ACTION DIALOGUE

Unlocking the Energy of Micro-digesters in South Africa

Online Expert Dialogue Outcome Report

technology innovation AGENCY

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South African National Energy Development Institute

Wicked Problems

"In planning and policy, a wicked problem is a problem that is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognise."

"Our **sensemaking** framework is designed to allow shared understandings to emerge through the multiple discourses of the decision-making group."

To achieve Social Impact

Design for Social Impact

Environmental aspects

hold the key for both the return of investors and community investment based micro-digester models.

The **market need** for micro-digester should be clearly defined and **appropriate technology development** should be informed by this need.

Policy that enable and regulate the micro-digester sector and boost regional competitiveness is needed.

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Overview

The South African National Energy Development Institute (SANEDI) is reviewing the state of the micro-digester industry in South Africa and the impact of projects they have implemented during the last five years. Supported by University of Johannesburg´s Process, Energy and Environmental Technology Station (UJ-PEETS), an Action Dialogue was facilitated with industry and subject experts to inform a roadmap for a sector development plan and engage with different stakeholders to foster collaboration.

Experts were invited to provide insights into barriers and drivers in the development of the micro-digester sector, socio-environmental aspects, socio-technical systems, techno-economic aspects, technology development and application, as well as the policy framework in South Africa. The Action Dialogue forms part of an engagement strategy to co-create a research agenda, which will support the assessment of the pilot projects implemented by SANEDI and inform future development of the micro-digester sector.

> "The objective of the Working for Energy Programme is to provide sustainable clean energy solutions to rural and low-income urban communities with special emphasis on job creation, skills development, and community enterprise development.
>
> The Programme targets the youth, women, and people with disabilities in rural areas and low-income urban communities."

It is believed that the development of micro-digester technology can provide government an alternative in its energy mix while still achieving the objective of skills development, economic transformation, and job creation. This has also been emphasised by the 2019 Integrated Resource Plan, that *"when deployed together, the nexus between the biomass and a government-backed biofuels programs could improve the economics of the initiatives and create job opportunities in rural and urban centres"* [1]. Moreover, biogas reportedly has the potential to generate 2,5GW of electricity in South Africa with a market potential of R10 billion [2]. This potential has however not been realised and a strategic shift is needed to support the sector to grow.

SANEDI Working for Energy has implemented several micro anaerobic biogas digester projects over the past five years. This has allowed SANEDI to develop the expertise and network to understand the technology and the industry. While the focus of the previous years has been on understanding the technology by providing clean energy solutions to selected but isolated beneficiaries, the technology, operations, and maintenance

regimes can still be optimised by co-creating solutions and applying a design thinking methodology. To date, SANEDI's focus on interventions have not enabled the Development Institute to quantify the total cost-benefit of the clean energy intervention to recommend implementation at scale. Hence, a better understanding on of the impact on livelihoods is needed to inform a techno-economic review, map a pathway to achieve this impact and develop a sustainable business case to support future implementation, to unlock the potential of economies of scale or scope.

To frame the problem, redefine the brief and define high impact practical solutions, an online one-day Action Dialogue was facilitated, allowing for keynote presentations and informed discussion, while applying a design thinking approach to develop appropriate solutions. Participants from academia, government, private sector, entrepreneurs, NGOs, technical and financial service providers were invited to share relevant information from their environment by presenting prepared concept notes to stimulate discussions, and with the assistance of a facilitator, develop solutions and devise an action plan to unlock the potential of the biogas industry. Where further information is needed, follow-up interviews will be scheduled to expand on ideas presented, supported by a literature review to establish best practices which will be presented in a subsequent report. The Action Dialogue was designed to inform the development of an Impact Pathway through the establishment of a Theory of Change, considering the social, economic, and environmental contexts. The insight gained through the Action Dialogue will contribute to the body of research to inform a roadmap for the micro-digester sector in South Africa. The outcome of the Action Dialogue and the way forward is captured in this report as part of an engagement strategy.

Key Topics of the Action Dialogue

- **Barriers and drivers in the development** of the micro-digester sector in South Africa were presented by reviewing the Mdwede/Ilembe Municipality case study, drawing from lessons learnt to map a way forward.
- **Socio-environmental Aspects** were reviewed, considering health, environmental and climatic benefits from micro-digesters, drawing on linkages to market specific context, identifying gaps in the problem definitions and the need for future R&D to identifying definitive market need that micro-digesters address in term of environmental aspects.
- Considering **Socio-technical Systems**, a question on the technical suitability and appropriateness of the technology was presented, highlighting issues related to localised manufacturing, skills and capacity, and the viability of investment/business case dependent of the technology.
- **Techno-economic Aspects** were reviewed during the discussions. In theory, a market shift towards sustainability creates new markets and employment opportunities, which supports innovation and competitiveness. Better understanding on the impact of livelihoods of the poor, and sustainable business cases are needed to build on existing and emerging solutions and technologies to grow the micro-digester market segment. Consumer/community needs and behaviour should be further evaluated to support the development of the micro-digester sector.
- When considering **Technology Development and Application** through a technical appraisal, important environmental, social and design benefits of the technology were presented. The discussion highlighted the potential of the technology, industry drivers and barriers and the prevailing conditions regarding the adoption and use of the micro-digesters, reviewing the status of the industry, skills needs and the requirement for the development of sustainable business case for the technology to thrive.
- An overview of the **Policy Framework** was presented, identifying policy context including status, process, and envisioned targets/outcome of existing policy. Opportunities for Regulatory framework promoting renewable energy, and Green funding and incentives were highlighted.

Introduction

The potential of micro-digester has not been realised in South Africa, even though the technology serves as a renewable energy and waste management solution and holds the potential to create employment opportunities.

Even though the biogas market is seen as the most powerful in Africa, this potential has not been realised in South Africa, certainly not on a micro-digester scale. Micro-digesters or domestic/residential digesters have a power supply capacity of <30 kW and they are normally used at household scale to supply energy for cooking and lighting [3]. Micro-digesters offer unique opportunities in that the technology can deal with environmental concerns of climate change, address sanitation needs and create employment opportunities. The technology in question can assist in controlling organic waste, while at the same time produces gas for cooking and fertiliser [4], [5]. Additionally, an effective uptake of the technology will assist in diverting organic waste from limited landfill airspaces and reusing already existing resources [6]. Municipality solid waste (MSW) is mainly made up of organic waste (56,3%) [7]. Furthermore, most waste generation takes place in urban spaces [8], which makes it a huge challenge to deliver adequate and sustainable waste management services for municipalities, while not compromising on social well-being and the environment. Micro-digester can play a significant role in organic waste management in urban environments, but the application in this market has been slow. Landfill scarcity, and rising costs to dispose of organic waste, supported by policy plans to ban organic waste from landfills will support a sustainable business case for micro-digester for domestic use which will need to be supported by appropriate technology development.

The first biogas digestor in South Africa was built in 1957 on a pig farm [9]. By 2015, there were about 700 known biogas digesters, including micro-digesters, in South Africa [10]. This number is very small compared to Asian countries, especially China, which have massively embraced biogas technology [5]. This is also reflected by the low number of 1,600 people employed in the South African biogas sector by 2016 [3]. An overview of key points for micro-digester in South Africa is illustrated in Figure 1.

The market need for micro-digester should be clearly defined and appropriate technology development should be informed by this need.

The potential of micro-digester technology to support rural household's energy needs is recognised, however the up-take, adoption and utilization have not been realised. Issues relating to ownership, sustainable business cases for infrastructure investment, and beneficiaries vs. clients, requires further consideration to unlock the potential of micro-digesters in the waste-energy-food nexus, specifically in the rural, agricultural household and urban context.

Figure 1 South Africa has not realised the potential of biogas, especially on a household level.

The development of the micro-digesters sector in South Africa is proposed as a solution to provide access to clean energy, support job creation and contribute to sustainable livelihoods of beneficiaries. To achieve this, the technology should support income generation, increasing well-being, reducing vulnerability, improving food resilience, and providing more sustainable use of natural resources within a sustainable socio-technical system.

While a practical definition of sustainable development evolved over the last four decades to include three main perspectives: **economic, social, and environmental dimensions**; sustainable development has a broad appeal and results in many contentious views. Most researchers combine economic development and the environment, as well as equity, in the many attempts to describe sustainable development. Each viewpoint corresponds to a domain (and a system) that has its own distinct driving forces and objectives, which relies on a trans-disciplinary knowledge base [11, 12, 13]. The Brundtland Report [14] developed the following definition for sustainable development in the late eighties and is regarded, although contentious, as a cornerstone in our understanding of sustainable development as it is understood today:

- Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:
- The concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and
- The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs."

This definition is also reflected in Section 24 of the South African. It is proposed that a quadruple helix innovation framework is established to support sustainable development through collaboration between academia, government, industry, and communities to support the development of the micro-digester industry within a sustainable socio-technical system.

Action Dialogue Outcomes

This section presents the project background and the outcomes from the Action Dialogue presented according to the thematic areas. The respective presentations can be viewed online.

Project Background and Vision

SANEDI has promoted the micro-digester project under the Working for Energy programme to provide sustainable clean energy solutions to rural and low-income urban communities with special emphasis on job creation, skills development and community enterprise development. The project, which commenced in 2008 and is currently being implemented in Gauteng, Eastern Cape, Limpopo, North-West and Western Cape provinces. The project promotes micro-digesters as a technology that uses renewable energy sources consisting of organic animal and household waste. The micro-digester technology is being promoted as an option for cooking. The project has targeted the following populations:

- rural households;
- boarding schools;
- early learning centres; and
- one of the projects is at a military base (The intention is to introduce micro-digesters into the public sector, that is, correctional services, the police).

When SANEDI began implementing the project, there were many unknowns regarding micro-digesters´ designs, materials required for equipment manufacture, skills, and the potential to grow an industry. Further, there was no monitoring and evaluation (M&E) system in place; and some of the projects that were handed over to beneficiaries did not succeed. A lot of work has been done in the project, leading to the production of guidelines and the creation of platforms to collaborate on micro-digesters.

However, SANEDI has recognized that the projects that are currently underway are not ready to be scaled-up to commercialisation and the subsequent development of an industry. As a way forward, SANEDI will be collaborating with university partners to conduct further research. SANEDI is working with UKZN to rehabilitate some of the projects through the Climate Change and Waste Management SARChI Chair and SANEDI is also working with UJ-PEETS to map a way forward to develop the micro-digester industry through a regional approach.

As part of the collaboration with UJ-PEETS, SANEDI is asking the following questions regards the micro-digester project:

1. What needs to be done to make the industry grow (e.g. issues that need to be addressed: regulatory, enterprise development, transportation of waste, purification, etc.)
2. What are the interlinkages between the project and the circular economy?
3. How can other sectors assist?

Some of the questions were addressed in the presentations and discussions during the Action Dialogue and there is potential to scale them into the research agenda. Through the collaboration with UJ-PEETS and other universities, SANEDI is intending to use applied research to develop innovative solutions that will catalyse growth of the micro-digester industry.

Six speakers presented at the Action Dialogue which will be summarised in this section. Firstly, a short biography of the expert is presented, followed by the content of the presentation and key takeaways form the discussion.

