequate and personally and culturally acceptable; and
6. The food is obtained in a manner that upholds human dignity.

In the case of asparagus production and the water resources of the Ica valley in Peru, only point 5 is not directly relevant. The people of the area, and indeed the mountains at the head of the watershed are having their access to food reduced. The food is not being grown in a sustainable manner. The ethics of production and consumption are not applied. The ability of the Peruvians in the region to acquire food is not ensured, in light of water abstraction and consumption by Agribusiness. Asparagus is not being obtained in a manner that upholds human dignity.

The causes of the problems in the Ica watershed are also complex. They are problems that are not unique to Peru either. Rather they are a feature of the developing world. These include lack of regulatory capacity, the subversion of government capacity by powerful elites and a lack of political will to control market forces. However responsibility is also shared by the private sector. To promote food security investors, insurers, purchasers and consumers must support businesses that exploit natural resources in a sustainable manner. This involves safeguards and market standards to avoid the reduction of access by the local population to local resources. Local resources that are being exploited at the expense of the local people and their ambient environment.



## 5.6 Applying Big Data in the Community

Big Data refers to the quantity and diversity of high frequency digital data. Research suggests that big data technology can make important contributions. Advancements in big data analysis may offer cost-effective opportunities to improve decision-making in areas such as infrastructure, health care, water and sanitation, livelihoods, food security, natural disaster and resource management. Challenges within developing regions such as inadequate technological infrastructure and economic and human resource scarcity need to be overcome before the full potential of big data in the community is realised. For local communities living in remote rural areas, access to big data can make a significant contribution towards improving their education and livelihood prospects.

**Projects within this theme will explore the relationship between big data and the community.**

[www.wherethereisnoengineer.org](http://www.wherethereisnoengineer.org)

# Big Data in the Community

## Case Study: Nepal



### The Environment

Nepal is a country of 28 million people, ranked amongst one of the poorest countries in the world with an annual GDP per capita of just US\$728 (\$2 per day).

It is a country of great beauty and contrasting environments. The Himalayan belt dominates the north of the country with a harsh mountainous terrain and extreme temperatures. This area hosts the tallest mountain in the world (Mt Everest), and one of the highest lakes on earth (Tilicho Lake).

The centre of the country is known as the hill country. This is the industrial heartland with the densely populated (1.5 million people) Kathmandu valley





Khumbu region, Nepal holds 10 mountains above 8,000m

dominating the region. The south of the country is a fertile plain bordering India. This is where most of Nepal's arable crops are grown. The climate varies across these three regions. It is generally cold in the mountains mild temperate climate in the hill country and warm in the terai plain.

With it's remote location, landlocked Nepal was closed to the outside world until the 1950's. Since then visitors have been drawn to Nepal for it's ancient culture, remote location and the stunning backdrop of the Himalayas. Tourism has become a major component of the country's economy.

Within this harsh environment transport options vary across the country. In the hill region a typical journey is shown on the next page comprising an overcrowded local bus on a single lane road perched precariously on the side of a mountain.



Boudhanath Stupa (largest Buddhist shrine outside Tibet)

Main Road Kathmandu to Dhunche



Four legged transport - Nepal



Such roads are prone to frequent landslides. Given limited resources transport via mule is common, with suspension bridges connecting villages across rivers and gorges.

Transport is frequently by humans. The photo on the left shows a family transporting building materials for



Travelling to school - Nepal

internet access for communities in Nepal could potentially offer education and livelihood opportunities that could make a real difference to their lives.

### The man who connected 60,000 people - Mahabir Pun

their house on a three day journey from the main road to their remote village.

### Access to Education

Access to education for many communities in Nepal is a daily challenge. The photo above shows the morning journey for local students attending a school in their region. Poverty, social exclusion of women, and lower caste discrimination are daily challenges. Students often leave primary school after they learn to read and write, but without additional education these skills are often forgotten. The 2015 earthquake destroyed many schools. Within this context, the benefits of increasing

Mahabir Pun is known as a “global connector”. In 2001 he returned from completing a master’s degree in education in the US to his native village of Nangi in western Nepal. To check his email he had to undertake a five hour walk to the main road and a three hour bus ride to the nearest town, Pokhara. Pun decided to tackle this challenge of bringing big data to Nangi’s villagers, primarily to increase education opportunities for the local children. By 2006, he had succeeded in linking 13 hamlets to the internet. Pun faced many challenges, not all geographical when he started on his quest. A Maoist insurgency was underway in Nepal in



Mahabir Pun setting up the remote network in the mountains of Nepal



Local villagers connecting internet

What served initially as a communications tool for these isolated communities has gone on to improve their quality of life in ways they never imagined. "We have shifted our focus from communication to using the technology for education, health and e-commerce, because we did not know how we could

the 2000's and transport of wireless equipment was banned by the government. Despite this, by 2006 he had connected almost 200 remote settlements. Pun taught villagers how to use the internet and e-mail, set up bulletin boards for communication, and installed internet phones so people could talk to others in nearby villages. Since few families are able to afford a computer at home, each village has up to four computers - in schools, clinics, communications centres and local government offices.

use the internet in the early years," Pun says. He is now a board member of Open Learning Exchange Nepal, which creates digital educational content in Nepalese, based on the school curriculum. The content is loaded onto local servers, which students can download at school, along with teacher training materials. Guesthouse owners can now avail of online booking systems to boost their business. Other technological solutions Pun has introduced to the impoverished nation include the

## EWB Ireland e-resource centre



Building on the work of innovators such as Mahabir, EWB Ireland has helped establish an e-resource centre by providing desktops, projectors and solar pv systems to digitise books for 1200 students and the wider community at Shree Birendra Secondary School in Nepal. Shown above are the students and community engaging with the technology.



Nepal Trekkers Tracking System, which is currently at the pilot stage. Relay stations have been built along a mountain route, and trekkers who sign up for the service are given wireless tags to wear that keep tabs of their whereabouts. Similarly, Pun is working with friends on a surveillance

system for porters at Chitwan National Park, on Nepal's southern plains, which is home to tigers and rhinos. It is also the hunting ground of armed poachers. He is also working on developing a centre in Kathmandu to help young innovators develop tech solutions.



This is not a "typical" dwelling but show the resilience of a local villager after the 2015 Nepal Earthquake when he left his temporary shelter in Kathmandu to return to his house in the mountains.



# 06 – Where There Is No Engineer – Learning Outcomes & Programme Rules

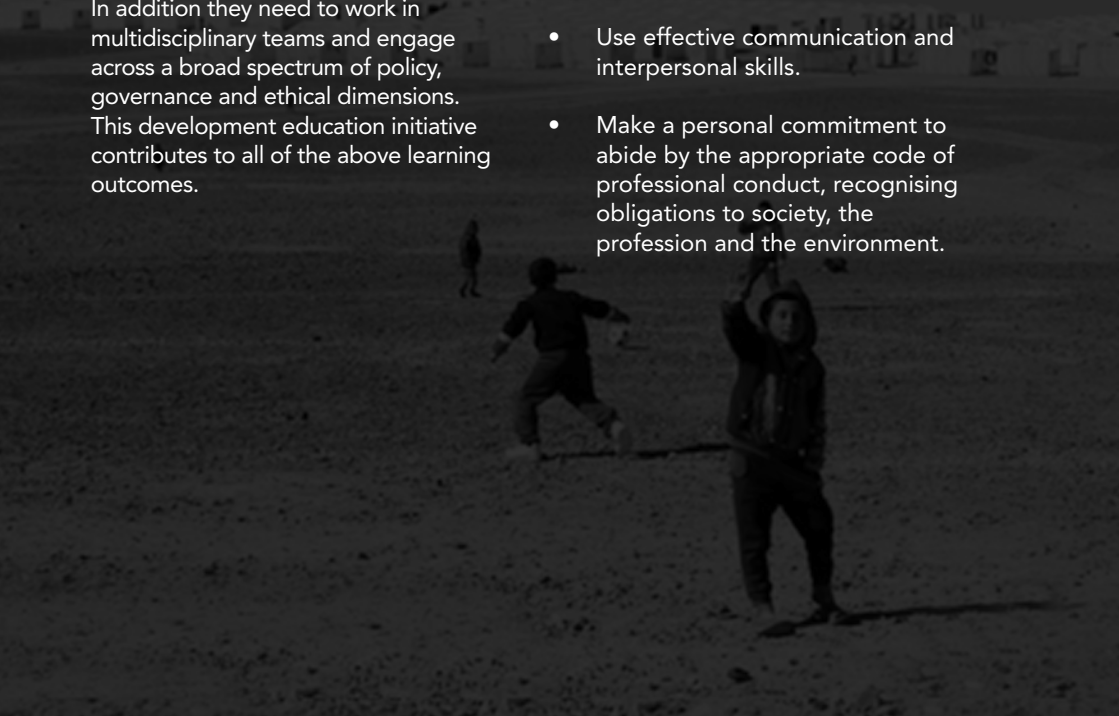
This generation of professionals need to be:

- **Creative and Enterprising**
- **Effective Communicators**
- **Globally Engaged**
- **Active Leaders**
- **Committed to Continuous Learning**

Engineers and associated professionals need an understanding of the effects of complexity, uncertainty, environmental limits, social acceptability, and community participation & accountability within their designs. In addition they need to work in multidisciplinary teams and engage across a broad spectrum of policy, governance and ethical dimensions. This development education initiative contributes to all of the above learning outcomes.

The programme can also contribute to the competencies a young professional needs to acquire to achieve Chartered Status. These are listed by Engineers Ireland as follows:

- Use a combination of general and specialist engineering knowledge and understanding to optimise the application of existing and emerging technology
- Apply appropriate theoretical and practical methods to the analysis and solution of engineering problems.
- Provide technical, commercial, and managerial leadership.
- Use effective communication and interpersonal skills.
- Make a personal commitment to abide by the appropriate code of professional conduct, recognising obligations to society, the profession and the environment.



**This design initiative will support a wide spectrum of core curriculum learning outcomes:**

- Students will be introduced to the design process and experience what it is to be a professional working on real life practical problems;
- Through the background research required, students will gain an ability to undertake problem identification and to apply knowledge and understanding of basic science and engineering principals;
- By defining the problem statement, students will gain an ability to communicate effectively, not only with engineers but more importantly with the community at large;
- Students will develop a basic awareness of global development issues and approaches to ensuring that basic rights and needs are fulfilled;
- Students will understand the importance of listening, engaging with and respecting local knowledge before proposing solutions;
- Students will have demonstrated an understanding of the need for high ethical standards in the practice of their profession, including the responsibilities of the profession towards people and the environment.

**This design initiative will support a wide spectrum of continued professional development (CPD) components including the following:**

- Ability to function effectively as an individual and in multi-disciplinary and multi-cultural teams, with the capacity to be a leader, not only to influence but to inspire and manage;
- Ability to undertake continuous and lifelong learning ;
- Ability to think and not learn by heart;
- Display an understanding of theorems and formula not just the application of same;
- Ability to invent and innovate, not to copy, replicate or play it safe.
- Professionals will be challenged to not only acquire skills and facts in relation to global development but will examine their own value base regarding issues such as overseas aid, trade and debt.
- Professionals will carry out a risk assessment for each design to assess the likelihood and probability of risks within their design solution and its impact on local and global development.

## 6.1 Who can participate?

### Undergraduate

Teams are eligible to participate in the “Where There Is No Engineer” undergraduate design initiative on the provision that they:

- Are enrolled in a Level 7, 8 or 9 course in a University or Institute of Technology in Ireland or Northern Ireland.
- Teams must have 2 – 6 members.
- Individuals can also enter provided they can meet the requirements of the project themes and/or design brief.