Barriers and Drivers in the Development of the Micro-digester Sector in South Africa

Prof Cristina Trois

Professor Cristina Trois is the former Dean of the School of Engineering at the University of KwaZulu-Natal (UKZN), in Durban, South Africa. She is a full Professor in Environmental Engineering and currently the NRF South African Research Chair in Waste and Climate Change (SARChI) at UKZN. Professor Trois was born in Sardinia, Italy, in 1971 and holds a degree in Environmental Engineering (summa cum laude) and a PhD in Geo and Environmental Engineering from the University of Cagliari, Italy. She is a Professional Engineer with the Engineering Council of Italy, since 1998.

Setting the Scene

The on-going research at UKZN, under the auspices of the SARChI Chair on Waste and Climate Change, is, *inter alia*, investigating the nexus of Waste-Climate Change-Human Health. Professor Christina Trois set the scene by giving a presentation on the barriers and drivers in the development of the micro-digester in South Africa. Micro-digesters can play a critical role in the promotion of human health and improve food resilience in the waste-energy-food nexus.

There is potential that micro-digesters can contribute in the afore-mentioned nexus by enhancing waste management through the provision of energy in rural and peri-urban areas; combating climate change; and providing food security. A case study of Ndwedwe/lLembe municipality in KwaZulu- Natal was presented, noting that 65% of organic municipal waste is disposed of in landfill sites, and that Africa has very little diversion of waste from landfill sites which is a major contributor to climate change.

The current roll-out of micro-digesters has been from the perspective of energy provision. There is need to extend the micro-digester value chain to incorporate waste management, emphasising the link between

Box 1: SABIA

The Southern African Biogas Industry Association (SABIA), is a network to drive the development of a sustainable commercial biogas sector by promoting the multiple benefits of biogas within the region.

The SABIA leads industry discussions with relevant governmental institutions, international organisations, NGO's and other industry associations to promote the sector, lobby for relevant legislative change, policy development and assisting members in gaining exposure.

Some achievements:

- Developing a biogas incentive scheme;
- Developing biogas standards for micro industrial scale plants;
- Implementing laws for the reuse of organic waste;
- Developing Environmental Norms and Standards for biogas projects;
- Exclusion of biogas plants from the air emission license; and
- Representing a community of 1500 stakeholders in the country.

From: Presentation by Mr. Yaseen Saliem (SABIA).

waste management, energy, and food production. Waste management in an emerging economy is a complex socio-technical challenge. It is estimated that 31 million tonnes of waste are generated annually in South Africa. The municipalities have limited information on how much waste is being generated in their regions. Micro-digesters technology is well suited to combat climate change, provide energy in rural and peri –urban areas, while dealing with organic waste management. Key challenges identified relates to

- Migration of a highly electrified society and systems in rural areas where there is no access to electricity;
- Localizing of technology in rural areas; and
- Awareness, education, and capacity building.

What is the operational context?

South Africa is ranked 14th in the world in terms of GHG emissions. The country ratified the Paris Agreement on GHG emissions in 2016. A significant amount of GHG is produced from landfill sites. Furthermore, South Africa's Nationally Determined Contributions (NDCs) are ranked as "Highly Insufficient".

The South African energy IRP 2019 identifies the generation of energy from waste (landfills) and biomass, but this is small compared to energy produced from coal, wind, solar, nuclear and hydro, and hence there is little up-take on bio-energy. The need to address climate change using waste-to-energy should motivate for the development of bio-energy, as part of the basket to address energy provision.

How can micro-digesters be localised in rural, peri-urban and urban areas?

The development of a micro-digester economy should consider the following "rules":

"Rules"	Challenges
What is the appropriate feedstock?	Lack of suitable feedstock.
Is the feedstock available?	Waste characterization.
	Contamination of plastic packaging on organic waste.
Where can the micro-digesters be localised – rural, peri-urban and/or urban areas?	Lack of local experience.
Capacity building to develop the sector, for technology providers and the community.	Lack of awareness.
Support between Research, Development and Innovation (RDI) and Public Private Partnerships (PPP).	Lack of funding from banks.
Incentivise in the right direction.	No feed-in tariff.
	Long approval process.
Benefits The benefits of biogas development address environmental, economic, and social issues.	

Key Action Points

- Micro-digester as a solution to improve human health, food security;
- Provide clean energy, combating and reducing climate change;
- A system to produce clean energy as well as for waste management;
- Opportunity for decentralized system to be investigated;
- Has environmental, social and economic potential;
- Explore other sources of feedstock e.g. abettor waste; and
- Lack of capacity, education, and awareness.

Research Gap

- To understand rural household needs and aspirations;
- To understand how biogas intervention, reshape or restructure households gender dynamics;
- To explore alternative decentralization models for biogas relevant in S.A. context;
- To develop a model for the production of biogas from market waste within urban context; and
- Feasibility of participation of local stakeholder for collection and transportation of waste.

Questions that arose from the presentation on socio-technical systems are:

1. How do we intervene in a highly electrified economy?
2. Is it possible to have a network that includes small scale and large-scale biogas digesters?
3. Can decentralised micro-digesters be connected into established biogas distribution networks (grids, canisters) to maximise biogas production and viability? (This requires such networks to be identified in the design phase of the project).
4. How does SABIA work with HEIs to support their goals (e.g. R&D)?
5. Would the viability of the decentralised micro-digesters improve if they were integrated into a biogas network, particularly in urban areas?

Socio-Environmental Aspects

Saliem Haider

Saliem has joined Green Cape in 2020, as the new Circular Economy Programme Manager. His role is to extend and drive GreenCape's circular economy strategy along with the design and management of the programmes/projects that contribute to this. Saliem Haider's background include a BSc Honours in Materials Science and Engineering from the University of Cape Town and a BCom in Business Management and Economics from the University of South Africa. He has accumulated over 21 years of experience in solid waste planning, training and management between the City of Cape Town, Western Cape Government and Stellenbosch Municipality.

Outcomes on Socio-Environmental Aspects

The presentation from Saliem Haider from Green Cape drew on the learning from a case study of a project that was implemented in Stellenbosch Municipality in 2016-2017. The power shortages that South Africa has been experiencing (since 2014) and the drought (water shortage) that has impacted the province necessitated the need to identify alternative sources of energy. Moreover, there is food wastage in South Africa (albeit a lot of households are experiencing hunger) and such waste ends up in landfills.

The Western Cape provincial government has instituted a ban on organic waste in landfills due to the growing scarcity of landfill airspace and rising disposal costs (the latter has risen from R100.00 a tonne to R500.00 a tonne in recent years). Regulations have been promulgated in the Province to ban organic waste, that is, 50% of organic waste should be diverted from municipal landfills by 2022, escalating to 100% by 2027. Municipalities that do not reach the set targets will be penalised.

To address this challenge, Stellenbosch municipality implemented a micro-digester energy project. Micro-digesters address decentralised waste management services and sanitation coupled with an energy benefit. Micro-digesters can also assist in developing sustainable communities through local economic development.

A home biogas system was introduced by the waste management department, with trials at Spier Wine Estate to provide energy for the labourers. The biogas system (imported from Israel at a cost of R60,000.00) that was introduced could digest 6kg of organic waste per day that would [theoretically] provide ±3 hours of cooking

time per day. Furthermore, the effluent from the micro-digester was used as a fertilizer for the workers' vegetable gardens (NB. The municipality was working with the CSIR in testing the effluents for fertilizer).

The design of the micro-digester (see slide 16 of the presentation by Mr Haider Saliem) was a two-bag system in a box. The bottom bag is where the microbes are rested, and food waste is added. The top bag collects the biogas. There is need to put sand in the sleeves to hold down the bag so that it does not float when it fills up with biogas. This top bag is connected to a small one-plate stove. The actual cooking time of the micro-digester was one hour before the biogas ran out (NB. The system was initially not filled-in with 6 kg of waste).

Key Action Points

- Biogas technology requires communal buy-in for successful project implementation, which needs a bottom-up approach and not imposing the technology on communities;
- The phased banning of waste disposal on landfills with anticipation of 100% waste diversion from landfills by 2027 offers a wide market for biogas technology;
- There is need for R&D in definitive market need that micro-digesters address in term of environmental aspects; and
- Equally important is the idea that there is also need for R&D on existing bio-digester models (such as Green Cape's ASDU) to check which digester models, can be adapted to improve viability of micro-digester projects?

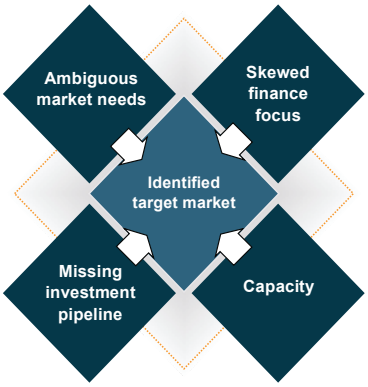

Figure 2 Reframing the problem, what are we trying to solve? (Adapted from Saliem Haider's presentation)

Research Gaps

The following socio-environmental research gaps were highlighted:

- Identifying definitive market need that micro-digesters address in term of environmental aspects;
- Understanding the impact of environmental aspects for both return of investor and community investment based micro-digester models;
- Understanding the sources of investment for pipeline development from an environmental aspect;
- Capacity building requirements to meet and adhere to environmental aspect needs;
- Does the technical specifications of existing micro-digesters meet the environmental legislative and target market needs?;
- Can meeting the environmental legislative and target market needs drive economic viable implementation of micro-digesters? and
- Are there existing models (such as GreenCape's ASDU) that can be adapted to improve viability of micro-digester projects?

Some questions that arise from this pilot project are as follows:

1. What are we trying to solve?
2. What is the definitive market that requires micro-digesters?
3. Are micro-digesters a potential alternative energy source for beneficiaries?
4. How should the development of micro-digesters be financed, and can an investment pipeline emerge?
5. What is the role of municipalities/government?
6. What type of waste is used in micro-digesters?
7. Do the technical specifications of existing micro-digesters meet the environmental, legislative and target market needs?
8. Can meeting the environmental, legislative and target market needs drive the economic viable implementation of micro-digesters?

9. Are there existing models such as Green Cape's ASDU that can be adapted to improve viability of micro-digester, e.g. address odours?
10. Should micro-digesters be household based or shared communally?
11. What is the cost comparison between imported and locally produced micro-digesters?
12. Is there information on the average cooking time for a South African household? What type of energy is being used for cooking? Are there any studies? (A study was done in KZN households but no published data yet).

Socio-Technical Systems

Yaseen Salie

Yaseen Salie is both a steering committee member for the Southern African Biogas Industry Association (SABIA) and the bioenergy analyst at GreenCape where he leads bioenergy sector desk and market intelligence work. Yaseen has 9 years of experience working and engaging with SMEs within the wastewater treatment and biogas sectors. Yaseen's experience includes designing and developing end to end solutions for wastewater and biogas projects; conducting feasibility studies through pilot projects; conducting economic and financial analysis within the business plan and proposal development; and engaging with bioenergy stakeholders (incl. governmental institutes, financial entities and private sector)

Outcomes on Socio-Technical Systems

SABIA's focus is on developing and growing biogas sector across all scales and promote that installers follow and adhere to international "best practice" standards from a technical basis, because there are no specific micro-digesters legislation that regulates technical aspects in South Africa. There are however many guidelines and well-established technology options available on the market.