### Professional

Teams are eligible to participate in the “Where There Is No Engineer” professional design initiative on the provision that:

- Postgraduates and professionals can compete in teams either from one or more organisations. Professional teams from one or more companies must nominate a lead organisation.
- Individuals can also participate by combining together and forming a team.
- Each participant must respect the privacy of all participating organisations and communities. All entrants to the competition must acknowledge that ideas and designs entered into the “Where There Is No Engineer” design programme become the right

of the programme partner(s) to use. The individual entrants also retain the right to develop their concepts separately.

## 6.2 What are the categories?



The programme will operate at different categories ranging from undergraduate to postgraduate to professionals. The programme is open to students and professionals across the disciplines of engineering, architecture, urban planning, science, business, social science, arts, media etc. Organisations participating within other development challenges in Ireland and UK may also enter their submissions for consideration in this design initiative.

## 6.3 How can I participate?

Individual third level Institutes of Technology and Universities will decide how to integrate the programme within their respective modules.

The programme can be run in either semester 1 or semester 2 courses.



Water is pumped from the pan using a treadle pump. JilloDabassa (on left) is just one of the community members who will take their turn to pump water for the benefit of all. The water is carried to water tanks which then gravity feed the irrigation pipes.

Source: Gideon Mendell, Concern, 2012

An introductory lecture at the start of the module can be provided for all participating teams. The aim of this lecture is to provide an introduction to the subject areas, provide a development context for the design initiative and explain how the programme will progress. This can be organised by emailing the programme coordinators. Email contacts can be sourced on the project website ([www.wherethereisnoengineer.org](http://www.wherethereisnoengineer.org)). Depending on the individual module, a design review is held with external evaluators organised by EWB / DTC. Final presentations are also reviewed by EWB evaluators. Participating colleges also get access to EWB/DTC educational resources. Each institute

may enter an unlimited number of teams into the programme within their institution.

Each academic institute will be responsible for assessing their own teams' submissions and selecting up to a maximum of four team submissions for external judging in the National finals.

## 6.4 What project area can I choose?

Teams may wish to address a single theme or provide an integrated design solution for two or more of the development themes.

Typical home in Marsabit, Kenya. Due to its high altitude, Marsabit serves as a dry season grazing destination – many animals will have migrated there at this time.

Source: Jennifer O’Gorman, Concern, 2012



## 6.5 What are the Submission Requirements?

Each University or Institute of Technology may nominate up to four team submissions for external judging. The final submission should take the form of a short written report using the template included in Appendix A, and an A0 poster. This can also be downloaded from our website [www.wherethereisnoengineer.org](http://www.wherethereisnoengineer.org).

Teams are welcome to submit additional supporting material produced over the course of the design initiative (photos, videos, models, laboratory testing etc.). Supporting material should be carefully selected by students and should only be included if it enhances the report reviewer’s ability to understand the design proposal.

## 6.6 Report Review Process

Internal module assessment within respective colleges and the “Where There Is No Engineer” programme assessment are separate processes. The “Where There Is No Engineer”

team will assess student reports purely for the purpose of selecting teams for entry into the National Finals. Individual academic institutes are free to integrate the programme into their own respective evaluation processes.

Report reviewers can be professional engineers, academics, graduate students, returned overseas placement volunteers, development professionals etc.

All submissions will be judged against a common set of criteria and guidelines. These criteria will be outlined on the programme website.

A multidiscipline engineering judging panel will decide upon a short-list of entries in each category.

Final judging will be based upon both the original entry and the presentations.

## 6.7 National Finals Day

The selected teams / individuals within each category will be invited to participate in the National Finals.

Finalists will be required to make a 10 minute presentation to a panel of judges:

- Judging is a voluntary role
- Judges are selected by the programme co-ordinator who will aim to cover as many different disciplines, professions and backgrounds as possible in order to ensure a fair and efficient judging process.
- Judges assess entrant's presentation on the basis of

their content, style and the team or individual's ability to answer questions relating to their proposal.

- Entrants are encouraged to be creative in their presentation content and style - presentations will not be limited to powerpoint.