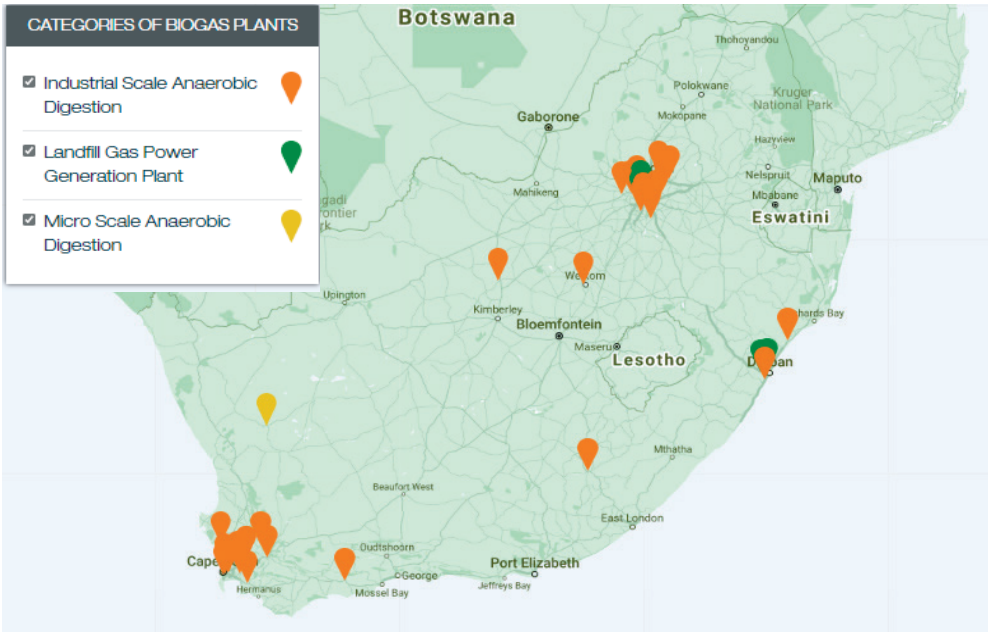

Figure 3 Existing biogas plants in SA (taken from sabia.org.za, presented by Yaseen Salie)

Furthermore, the issue of proper skills was raised by the speaker. In the same vein, the need for technically viable bio-digester options that create clear and attract investment/business case viability was highlighted and a call

to improve the viability of biogas digesters in South Africa. Furthermore, the phased banning of organic waste from landfill sites presents opportunities for the growth of the biogas industry in South Africa. The adoption of biogas technology at agro-industry processing facilities, urban wastewater treatment plants and livestock farms was highlighted as very important in having successful biogas projects. Moreover, the separation of organic waste at source such as at household level would be critical in the expansion of the biogas industry.

Key Action Points

- The lack of legislation on technical aspects regulating the technical aspects of biogas digesters presents an opportunity for players in the biogas sector to develop their own guidelines and lobby government for adoption;
- Development of framework to guide transfer and uptake of skills and capacity;
- The phased banning of organic waste on landfill presents an opportunity for the growth of the biogas sector in South Africa; and
- The policy framework in South Africa should cover the following:
  - Regulations that enforce municipalities and Eskom to buy-back surplus energy at Mega-flex rates from Independent Power Producers
  - Standards and certification for the safe trading and use of digestate
  - Enforcement of the capture and utilization gas at both private and municipal landfill sites
  - Adoption of the Organic Waste Norms and Standards developed by SABIA in 2016.

Research Gap

Research gaps identified related to Socio-Technical Systems and engagement between HEIs and SABIA

- Mapping of accessibility and local projects;
- Clear enabling legislation that promotes best practices and health and safety;
- Develop framework to guide transfer and uptake of skills and capacity; and
- Technically viable options that create clear and attract investment/business case viability.

Box 2: SABIA Looking Forward

Banning of organics/food waste entering a landfill site and introduction of separate organic waste collection for treatment in biogas facilities across South Africa.

Setting of targets for the recycling of biodegradable wastes and feedstocks.

Development, support, and creation of the SABIA PES tariff (Payment for Ecosystem Services or Payments for Environmental Services) to stimulate the recovery of organic residues.

Production of biogas through the installation of biogas technologies at:

a. Agri-industry processing facilities;
b. Urban wastewater treatment plants; and
c. Livestock farms.

Enforcement of the capture and utilization of landfill gas at both private and municipal landfills.

Enforce all municipalities and Eskom to buy-back surplus energy at Mega-flex rates from IPPs (Independent Power Producers).

Incentivize the energy generation and use from livestock manure via targeted policies such as specific rural schemes for micro-scale digestion that result in energy security and independence, reduced use of solid fuels for domestic cooking and heating, and reduced deforestation.

Adoption of the Organic Waste Norms and Standards developed by SABIA in 2016.

Questions raised by SABIA

1. Are micro-digesters technically suitable for the context it has been applied in?
2. Is it accessibility enough? Is there sufficient local manufacturing?
3. Is there appropriate legislation in place or required?
4. Is there sufficient skills and capacity? Or ideal transfer of those skills and capacity?
5. Is the investment/business case viability dependent of the technical requirements?

Socio-Economic Aspects

Prof Johane Dikgang

Johane Dikgang is an Associate Professor and Director of Public and Environmental Economics Research Centre (PEERC) at the University of Johannesburg, with an appointment at the School of Economics. He is also a Research Associate at the Environmental Policy Research Unit (EPRU), in the School of Economics, at the University of Cape Town. Johane is an NRF Rated Researcher. His research draws from the fields of resource and agricultural economics, climate change, behavioural and experimental economics, and productivity analysis. Outlets for his work included Food Policy, World Development Perspectives, Ecological Economics, Environment and Development Economics, Applied Economics, South African Journal of Economics, Journal of Commodity Markets, Agriculture and Food Economics, Journal of Environmental Economics and Policy, and Water Resources and Economics. His research has been funded by the Swedish International Development Cooperation Agency (SIDA) through the Environment for Development Initiative (EfD), the Carnegie Foundation, Water Research Commission (WRC), National Research Foundation (NRF), the Research Council of Norway and the University of Johannesburg Research Committee (URC).

Outcomes on Socio-Economic Aspects

Prof. Johane Dikgang from UJ-PEERC presented on biogas development from the perspective of environmental and resource economics and chronicled the history of energy transitions towards an industrial civilization.

There is a positive correlation between advancement in the economy and energy needs. Biogas in developed countries has developed into a billion-dollar industry as these countries address climate change by transitioning from fossil fuel energy to renewable energy sources. In the UK, biogas from landfills contributed 34% of total installed bio-power capacity in 2011. In the USA, it is a closed-loop system providing energy, recycling, and fertilizer services. In Asia, China is producing energy from bio-organic municipal waste and wastewater (sewage sludge). In India, the Family Size Biogas Plants Programme is developing and promoting cookstoves.

In Africa, biogas technology appears to be promoted by an oligopoly of technology-driven projects. Biogas technology was introduced in 1950 in South Africa and Kenya. Previous experience has noted that introducing a new technology focusing on engineering and capacity building may not always succeed and may not create a market. Several African countries – Burundi, Botswana, Burkina Faso, Cote d'Ivoire, Ethiopia, Ghana, Guinea, Lesotho, Namibia, Nigeria, Rwanda, South Africa, Uganda, and Zimbabwe – have begun implementing biogas projects. Africa is learning from best practices from Nepal and Vietnam, e.g. dedicated market approach and well-defined roles between agents (government, business, suppliers, contractors, consumers and credit institutions). Biogas implementation in Africa is being facilitated by various international organizations and foreign aid agencies that are providing technical and financial support.

In South Africa, 45 % of schools lack electricity, 66% have poor sanitation facilities, 27% have no clean water, and 12 % have no sanitation. Biogas is a potential solution to mitigate all these problems.

In South Africa, the following are barriers and opportunities in biogas development:

"Rules"	Opportunities
Lack of awareness on benefits if biogas.	Biogas is an important driver of economic growth, especially in rural areas in need of economic opportunities.
Lack of awareness of waste characterization.	Diverting organic waste from landfills for biogas generation contributes to the reduction of GHS emissions, contributes to clean air and water, and improves soil health.

"Rules"	Opportunities
Volatile Conditions of Biogas Market.	Biogas converts waste into valuable resources.
Market immaturity.	
Dearth of comprehensive studies on market potential of biogas.	
Lack of coordination between the national, provincial, and municipal governments.	
Lack of technical information, analysis and research.	

Key Action Points

- There is a transition away from fossil fuels towards renewable sources of energy;
- Renewable energy sources currently consist of 20% of energy uses and 80% is fossil fuels;
- The is prediction that the cost of renewable energy will decline whilst that of fossil fuels will increase;
- The market potential of biogas in expected to grow from US$21Bn in 2018 to US$50Bn in 2030;
- An increase in constructed biogas digesters reduces the cost;
- Biogas has the potential of energy needs in schools and improve sanitation in communities;
- Some of the barriers faced by biogas in South Africa are:
  - Lack of Consciousness of Biogas Benefits
  - Lack of Awareness of Waste Classification
  - Market Immaturity
  - Lack of Full Assessment
  - Lack of Technical Information, Analysis, and Research
- Biogas is an important driver of economic growth, especially in rural areas in need of economic opportunities;
- Biogas also contributes to GHS emissions reduction, clean air and water, and improves soil health; and
- More work is required to quantify the economic costs and benefits of Biogas technologies.

Research Gap

To address the barriers and promote the opportunities outlined above, there is need to conduct further research related to:

- Quantifying the economic costs and benefits of biogas technologies;
- Life-cycle cost analysis of biogas digesters;
- Cost comparisons of different energy sources available;
- Technical performance, social acceptance and investment costs; and
- Economic and environmental impact benefits required, and the latter should be disseminated in energy poor communities.

Questions that arose from the presentation on the socio-economic perspective are:

1. Can we conduct comparative studies between developed and developing countries on biogas development, especially identifying the drivers that have necessitated the adoption of biogas in developed countries and contextualise into the South African situation?
2. How do you stimulate demand for micro-digesters in rural areas?
3. How do you deal with the bias of micro-digesters not being used by affluent households but promoted for low-income households? If affluent people take up the technology, will this create interest in low-income households?

Technology Development and Application

Dr David Tinarwo

David Tinarwo holds a Ph.D. in Electrical Engineering (2008) from the University of Kassel in Germany, M.Sc. in Renewable Energy (2003), and a B.Sc. Hons. (Physics) (2001), from the University of Zimbabwe, and a Lic.Ed (Physics) (1993) from Cuba. Has worked in education both basic education and Higher education from 1993 until to date. He has been a researcher in Renewable Energy, a University Senior Lecturer in the Department of Physics at the University of Venda, supervisor of several postgraduate theses, and has been responsible for over ten national and international projects. He has and still is implementing a number of renewable energy research and community projects around South Africa, Mozambique and Zimbabwe. The projects range from technology demonstration, awareness, and research.

Outcomes on Technology Development and Application

Dr David Tinarwo from the University of Venda (UNIVEN) presented on the biogas digester project that is being implemented in a rural area in the Limpopo province.

The presentation focused on technology development and application. The project thus begins to address some of the issues and research questions raised in the above presentations and the knowledge generation on biogas technology development and application. This project has noted that whilst, in theory, there is potential of biogas micro-digesters as a source of energy, the up-take, adoption and utilization does not seem to concur with the theory.

Rural households are facing an energy crisis as they cannot easily access wood fuel which is used for heating and cooking due to disappearing woodlands. Rural households have resorted to buying firewood. Whilst some rural households are connected to the electricity grid, the use of this energy source is reserved for lighting and powering household appliances, e.g. TVs, etc. About 79% of rural households in South Africa own at least 4 head of cattle and the cow dung is used as manure in the fields and gardens. Rural households also experience inadequate access to water. Feedstock from cattle and water are key inputs for operating a micro-biogas digester.

The implementation of biogas technology in rural areas project based and is currently being funded by government institutions and NGOs. A survey by UNIVEN combined with a NERSA report concluded that 19% of the installed digesters are fully operational, 5% are active but not in use, and 76% are not active. Project beneficiaries give various reasons, for example:

- The burner hole is suspected to be clogged due to wet biogas that corrode the cast iron material;
- The facility is yet to be commissioned;
- Construction is incomplete;
- The was no one to feed the digester; and
- The facility was never commissioned because the micro-digester was found leaking when it was tested after the construction.

The transferring of skills in the project has been conducted with limited funding, e.g. a trainee constructs only three digesters during the training and may stay a long time without building to perfect the skills. Moreover, there is need to focus more on localising the technology by developing properly planned programmes that encompass the integration of production from micro-digesters with income-generating activities like farming. There are 4 types of micro-digesters common in South Africa, *that is*, brick and mortar fixed dome, prefabricated fixed dome digesters, floating drum, and the plug-flow tube digesters. Information on the micro-digester´s design and performance is gradually becoming available, e.g. performance parameters (i.e. pH, temperature, type of feedstock, hydraulic retention time, etc.), cost of a locally designed and built biodigester, availability of different sizes of digesters, and cooking time.

Key Action Points

- Micro-digester projects implemented through government and private funding;
- The up-take, adoption and utilization not matching the potential of digesters;
- The economic value of digester must be studied in sponsored or externally funded digesters;
- Ownership of micro-digesters in communities still needs to be improved;
- Increasing Education and Certification will increase participation;
- 19% of installed digesters are operational;
- 5% active but not in use; and
- 76 are not active.

Research Gap

- Economic analysis on externally funded micro-digesters;
- Adoption of technology in rural context;
- Proper training (technical skills) of the beneficiary households;
- Selection criteria of the beneficiaries of funded biogas projects;
- Pre-feasibility study; and
- Validation of technology – does it really produce what it says it will?

The following table summarizes the drivers, barriers, adoption and use, and changes needed to advance the development of micro-biogas digesters in South Africa, using the outcomes of the project:

Drivers	Barriers	Adoption and Use	Changes needed to advance biogas (gaps)
Regulatory framework promoting renewable energy.	Some of the rural households have limited access to feedstock (no livestock) and water and this presents a challenge to the adoption of the technology.	The intended owners of the micro digester technology are generally poor and cannot afford the prices of the digesters.	Proper selection of beneficiaries.
Green funding and incentives.	Failure of previous biogas projects has impacted negatively on how beneficiaries perceive the sponsored projects and presenting a hurdle in the adoption of the technology.	Presently, the companies in the industries are still charging exorbitant prices that excludes many households in rural areas.	Capacity building of actors in the micro-digester industry.
Energy security (unreliable grid supply and increasing tariffs; diminishing woodlands in rural areas).	Lack of support for training (technical skills) of the beneficiary households.	Adoption of the biogas technology is limited or not there.	Increased involvement and participation of beneficiary communities.
Available and untapped feedstock sources, e.g. landfill sites reaching their capacity; a significant agriculture sector (livestock and agricultural residues).	Poor selection criteria of the beneficiaries of funded biogas projects.	Most of the users of the digester are getting the equipment for free and it could be misleading to consider these users as 'adopters;.	Development and adoption of models for sustainable operation of micro-digesters and utilization of bio-slurry.
Government's commitment to cleaner energy sources.	Limited biogas awareness campaigns.		More awareness drive at all levels.

Policy Framework

Phindile Nkosi

Phindile Nkosi is a lecturer and a PhD candidate in Economics at the University of Johannesburg. Her work translated to an award she received for her Master's degree where the "South African Households' Willingness to Pay for Renewable and Nuclear Energy to Avoid Power Outages" was investigated. She has over 5 years' experience in the private consulting sector where she worked on a number of different projects. Her research interests include environmental economics, energy economics, economic development and health economics. She has experience designing and implementing household surveys.

Overview

Phindile Nkosi from UJ-PEERC presented on the policy framework as regards to biogas in South Africa.

It was noted that in South Africa there is no specific policy or legislation aimed directly at the biogas industry, albeit, there are policies that support renewable energy development. The policies that indirectly address the biogas sector in South Africa are the National Environmental Waste Management Act, the Air Quality Act and the Gas Act.

Setting appropriate policies can facilitate the development of the biogas sector and this has enabled the industry to develop in Europe, where the biogas sector is at utility scale. There are some best practices from Europe that South Africa may want to consider in developing biogas policies, for example:

- The renewable-related policies in Europe have specific aims and legally binding agreements.
- Over time, existing policies are reformulated to adapt to the changing market environment and provide a steady framework for investments.
- In Germany, there is a comprehensive service for biogas development (technical rules, financial support, reducing barriers to access market, providing convenience for adding biogas into the gas grid).

China is among the leading countries in domestic biogas technology. The government developed a policy for household-based digesters that focuses on rural development but does not address industrialising and commercialising the biogas sector. The laws stipulate that the government must provide financial support for the development of renewable energy. The laws are updated continually to reflect socio-economic circumstances.

Key Action Points

- No policy in South Africa specifically directed towards micro-digesters; and
- Review of policies around the world is needed to aid the development of biogas policies in South Africa.

Research Gap

The following are some recommendations to enable the development of biogas policies in South Africa:

- **Redesign the policy framework** – to be more comprehensive with specific thresholds;
- **Supervision policy** – strict supervision measures and severe penalties;
- **Biogas power generation policy** – lowering the market access threshold and clearing barriers;
- **Multi-stage subsidy policy** – targeted subsidy policies that are implemented in stages; and
- **Environment protection policy** – to avoid environment pollution during the process of biogas production.

Reflection and Developing – a Theory of Change

Mrs. Nickey Janse van Rensburg from UJ-PEETS presented on the Theory of Change that is proposed to assist in directing future projects. A design thinking approach was introduced to frame the problem and support future technology development.

Design for social change interrogates institutional, economic, social, and political systems, as well as giving a voice to intended beneficiaries to articulate their needs. The current micro-digester project has focused on developing technology and should expand to develop a sustainable business case for future technology development to respond to.

UJ-PEETS and SANEDI are collaborating to produce the South African micro-digester sector development plan. The information that will be generated from the impact assessment of the implementation the micro-digester project and the insights from this current Action Dialogue will contribute to the design and development of the sector plan.

Applying the theory of change and a design thinking approach will assist in the articulation of goals, map pathways, identify stakeholders and refine the project design.

The Action Dialogue has identified key areas to focus on that will impact on the development of the micro-digester sector. There are opportunities and lessons learnt from the presentations that will be built on through a directed approach by aligning resources and expertise. In other sectors of the renewable energy space, there are easier technologies with plug and play solutions, which need further development for micro-digesters to become a competitive alternative. The business case for renewable energy technologies in South Africa is starting to emerge as a viable investment opportunity mainly due to policy alignment in the last 5 years. A holistic approach is called for to ensure that the micro-digester sector advances to impact on the South African energy mix, with the added benefits highlighted, exploiting the drivers for the technology, as well as understand how the technology fits into a sustainable business case for specific markets.

Co-creation and ownership are key – in the past, a project is implemented and commissioned and when the investor returns to the site, the equipment has been destroyed or taken away, for fear of blocking future development from government. The approaches thus far have investigated indigents, isolated households, and interventions on a one-to-one basis. There is a need to refine the project brief to include how the technology would be supplied, maintained, developing economies of scale and responding to a market need. A model that has not yet been tried out is the small/community scale utility model and linking with other government programmes such as free basic energy services; linking in with local government interventions that are meant to ease the burden of services to communities. The research that has been done in the past did not include the beneficiaries, e.g. the project in Giyani (Limpopo Province) was driven from a technological perspective. It is only recently that there is engagement with local government, Department of Social Services, provincial government, and the Expanded Works Programme (EPWP). When the theory of change is applied to the development of the micro-digester development plan, there is a need to address the problem appropriately and identify the

stakeholders that will be engaged. The assumptions we are making need to be understood and action plans that will deliver on the envisaged impacts need to be build.

From a policy perspective, the biogas sector is still guided by the Gas Pipeline Regulations which are not relevant to the micro-digester economy. There is also the need to bring in the climate change/environmental issues in the design of the micro-digester sector plan. In designing the sector plan, there is the need to look at the journey towards the goal and the goal must be determined with the journey in mind.

Mr. David Mahoma from SANEDI thanked all the participants for their contributions, as well as UJ-PEETS for organising the Action Dialogue. Nickey Janse van Rensburg thanked SANEDI for taking the lead in identifying and promoting the development of micro-digesters in South Africa and expressed her gratitude towards the presenters and UJ-PEETS staff for their contribution to the success of the Action Dialogue.

Design for Social Impact

The way forward

Technologies can be a catalyst and enabler to achieve SANEDI´s Working for Energy Group, however, to achieve social impact, you must design for social impact. The access to technology and infrastructure investment will not necessarily bring about the desired social change if it is not intrinsically built into the project design. Social Impact Design is "design that seeks to solve humanitarian issues such as improving living conditions for its beneficiaries". This requires us to interrogate systems – institutional, economic, social, and political systems – to define and exploit opportunities for social change that give voice to those who has been disenfranchised or marginalized by design [15]. Technology cannot bring about social change if it is not imbedded in a sustainable socio-technical system.

Drawing from the objectives to provide sustainable clean energy solutions to rural and low-income urban communities and creating job, supporting local skills development, and developing community enterprises in the process, project design briefs should be refined to achieve these goals. These goals should be clearly articulated and considered in the programme design and linked to an **impact pathway developed based on a theory of change**. New projects should be designed to consider the triple bottom line (TBL), people, plant, profit, or social, environmental, and economic aspects within a sustainable livelihoods framework.

1. Articulate Goals
2. Map Impact Pathways
3. Refine the Brief

To bring about social change and to improve livelihoods we rely on social processes in which people construct solutions to their problems, often by modifying both new technologies and their own production systems to take advantage of new opportunities offered by the technologies. Firstly, to support growth in the micro-digester sector, the study aims to develop an impact pathway which is an explicit theory of change of how SANEDI sees itself achieving impact through the implementation of pilot projects. This will be done retrospectively for the executed projects. For future research and pilot projects the impact pathway to guide project management in complex environments should be applied. The impact pathway may evolve, based on learning over time, and should be informed by stakeholder engagement. The second stage is a post-impact assessment, in which the project's wider benefits are independently assessed. The study should seek to establish plausible links between the project outputs and developmental changes, such as poverty alleviation, job creation and skills development, as defined by SANEDI.