Further Information:

[www.dit.ie/dtc](http://www.dit.ie/dtc)  
[www.wherethereisnoengineer.org](http://www.wherethereisnoengineer.org)  
[www.ewb-ireland.org](http://www.ewb-ireland.org)



## Creating a Community of Global Professionals

By participating in the program, students and professionals will have the opportunity to:

**Design creative solutions to real life development projects.**



# Appendix A

## Where There Is No Engineer Final Submission

<b>Project:</b>		
<b>Project Team:</b>		
<b>Contact:</b>		

**Abstract:** Please insert a short (250 word) abstract which explains your concept and how you would envisage it being implemented.

**Program Theme:** Please select the program theme under which your project / concept is being submitted by placing an "X" in the appropriate column. (note you can select more than one thematic area)

<b>1. Climate Resilient Infrastructure</b>	
<b>2. Self Supply Water and Sanitation</b>	
<b>3. Community Participatory Health</b>	
<b>4. On and Off (Micro) Grid Energy Systems</b>	
<b>5. Food Security</b>	
<b>6. Applying Big Data in the Community</b>	

**Sustainable Development Goals (SDGs):** Please select the SDGs relevant to your project concept by placing an "X" in the appropriate boxes. (note you can select more than one)

<b>SDG1 - No Poverty</b>		<b>SDG10 – Reduced Inequalities</b>	
<b>SDG2 – Zero Hunger</b>		<b>SDG11 – Sustainable Cities &amp; Communities</b>	
<b>SDG3 – Good Health &amp; Well Being</b>		<b>SDG12 – Responsible Consumption &amp; Production</b>	
<b>SDG4 – Quality Education</b>		<b>SDG13 – Climate Action</b>	
<b>SDG5 – Gender Equality</b>		<b>SDG14 – Life Below Water</b>	
<b>SDG6 – Clean Water &amp; Sanitation</b>		<b>SDG15 – Life On Land</b>	
<b>SDG7 – Affordable &amp; Clean Energy</b>		<b>SDG16 – Peace &amp; Justice, Strong Institutions</b>	
<b>SDG8 – Decent Work &amp; Economic Growth</b>		<b>SDG17 – Partnerships For The Goals</b>	
<b>SDG9 – Industry, Innovation &amp; Infrastructure</b>			



In the following sections you are asked to provide a concise description of your concept and how it would work in practice (Maximum 5 pages). You can insert tables, graphs, photos, drawings to illustrate your concept as appropriate.

### **Objective (What you are planning to do):**

*Describe your overall idea / concept and approach. Identify the alternative options considered during the design process and a justification for the selected technology, approach and/or process.*

- a) *Describe your overall idea / concept and approach.*

### **How it works:**

- a) *Identify the alternative options considered during the design process and a justification for the selected technology, approach and/or process.*

**Background (Why you are doing it):** *Key questions to address in this section include the following:*

- *What problem are you trying to solve?*
- *Is the solution already available (product / service/ knowledge)?*
- *What makes your idea different?*

### **Expected Results (who wants them and how will they use them)**

- *What will be the expected results from your concept?*
- *Who will use your product / service and how?*
- *What further development will be needed before the service / knowledge is market ready ?*

### **Community Participation**

*Outline briefly how you would envisage the community could participate in the various stages of your concept from design through to final implementation.*

You are welcome to bring along additional supporting material produced over the course of the design initiative (photos, videos, scale models, laboratory testing etc.). Supporting material should be carefully selected by students and should only be included if it enhances the reviewer's ability to understand your concept.

**References:**

*All intellectual property rights in the original idea shall at all times remain the property of the entrant(s). However by entering the competition, participants grant EWB and its partners perpetual permission to further adapt, develop and use the concept within its development programs on a non-profit humanitarian basis with proper credit and at no cost or liability to EWB or its partners.*

*Partners - organisations, individuals or communities involved in the design, manufacture, testing, installation or use of the product / service.*

# Appendix B

## Adapted from Atlas of Sustainable Development Goals 2017



### End poverty in all its forms everywhere

An estimated 766 million people, or 10.7 percent of the world's population, lived in extreme poverty in 2013. In 2012 the extreme poverty rate stood at 12.4 percent globally, and over the year the number of people living below the international poverty line of \$1.90 a day fell by 114 million. Goal 1 aims to end poverty in all its forms by 2030. It also seeks to ensure social protection for poor and vulnerable people, to increase access to basic services, and to support those harmed by conflict and climate-related disasters.