By applying the principle of co-creation, it is proposed that through multi-stakeholder participation, a Participatory Impact Pathways Analysis (PIPA) is applied as a planning, monitoring and evaluation tool, designed to help the people involved in a project, program or organization make explicit their theories of change, in other words how they see themselves achieving their goals, and having an impact. A tool to develop the Theory of Change is included in Appendix 1 Theory of Change and Impact Pathway. A list of Specific, Measurable, Attainable, Relevant, and Time-Bound Key Performance Indicators are listed in Appendix 2 TBL Assessment Tool, which will be developed to measure and evaluate the impact of the Working for Energy initiatives related to micro-digesters, along with an assessment tool that will be used to evaluate the technical performance of installed micro-digesters.

Through collaboration with the Technology Station, a **triple (or rather quadruple) helix innovation framework** is established to support collaboration between academia, government, industry, and communities. This framework will assist the development of the micro-digester industry within a sustainable socio-technical system. The triple helix spheres contextualised the external environment (the political, economic, social, cultural, and technological contexts), and describe the dynamic and interactive movements of partnerships, supported by and in the format of cooperative networks striving to boost regional competitiveness, as illustrated in Figure 4.

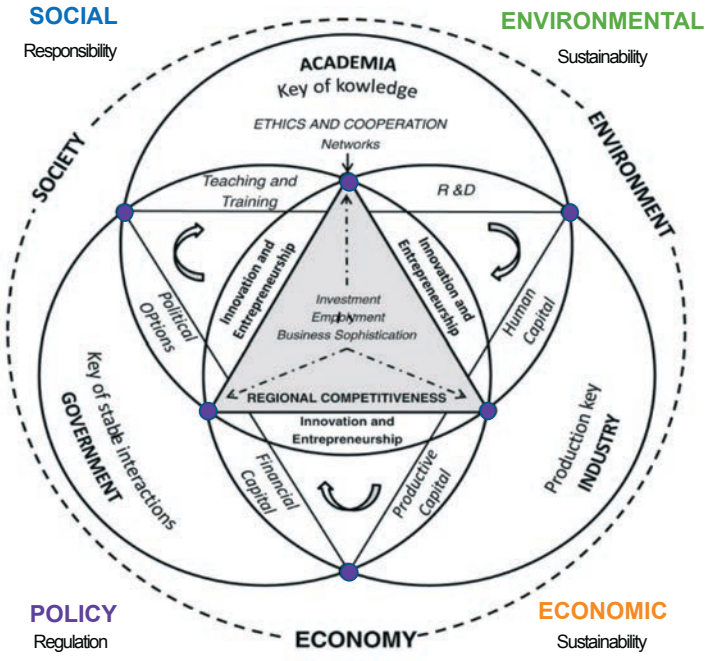

Figure 4 Triple helix triangulation model applied to support innovation in the micro-digester sector development [adapted from [15]

As proposed by [16] and considered in the development of the triple helix framework by [15], a regional competitive advantage inherently requires articulated involvement and action across a multi-level scenario, within which feature the different variants of capital. The model put forward foresees articulated and dynamic interactions between teaching and research, R&D, human and creative capital, and productive capital, financial capital, as well as political options. Supporting this perspective by [17] [18] these capital factors combine to establish partnership and cooperation networks enabling the pro-innovation and entrepreneurial environment necessary to attract investment and provide employment through the creation and maintenance of jobs (enhanced through the valuing of personal competences) which underpins the goals of the SANEDI Work for Energy. Furthermore, increased business sophistication similarly confers a higher level of regional competitiveness through the provision of non-standardised goods and services of greater added value in the marketplace. Again,

it is critical that the market context is clearly understood, and that further technology development should be directed by the identified market need and not driven through technology advancement.

Considering the relevance of developing this theme in future work, with pressure of recessions at local and global scale dramatically increasing due to the Covid-19 pandemic, and reflecting in the rescaling and postponement of new investment projects (despite the corresponding need for job creation within a failing economy) technology innovation in the green economy stands out as a key factor to drive competitive markets. Combined with the priority attributed to regional development and sustainable business cases, the implementation requires the dissemination of knowledge and technology through a sustainable inter-organisational network.

Within the proposed triple helix innovation network, the Technology Station will contribute towards the competitiveness of industry through applied specialised knowledge and technology that supports the TBL to bring about socio-economic impact. The Technology Station will also endeavour to facilitate interaction between industry, academia, government, and communities to enable innovation. This mandate enables Higher Education Institutes to be more responsive to the needs of industry, and enables Industry to gain access to benefit from specialised knowledge and innovative technology, but also supports the sustainable development approach that is needed to support the micro-digester sector.

Furthermore, the **sustainable livelihoods framework** as proposed by [17] will be used to improve our understanding of livelihoods, particularly the livelihoods of the poor in rural and urban environment. The sustainable livelihoods framework presents the main factors that affect people's livelihoods, and typical relationships between these factors. The framework provides a checklist of important issues and illustrates these links to each other; draws attention to core influences and processes; and emphasises the multiple interactions between the various factors which affect livelihoods. It can be used in planning new development activities and should be applied to assess the contribution to livelihood sustainability made by existing activities of SANEDI projects in the micro-digester sector as illustrated in Figure 5.

The arrows within the framework are used as shorthand to denote a variety of different types of relationships, all of which are highly dynamic. The framework is centred on people. It does not work in a linear manner and does not try to present a model of reality. Its aim is to help stakeholders with different perspectives to engage in structured and coherent debate about the many factors that affect livelihoods, their relative importance, and the way in which they interact. This, in turn, should help in the identification of appropriate entry points for support of livelihoods. Refer to Appendix 3 Sustainable Livelihoods Guidance Sheet for a full review. The learnings from this assessment should influence future programme development at SANEDI.

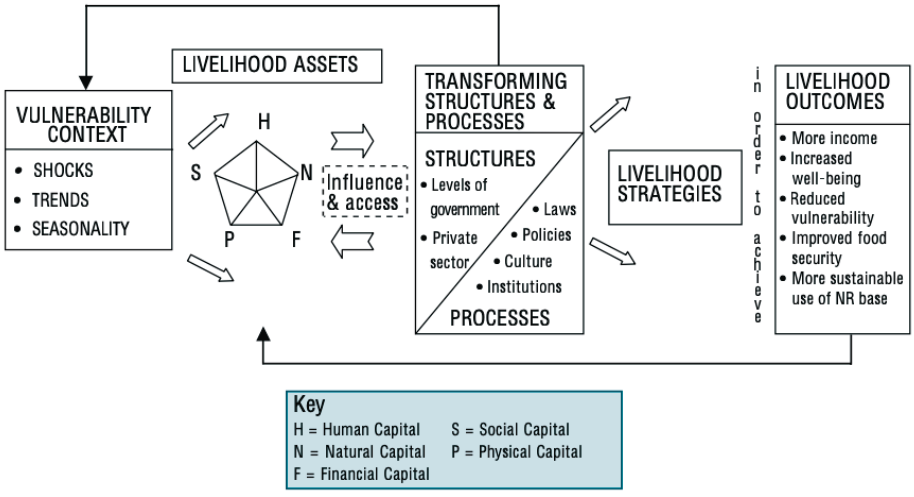

Figure 5 DFID Sustainable livelihoods framework [17]

Further consideration of the policy framework and regulatory environment is needed, standard development and techno-economic considerations will be expanded on through further engagement with experts in these fields.

At technology development level, **design thinking** has emerged as a progressive method for creative problem solving and for effecting social change. It relies on an iterative, collaborative, human-centred approach in which the designer redefines and reframes the problem with end user involved and in mind. Design thinking is characterised by five iterative stages: empathy, definition, ideation, prototyping and testing. The first stage involves developing empathy through ethnographic research.

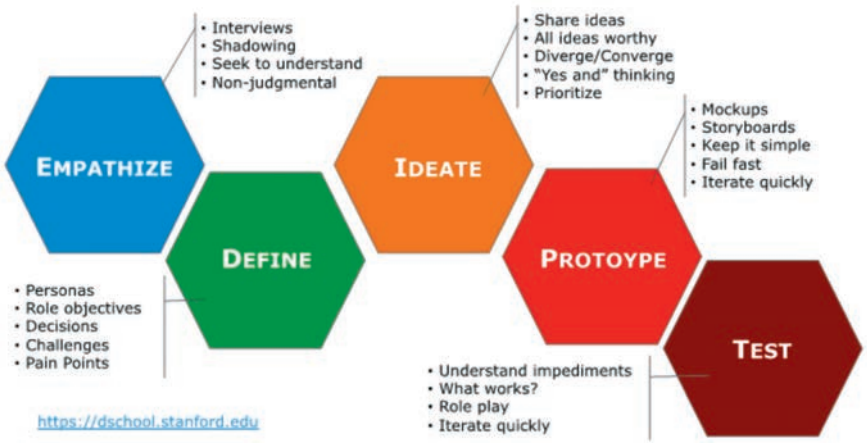

Figure 6 Stanford d.school Design Thinking Process.

This stage aims to engage with stakeholders and beneficiaries through open-ended conversation and applies ethnographic methods of immersion to observe end-users. It seeks to humanise technology through ethnographic study, synthesis, and prototyping. Explicit and implicit needs, as well as underlying meanings and insights, are identified and then used to reframe the problem. During the definition stage, the system is mapped out and choices made regarding which solution spaces to focus on. This implies that solutions are designed to address a specific subset of needs as opposed to attempting to address all needs. During the ideation, prototyping and testing phases, brainstorming, and flaring techniques are applied, and prototypes are developed to test and evaluate solutions. As mentioned, this is an iterative process and it relies on extensive collaboration, stakeholder engagement and **co-creation of solutions**. In recent years, a method of organisational change known as co-creation has spread rapidly within the business sector. In a co-creative effort, multiple stakeholders come together to develop new practices that would traditionally have emerged only from a bureaucratic, top-down process. Change, moreover, occurs not just at the level of an organisation, but also across an entire value chain. The same approach can be used to develop micro-digester prototypes that are appropriate for the intended use in either rural or urban environments.

For a technology to act as a catalyst for sustainable development, a **sustainable business case** is needed. A business model canvas (BMC), included in Appendix 4 will be used to understand a business model for micro-digesters applied in either rural or urban environments, in a straightforward, structured way. Using the BMC will lead to insights about the customers a business serve, what value propositions are offered through what channels, and how a company makes money. A BMC will be applied to develop a business case for micro-digesters, working closely with colleagues from the UJ Business School, the Industrial Design Department, and SMEs, integrating Design Thinking and the BMC to develop these solutions further.

Conclusion

The potential of micro-digester has not been realised in South Africa, even though the technology serves as a renewable energy and waste management solution and holds the potential to create employment opportunities, thereby fulfilling the mandate of SANEDI's Working for Energy Programme. It is necessary to design the programme for social change, so that a technology can become an enabler for social change. Micro-digesters need to be embedded in a holistic strategy, looking at the Triple Bottom Line. Firstly, the clear definition and establishment of the market for micro-digesters is needed. The market includes the rural and urban dimensions and will differ for each dimension. Secondly, the defined and established marked will assist to develop appropriate and context specific technologies and sustainable business cases, which can contribute to the creation of SMEs, that build the micro-digesters and also train local apprentices for its maintenance. Additionally, the technology should be designed using design thinking and co-creation. Simultaneously, the current policy needs strengthening and development to support the technology and make it appealing on household scales, e.g. financial incentives to install and maintaining the technology over the lifetime of the technology.

The way forward illustrated in Figure 7 for SANEDI Working for Energy Programme and the development of the micro-digester sector should entail the development of the Theory of Change, which informs an Impact Pathway and directs the development of appropriate technology and a sustainable business case for micro-digesters by applying Design Thinking as well as the Business Canvas Model. Together, these methods form an overarching tool for designing, monitoring, and assessing SANEDI's programme. The TBL assessment tool and the development of a survey including all three dimensions are crucial for monitoring and assessing of the Theory of Change and Impact Pathway. The Theory of Change and Impact Pathway are also informed by the Sustainable Livelihood Framework and supported by the triple helix innovation framework continue to support the development of the micro-digester sector.

For the projects that SANEDI has already implemented, the described approached will be executed retrospectively, for example the contextualisation and implementation of the TBL assessment tool and survey for the installed micro-digesters will assess the achieved social impact. This will help to identify shortcomings in the projects and optimisation opportunities for future projects.

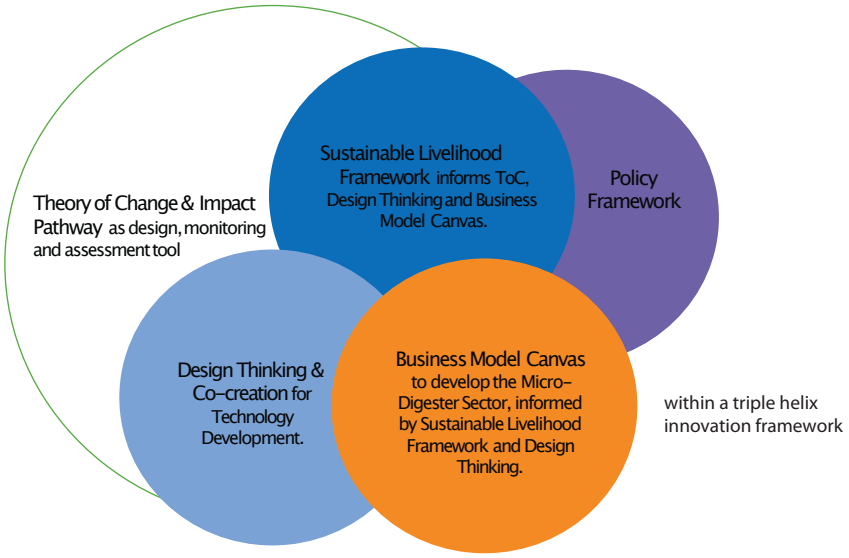

Figure 7 Methods that should be implemented to create sustainable projects that bring about the anticipated social change by SANEDI.

Future project should also be designed for social impact to create sustainable solutions and efficiently using limited resources. Each project needs to also take into account that micro-digesters are not always the most suitable technology and other technologies might be more appropriate.

Further consideration of the policy framework and regulatory environment is needed, supported by standard development and techno-economic considerations which will be expanded on through further engagement with experts in these fields.

Summary of potential research themes identified and future work

Socio-technical systems	Socio-environmental aspects	Techno-economic aspects	Technology development and application	Policy framework
Understand rural household energy needs and aspirations.	Identify a definitive market need that micro-digestors address in terms of environmental aspects.	Randomized Control Trials (RCTs) to quantify benefits of Biogas technologies such as digesters.	Proper selection of beneficiaries.	**Redesign the policy framework** – develop a policy framework.
Understand how biogas interventions reshape household gender dynamics.	Understand the impact of environmental aspects for both return of investor and community investment based micro-digester models.	Cost comparisons between different energy sources are made by calculating the levelized cost of energy (LCOE).	Capacity building of actors in the micro-digester industry.	**Supervision policy** – strict supervision measures and severe penalties.
Understand role of municipal and provincial government in driving biogas investment and innovation.	Understand the sources of investment for pipeline development from an environmental aspect.	Life-cycle cost analysis of biogas digesters.	Increased involvement and participation of beneficiary communities	**Redesign the policy framework** – more comprehensive with specific thresholds.
Explore alternative decentralisation models for biogas, eg. agri-industry processing facilities, urban wastewater treatment plants, livestock farms.	Capacity building requirements to meet and adhere to environmental aspect needs.	What do we know about technical performance, social acceptance and investment costs?	Development and adoption of models for sustainable operation of micro digesters and utilization of bio-slurry.	**Biogas power generation policy** – lowering the market access threshold and clearing barriers.
Develop a model for the production of waste from urban areas to explore the feasibility for the participation of beneficiaries for collection and transport of feedstock.		Economic benefits and environmental impact estimates required and should be disseminated in energy poor communities.	More awareness drive at all levels	**Multi-stage subsidy policy** – targeted subsidy policies that are implemented in stages.
Mapping local projects.				**Environment protection policy** – to avoid environment pollution during the process of biogas production.
Develop framework to guide transfer and uptake of skills and capacity.				
Research on enabling legislation that promotes best practices and health and safety.				

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Appendix 1: Theory of Change and Impact Pathway

Hypothesis		Inputs	Activities	Outputs		Outcomes	Impact
What it the problem we are trying to solve?	**Who is the key Audience?**	**What is our entry point to reaching your audience?**	**What resources are needed to bring about change?**	**What steps are needed to bring about change?**	**Measurable effect of our work?**	**What are the wider benefits of our work?**	**What is the long-term change you see as your goal?**
					Economic Dimensions		
					Social Dimensions		
					Environmental Dimensions		
					Policy Framework		
Key Assumptions	Key Assumptions	Key Assumptions	Key Assumptions	Key Assumptions	Key Assumptions	Key Assumptions	**Key Stakeholders**

Appendix 2: TBL Assessment Tool

Impact and Performance Area	Sample KPI	Sample Unit of Measure	Sample Method of Measurement
Social Dimension			
Income provided	Number of new employees, who have been hired during the reporting period	Number of new employees	Employees records
Income provided	Wage level of the enterprise compared to wage level of the main competitors	Percentage	Market study on competitor wages
Income provided	Income level of the enterprise compared to minimum income in the country	Percentage	Comparison between national minimum wage and enterprise wage
Income provided	Number of people making a full-time living solely from job in the enterprises or the sale of products and services from this enterprise.	Number of people	Sample employee survey
Occupational education and skills training delivered	Number of training hours provided to employees (full-time, part-time, or temporary) during the reporting period.	Number of hours	Training records
Occupational education and skills training delivered	Number of trainings attended on average by employee	Number of trainings	Training records
Social development benefits secured	Number of community members that benefit from your service / product	Percentage	Market survey realised among the community and calculation of the ratio
Stronger community organisation fostered, strengthening women's roles	Percentage of the employees working in the enterprise coming from the local community	Percentage	Employees survey and calculation of the ratio
Stronger community organisation fostered, strengthening women's roles	Percentage of the women involved in the enterprise	Percentage	Employees records
Stronger community organisation fostered, in particular strengthening women's roles	Percentage of major activities carried out by women	Percentage	Enterprise major activities compared with the ones carried out by women
Occupational education and skills training delivered	Number of training hours provided to women (full-time, part-time, or temporary) during the reporting period.	Number of hours	Training records
Stronger community organisation fostered, in particular strengthening women's roles	Number of women who received female empowerment services during the reporting period. (For example, leadership training, rights education, or counselling for victims of violence).	Number of women	Training records

Impact and Performance Area	Sample KPI	Sample Unit of Measure	Sample Method of Measurement
Workforce	Percentage of activities carried out by youth (between 14-25)	Percentage	Employees records
Occupational education and skills training delivered	Number of training hours provided to youth (full-time, part-time, or temporary) during the reporting period	Number of hours	Training records
Environmental Dimension			
Environmental impact of the enterprise reduced	Amount of chemicals used during the reporting period	Number of kg	Procurement records
Environmental impact of the enterprise reduced	Amount of fuel used during the reporting period	Number of litre	Procurement records
Environmental impact of the enterprise reduced	Amount of water used during the reporting period	Number of litre	Water bills or estimation
Environmental awareness, training and education delivered	Number of trainings and/or presentations delivered to the community members during the environmental awareness campaign during the reporting period	Percentage	Presentations/ trainings records and number of flyers distributed
Environmental awareness, training and education delivered	Number of employees using new approaches after environmental training	Percentage	Training records and participants survey
Changes in community choices and actions delivered	Number of community members replacing their unsustainable product by sustainable products during the reporting period	Percentage	Community survey and products/services which have been sold
Environmental impact of the enterprise reduced	Amount of renewable energy used by the enterprise during the reporting period	Number of kWh	Electricity bills and records of the renewable energy used
Environmental impact of the enterprise reduced	Number of greenhouse gases emissions offset/mitigated during the reporting period by replacing traditional power generation with renewable, modern, or more efficient power generation.	Number of metric tonnes of CO2 equivalent	Calculations should be made leveraging Clean Development Mechanism (CDM) guidelines/ methodologies to the extent possible
Environmental awareness, training and education delivered	Number of climate change awareness activities delivered by the enterprise during the reporting period	Number of activities	Enterprise records
Economic Dimension			
Financial sustainability	Revenue resulting from all business activities during the reporting period.	Currency	Accounting
Financial sustainability	Revenue from sales of the product or service during the reporting period.	Currency	Accounting
Financial sustainability	Number of products or services sold during the reporting period	Number of products/ services	Accounting

Impact and Performance Area	Sample KPI	Sample Unit of Measure	Sample Method of Measurement
Technological innovations	Number of innovations developed by the enterprise during the reporting period	Number of innovations	Enterprise records
Technological innovations	Number of new processes created by using your technology/services during the reporting period	Number of new processes	Enterprise records
Business plan in place, reviewed and updated regularly	Number of reviews of business plan during the reporting period	Number of reviews	Enterprise records
Business plan in place, reviewed and updated regularly	Number of times used to apply for loans and financial support during the reporting period	Number of times	Enterprise records
Marketing networks established and new opportunities investigated	Number of marketing meeting realised during the reporting period	Number of meetings	Meeting records
Marketing networks established and new opportunities investigated	Number of new marketing partnership realised during the reporting period	Number of marketing partnerships	Enterprise records
Marketing networks established and new opportunities investigated	Number of visits to fairs and exhibitions during the reporting period	Number of visits / exhibitions	Visits records
Livelihood for the enterprise manager	Enterprise wage compared to the national minimum wage	Percentage	Wage records and national available statistics
Regulatory Dimension[1]			
Regulations			
Standards			
Incentives			

[1] The Regulator Dimension needs further development as part of the UJ-PEETS & SANEDI collaboration.