### End hunger, achieve food security and improved nutrition, and promote sustainable agriculture

Undernourishment declined globally from 19 percent to 11 percent in the past quarter century, while child stunting fell from 40 percent to 23 percent. But populations and food demand continue to grow, especially in South Asia and Sub-Saharan Africa. Ending hunger and all forms of malnutrition by 2030 requires faster downward trends. Goal 2 also addresses poverty and food insecurity through enhancing agricultural productivity and sustainability.



### Ensure healthy lives and promote well-being for all at all ages

In 2015, 303,000 mothers died from complications in pregnancy or childbirth — 216 per 100,000 live births. In Sub-Saharan Africa the rate was more than twice that. Both there and in South Asia only half of births are attended by skilled staff, and the number of newborn deaths in the first month is also high, at around 30 per 1,000 births. Goal 3 addresses these and other causes of premature death and seeks universal health coverage, so that people can obtain health care without great financial penalty.

## 4 QUALITY EDUCATION



### Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

The ratio of students completing lower secondary school increased in Sub-Saharan Africa from 23 percent in 1990 to 42 percent in 2014 but remains low compared with a global ratio of 75 percent. Increased enrollment at school leads to an empowered citizenry and a more productive labor force. Goal 4 aims to make learning opportunities accessible to all. It also examines the quality of education, which plays a large role in sustainable development and poverty alleviation. Investment in human capital at various ages accelerates improvement in other areas.

## 5 GENDER EQUALITY



### Achieve gender equality and empower all women and girls

One hundred fifty countries have at least one law that treats women and men differently, and 63 countries have five or more. Such institutional biases together with adverse social norms, persistent gender gaps in access to assets, and the failure to recognize, reduce, and redistribute unpaid domestic work undermine women's economic empowerment. Goal 5 offers an opportunity to deliver transformative actions for addressing these constraints and for accelerating progress toward stronger economies.

## 6 CLEAN WATER AND SANITATION



### Ensure availability and sustainable management of water and sanitation for all

More than 90 percent of the world's people now have access to improved water sources. In the past 25 years 2.1 billion people gained access to improved sanitation facilities. At the same time the share of people practicing open defecation halved, from 27 percent to 13 percent. While such improvements show progress toward access for all, these measures do not capture all dimensions of providing water and sanitation. Goal 6 introduces a new, more comprehensive monitoring framework to ensure access that is safe, equitable, and universal.

## 7 AFFORDABLE AND CLEAN ENERGY



### Ensure access to affordable, reliable, sustainable, and modern energy for all

Nearly 1.1 billion people had no access to electricity in 2014, and more than 3 billion had no access to clean fuels and technologies. Goal 7 recognizes that extending access to electricity and other forms of energy is fundamental to improving people's lives and communities. It aims for efficiencies in energy use and the promotion of renewable sources to sustainably manage resources for development.

## 8 DECENT WORK AND ECONOMIC GROWTH



### Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all

Young people ages 15–24—who make up 22 percent of the world's adult population—often face great challenges in finding employment. And even after they find work, they are disproportionately engaged in low-productivity and low-quality jobs, with few opportunities. In addition to sustained job creation, Goal 8 recognizes that decoupling economic growth from environmental degradation is fundamental to sustainable development.

## 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



### Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation

Just over half the rural population in Nepal live within 2 kilometers of a road in good or fair condition, leaving around 10.3 million people without easy access. And around 15 million rural residents lack good road access in Mozambique. Yet reliable roads and other decent infrastructure are essential for lifting rural communities out of poverty. Goal 9 explores not only opportunities to improve transport but also those in industry, innovation, and other types of infrastructure.