Section A: Location and Demographics							
A1: Province		**A2: District**		**A3: Owner**			
A4: GPS Coordinates		**A5: Name of Data Collector:**					
A6: Ownership type	1 = Household	2 = Institutional	3 = Other				
Section B: Biogas digester							
B1: Type (circle)	1 = Brick and mortar fixed dome digestor	2 = Floating drum digestor	3 = Biobag digestor	4 = In situ cast concrete digestor	5 = AGET digestor	6 = Plastic Roto digestor	7 = Other (specify)
B2: Capacity	1 = 6m^3	2 = 8 m^3	3 = 10 m^3	4 = 12 m^3	5 = 16 m^3	6 = Other	
B3: Year of construction		**B4: Estimate cost (in Rands)**					
B5: Who funded it	1 = Government	2 = NGO	3 = Personal	4 = Other			
B6: Type of Substrate	1 = Cow dung	2 = Kitchen waste	3 = Pig waste	4 = Plant substances (Specify)	5 = Human waste	6 = Others (Specify)	
B6: 1 Ratio of Substrate e.g. 60% 1 and 40% 2							
B7: State number of livestock							
B8: Status (Circle)	1 = collapsed	2 = functional	3 = non-functional	4 = to be completed	5 = to be fed	6 = abandoned	
B9: When did it stop functioning:							
B10: If answer to above is not 2, what are the reasons							
B11: Mode of feeding	1 = Manual	2 = Automatic	3 = Other				
B12: Approximate distance from user							
B13: Distance from feedstock source							
B14: Distance from water source							
B15: Own opinion on design and functionality							

Section C: Biogas digester operation					
C1: Who operates the plant (feeding, small maintenance)					
C2: How regular are the feedings	1 = Daily	2 = Weekly	3 = Monthly	4 = Other (specify)	
C3: Quantity of substrate per feeding	1 = 1 bucket	2 = 2 buckets	3 = Others (specify)		
C4: How would you rate your satisfaction with the digester operation	1 = Not at all satisfied	2 = Slightly satisfied	3 = Moderately satisfied	4 = Very satisfied	5 = Extremely satisfied
C5: Characterization of waste	Any samples taken Y/N	pH of sample	Temperature of sample	Any comments	
C6: Operational problems faced					
Section D: Energy Uses					
D1: What is the gas being used for	1 = Cooking	2 = Lighting	3 = Refrigeration	4 = Other (specify)	
D2: How many? State numbers					
D3: Other energy sources	1 = Firewood	2 = Electric1ty	3 = Solar	4 = Other (specify)	
Quantity of other energy sources					
D4: Use of slurry if any	1 = Farming	2 = Selling	3 = Other / specify		
D5: Economic activities at the place	1 = Livestock production	2 = Crop production	3 = Both 1 & 2	4 = Others/ Additional, specify	
Section E: Lessons and Experience					
E1: Experiences and comments on the biogas design / usage					

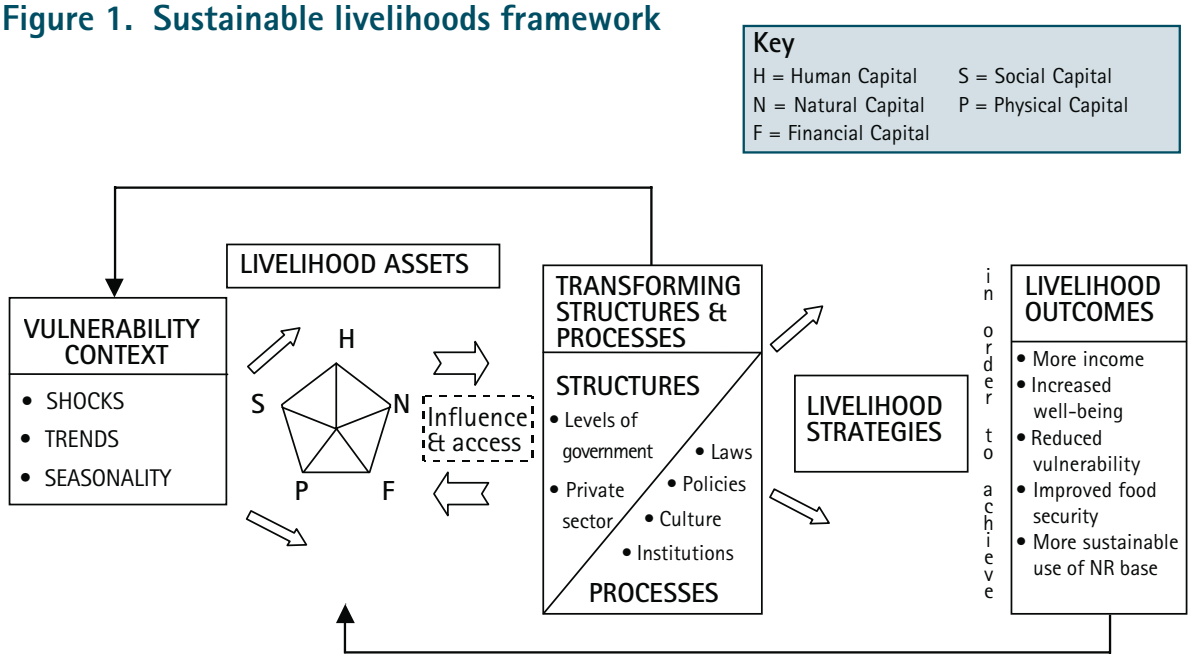
Appendix 3:
Sustainable Livelihoods Guidance Sheet

FRAMEWORK INTRODUCTION 2.1

The livelihoods framework is a tool to improve our understanding of livelihoods, particularly the livelihoods of the poor. It was developed over a period of several months by the Sustainable Rural Livelihoods Advisory Committee, building on earlier work by the Institute of Development Studies (amongst others).

This section of the Guidance Sheets provides an introduction to the framework itself. The individual components of the framework are described in more detail in the subsequent sheets in this section. Practical questions and challenges of operationalising the approach will be covered in Section 3 and following.

Figure 1. Sustainable livelihoods framework



Why a framework?

The sustainable livelihoods framework presents the main factors that affect people's livelihoods, and typical relationships between these. It can be used in both planning new development activities and assessing the contribution to livelihood sustainability made by existing activities.

In particular, the framework:

- provides a checklist of important issues and sketches out the way these link to each other;
- draws attention to core influences and processes; and
- emphasises the multiple interactions between the various factors which affect livelihoods.

The framework is centred on people. It does not work in a linear manner and does not try to present a model of reality. Its aim is to help stakeholders with different perspectives to engage in structured and coherent debate about the many factors that affect livelihoods, their relative importance and the way in which they interact. This, in turn, should help in the identification of appropriate entry points for support of livelihoods.

The **arrows** within the framework are used as shorthand to denote a variety of different types of relationships, all of which are highly dynamic. None of the arrows imply direct causality, though all imply a certain level of influence.

Understanding the framework

- The form of the framework is not intended to suggest that the starting point for all livelihoods (or livelihood analysis) is the *Vulnerability Context* which through a series of permutations yields *Livelihoods Outcomes*. Livelihoods are shaped by a multitude of different forces and factors that are themselves constantly shifting. People-centred analysis is most likely to begin with simultaneous investigation of people's assets, their objectives (the *Livelihood Outcomes* which they are seeking) and the *Livelihood Strategies* which they adopt to achieve these objectives.
- Important feedback is likely between:
  (a) *Transforming Structures and Process* and the *Vulnerability Context*; and
  (b) *Livelihood Outcomes* and *Livelihood Assets*.
  There are other feedback relationships that affect livelihoods which are not shown. For example, it has been shown that if people feel less vulnerable (*Livelihood Outcome*) they frequently choose to have fewer children. This has implications for population trends which might be an important part of the *Vulnerability Context*.

The framework summarises the main components of and influences on livelihoods; it does not provide an exhaustive list of the issues to be considered. It should be adapted to meet the needs of any given circumstance.

Using the framework to help eliminate poverty

The framework is intended to be a versatile tool for use in planning and management. It offers a way of thinking about livelihoods that helps order complexity and makes clear the many factors that affect livelihoods.

A more important task than perfecting the framework itself is putting the ideas that it represents into practice. If that calls for adaptation of certain boxes or revision of certain definitions to make the framework more useful, all the better; the framework becomes a living tool.

Use of the framework is intended to make a distinct contribution to improving DFID's ability to eliminate poverty. It is not simply a required step in project/programme preparation, nor does it provide a magic solution to the problems of poverty elimination. In order to get the most from the framework:

- The core ideas that underlie it should not be compromised during the process of adaptation. One of these core ideas is that (most) analysis should be conducted in a participatory manner.
- Use of the framework should be underpinned by a serious commitment to poverty elimination. This should extend to developing a meaningful dialogue with partners about how to address the underlying political and economic factors that perpetuate poverty.
- Those using the framework must have the ability to recognise deprivation in the field even when elites and others may want to disguise this and skew benefits towards themselves (this will require skill and rigour in social analysis).

The sustainable livelihoods framework continues to develop. Use it as a flexible tool and adapt it as necessary. You can focus on any part of the framework, but it is important to keep the wider picture in mind.

FRAMEWORK VULNERABILITY CONTEXT 2.2

What is the vulnerability context?

The *Vulnerability Context* frames the external environment in which people exist. People's livelihoods and the wider availability of assets are fundamentally affected by critical **trends** as well as by **shocks** and **seasonality** – over which they have limited or no control. The box below provides examples (this is not a complete list):

Trends
- Population trends
- Resource trends (including conflict)
- National/international economic trends
- Trends in governance (including politics)
- Technological trends

Shocks
- Human health shocks
- Natural shocks
- Economic shocks
- Conflict
- Crop/livestock health shocks

Seasonality
- Of prices
- Of production
- Of health
- Of employment opportunities

Why is it important?

The factors that make up the *Vulnerability Context* are important because they have a direct impact upon people's asset status and the options that are open to them in pursuit of beneficial livelihood outcomes.

- **Shocks** can destroy assets directly (in the case of floods, storms, civil conflict, etc.). They can also force people to abandon their home areas and dispose of assets (such as land) prematurely as part of coping strategies. Recent events have highlighted the impact that international economic shocks, including rapid changes in exchange rates and terms of trade, can have on the very poor.
- **Trends** may (or may not) be more benign, though they are more predictable. They have a particularly important influence on rates of return (economic or otherwise) to chosen livelihood strategies.
- **Seasonal shifts** in prices, employment opportunities and food availability are one of the greatest and most enduring sources of hardship for poor people in developing countries.

Different types of **conflict** can have profound adverse effects on the livelihoods of the poor. In areas of civil conflict people suffer from lawlessness and physical damage. Conflicts over access to resources are of increasing importance as populations expand and resource use intensifies. If unaddressed, such conflicts may further marginalise already poor groups.

Is it always negative?

Not all the trends listed above are negative or cause vulnerability. For example, economic indicators can move in favourable directions, diseases can be eradicated and new technologies may be very valuable to poor people.