## 10 REDUCED INEQUALITIES



### Reduce inequality within and among countries

The income and consumption of the poorest 40 percent of the population (the “bottom 40”) grew faster than the national average in 49 of 83 countries between 2008 and 2013. By providing a platform for sustained income growth among the poorer segments of society, Goal 10 aims to reduce inequalities between a country’s citizens and to promote shared prosperity and gains in wealth for all.

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## 11 SUSTAINABLE CIT AND COMMUNITIES



### Make cities and human settlements inclusive, safe, resilient, and sustainable

The number of urban dwellers is growing by 2 percent a year globally, but by 4 percent in Sub-Saharan Africa, which will double the number of people in the region’s cities in two decades. Cities are engines of economic growth and offer opportunities for innovation and sustainable development. But Goal 11 recognizes that urban areas still face numerous challenges in ensuring access for all to safe housing, affordable transport, clean air, and green and public spaces.

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## 12 RESPONSIBLE CONSUMPTION AND PRODUCTION



### Ensure sustainable consumption and production patterns

The equivalent of more than 500 kilocalories of food per person a day is lost in the supply chain in Latin America and the Caribbean before it even gets to the final consumer. By reducing such waste, and promoting recycling, reuse, and more efficient practices across high-consumption economies and those highly dependent on natural resources, Goal 12 looks to bolster the mechanisms for sustainable development to flourish.

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## 13 CLIMATE ACTION



### Take urgent action to combat climate change and its impacts

Without climate-informed development, climate change could erode development gains and force 100 million more people into extreme poverty by 2030. Climate change is already affecting every country on every continent through changing seasons and weather patterns, rising sea levels, and more extreme weather events. Goal 13 addresses the changes in climate that pose substantial risks for agriculture, water supplies, food production, ecosystems, energy security, and infrastructure.

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## 14 LIFE BELOW WATER



### Conserve and sustainably use the oceans, seas, and marine resources for sustainable development

Almost 90 percent of global marine fish stocks are now fully exploited or overfished, and wild capture fisheries struggle without sound regulatory frameworks and strong enforcement. The status of marine biodiversity is closely connected with ocean pollution and acidification. About two-thirds of the world's oceans showed signs of increased human impact between 2008 and 2013. Goal 14 recognizes these broad challenges and seeks the conservation and sustainable use of oceans.

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## 15 LIFE ON LAND



### Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss.

Over the last 25 years Brazil lost around half a million square kilometers of forest around the same area that China gained. Losses and gains are spread across the globe, but the farther south a country, the more likely it is to have depleted forest land, while more northern countries tend to have gained more forests (figure 15a). Human activity can have a detrimental effect on forests and other parts of the environment, and Goal 15 pledges to reduce or reverse these consequences to provide a more viable ecological platform for sustainable development.

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**16** PEACE, JUSTICE AND  
STRONG INSTITUTIONS



**Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels.**

Nearly one in three firms in countries surveyed in East Asia and Pacific encounter at least one bribe payment request, the most of any region. Businesses in poorer countries are more likely to encounter bribery than those in richer ones, impeding sustainable development. Goal 16 promotes just, transparent, and accountable governance, together with inclusive frameworks and peaceful societies.

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**17** PARTNERSHIPS  
FOR THE GOALS



**Strengthen the means of implementation and revitalize the global partnership for sustainable development.**

Personal remittances received from across borders and foreign direct investment (FDI) reached \$2.7 trillion in 2015, representing 3.6 percent of global GDP. These transfers and official aid enable the poorest countries to lay the foundations for viable long-term development. Funding, capacity building, knowledge sharing, international outreach, debt sustainability, trade facilitation, domestic resource mobilization, effective public-private partnerships, and access to tools and technologies form the basis of Goal 17, which seeks to strengthen global partnerships to support sustainable development.

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# Where There Is No Engineer Designing for Community Resilience

## Program Coordinators

Development Technology in the Community (DTC)  
Research Group, Dublin Institute of Technology  
and Engineers Without Borders Ireland



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