However, use of the term V*ulnerability Context* draws attention to the fact that this complex of influences is directly or indirectly responsible for many of the hardships faced by the poorest people in the world. It is common for there to be a vicious circle in action. The inherent fragility of poor people's livelihoods makes them unable to cope with stresses, whether predictable or not. It also makes them less able to manipulate or influence their environment to reduce those stresses; as a result they become increasingly vulnerable. And even when trends move in the right direction, the poorest are often unable to benefit because they lack assets and strong institutions working in their favour.

What can be done to alter the vulnerability context?

The *Vulnerability Context* is the part of the framework that lies furthest outside people's control. In the short to medium term and on an individual or small group basis there is little that can be done to alter it directly (though there are exceptions: for example, direct intervention to diffuse conflict).

Most externally-driven change in the V*ulnerability* C*ontext* is a product of activity at the level of *Transforming Structures and Processes* (e.g. changes in policy). Another way of managing the *Vulnerability Context* is to help people to become more resilient and better able to capitalise on its positive aspects. This is a core aim of the sustainable livelihoods approach. It can be achieved through supporting poor people to build up their assets. For example, increasing people's access to appropriate financial services – including insurance – is one way of reducing vulnerability. Another approach is to help ensure that critical institutions and organisations are responsive to the needs of the poor.

Different components of the *Vulnerability Context* affect different people in different ways. Thus, natural shocks may have a more adverse effect on agricultural activity than on urban employment. Likewise, changes in international commodity prices will affect those who grow, process or export such commodities but have little direct effect on those who produce for, or trade in, the local market. Understanding the nature of vulnerability is a key step in sustainable livelihoods analysis.

What type of information is required to analyse the vulnerability context?

Livelihoods analysis does not have to be exhaustive to be effective. Rather than trying to develop a full understanding of all dimensions of the *Vulnerability Context*, the aim is to identify those trends, shocks and aspects of seasonality that are of particular importance to livelihoods. Effort can then be concentrated on understanding the impact of these factors and how negative aspects can be minimised. This requires a prior understanding of the nature of local livelihoods – what types of livelihood strategies are employed by local people and what factors constrain them from achieving their objectives. Such understanding cannot be gained without social analysis so that particular social groups and their relationship with factors within the *Vulnerability Context* can be identified.

While it is important to narrow down the extent of analysis, it is also important to think broadly about factors within the *Vulnerability Context* that *might* affect local people, so that less-obvious issues are not neglected. For example, when thinking about **seasonality**, it is important to consider both immediate and more distant effects.

In a rural setting, it may be necessary to find answers to the following types of question:

- Which groups produce which crops?
- How important is each crop to the livelihoods of the groups that produce it?
- Is the revenue from a given crop used for a particular purpose – e.g. if it is controlled by women is it particularly important to child health or nutrition?
- What proportion of output is marketed?
- How do prices for different crops vary through the year?
- How predictable is seasonal price fluctuation?
- Are the price cycles of all crops correlated?
- What proportion of household food needs is met by own consumption and what portion is purchased?
- At what time of year is cash income most important (e.g. school fees might be collected one or more times during the year)? Does this coincide with the time at which cash is most available?
- Do people have access to appropriate financial service institutions to enable them to save for the future? Does access to these vary by social group?
- How long and intense is the 'hungry period'?
- What effect do the 'hungry period' and other seasonal natural events (e.g. the advent of the rainy season) have on human health and the ability to labour?
- Has the length of the 'hungry period' been increasing or decreasing?
- How do income-earning opportunities vary throughout the year? Are they agricultural or non-farm?
- How does remittance income vary throughout the year (e.g. falling off at times when it is most needed because of food price rises)?

Methodologies for conducting this type of analysis will be investigated in more detail in Section 3.

Seasonality is usually associated with rural economies. It can, however, be equally problematic for poor people in urban areas, especially when these people spend a large proportion of their income on foodstuffs, the prices of which may be very volatile.

FRAMEWORK LIVELIHOOD ASSETS 2.3

The livelihood framework identifies five core asset categories or types of capital upon which livelihoods are built. Increasing access – which can take the form of ownership or the right to use – to these assets is a primary concern for DFID in its support of livelihoods and poverty elimination.

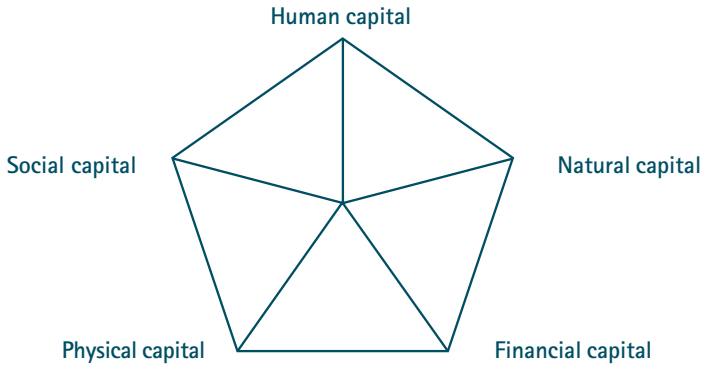
The livelihoods approach is concerned first and foremost with people. It seeks to gain an accurate and realistic understanding of people's strengths (assets or capital endowments) and how they endeavour to convert these into positive livelihood outcomes. The approach is founded on a belief that people require a range of assets to achieve positive livelihood outcomes; no single category of assets on its own is sufficient to yield all the many and varied livelihood outcomes that people seek. This is particularly true for poor people whose access to any given category of assets tends to be very limited. As a result they have to seek ways of nurturing and combining what assets they do have in innovative ways to ensure survival.

The asset pentagon

The asset pentagon lies at the core of the livelihoods framework, 'within' the vulnerability context. The pentagon was developed to enable information about people's assets to be presented visually, thereby bringing to life important inter-relationships between the various assets.

For definitions and explanations of the different types of capital, please refer to the following sheets:

2.3.1: Human capital
2.3.2: Social capital
2.3.3: Natural capital
2.3.4: Physical capital
2.3.5: Financial capital



Although the term 'capital' is used, not all the assets are capital stocks in the strict economic sense of the term (in which capital is the product of investment which yields a flow of benefits over time). The five capitals are perhaps best thought of as livelihood building blocks; the term 'capital' is used because this is the common designation in the literature.

The shape of the pentagon can be used to show schematically the variation in people's access to assets. The idea is that the centre point of the pentagon, where the lines meet, represents zero access to assets while the outer perimeter represents maximum access to assets. On this basis different shaped pentagons can be drawn for different communities or social groups within communities.

It is important to note that a single physical asset can generate multiple benefits. If someone has secure access to land (natural capital) they may also be well-endowed with financial capital, as they are able to use the land not only for direct productive activities but also as collateral for loans. Similarly, livestock may generate social capital (prestige and connectedness to the community) for owners while at the same time being used as productive physical capital (think of animal traction) and remaining, in itself, as natural capital. In order to develop an understanding of these complex relationships it is necessary to look beyond the assets themselves, to think about prevailing cultural practices and the types of structures and processes that 'transform' assets into livelihood outcomes (see 2.4).

Pentagons can be useful as a focus point for debate about suitable entry points, how these will serve the needs of different social groups and likely trade-offs between different assets. However, using the pentagon in this way is necessarily representative. At a generic level there is no suggestion that we can – or should – quantify all assets, let alone develop some kind of common currency that allows direct comparison between assets. This does not, of course, rule out the development of specific, quantifiable indicators of assets where these are thought to be useful.

Change in asset status

Asset endowments are constantly changing, therefore pentagons are constantly shifting. A three dimensional framework, with the third dimension representing time, would enable this change to be visualised. A two dimensional framework does not. However, it is imperative to incorporate a time dimension into any analysis of assets. Information should be gathered on trends in overall asset availability (e.g. if societies fragment, the overall 'stock' of social capital might decline) as well as on which groups are accumulating assets, which are losing and why. Where processes of 'social exclusion' are at work, those who are already poorly endowed with assets may well be becoming gradually, but notably, more marginalised.

Relationships within the framework

Relationships between assets

Assets combine in a multitude of different ways to generate positive livelihood outcomes. Two types of relationship are particularly important:

- ***Sequencing***: Do those who escape from poverty tend to start with a particular combination of assets? Is access to one type of asset (or a recognisable sub-set of assets) either necessary or sufficient for escape from poverty? If so, this may provide important guidance on where livelihood support should be focused, at least at the outset.
- ***Substitution***: Can one type of capital be substituted for others? For example, can increased human capital compensate for a lack of financial capital in any given circumstance? If so, this may extend the options for support.

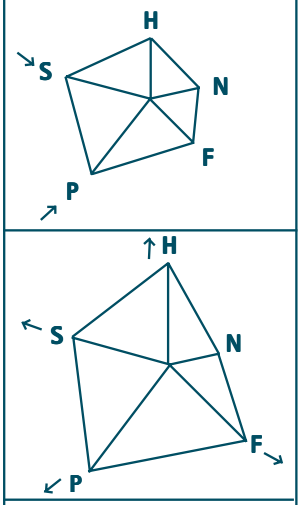
Relationships with other framework components

Relationships within the framework are highly complex. Understanding them is a major challenge of, and a core step in, the process of livelihoods analysis leading to action to eliminate poverty.

- ***Assets and the Vulnerability Context***: assets are both destroyed and created as a result of the trends, shocks and seasonality of the *Vulnerability Context*.
- ***Assets and Transforming Structures and Processes***: The institutions and policies of the *Transforming Structures and Processes* have a profound influence on access to assets. They:
  (a) Create assets – e.g. government policy to invest in basic infrastructure (physical capital) or technology generation (yielding human capital) or the existence of local institutions that reinforce social capital.
  (b) Determine access – e.g. ownership rights, institutions regulating access to common resources.
  (c) Influence rates of asset accumulation – e.g. policies that affect returns to different livelihood strategies, taxation, etc.

  However, this is not a simple one way relationship. Individuals and groups themselves influence *Transforming Structures and Processes*. Generally speaking the greater people's asset endowment, the more influence they can exert. Hence one way to achieve empowerment may be to support people to build up their assets.
- ***Assets and Livelihood Strategies***: Those with more assets tend to have a greater range of options and an ability to switch between multiple strategies to secure their livelihoods.
- ***Assets and Livelihood Outcomes***: Poverty analyses have shown that people's ability to escape from poverty is critically dependent upon their access to assets. Different assets are required to achieve different livelihood outcomes. For example, some people may consider a minimum level of social capital to be essential if they are to achieve a sense of well-being. Or in a remote rural area, people may feel they require a certain level of access to natural capital to provide security. Such relationships will need to be investigated case by case.

Different shaped pentagons – changes in access to assets



The upper pentagon shows reasonable, but declining, access to physical capital and limited access to natural capital. Social capital is also falling. Perhaps the people whose livelihood assets are represented live in an urban area but do not have the skills or finance to invest in infrastructure maintenance. The decline of social capital also constrains their ability to form shared work groups. The lower pentagon shows the situation after support that has extended access to financial capital (perhaps through group-based micro-finance schemes that also help build social capital) as well as providing skills and training (human capital). Together these enable the people to maintain and extend their physical capital. Access to natural capital remains unchanged.

FRAMEWORK HUMAN CAPITAL 2.3.1

In its *Statement of Purpose* DFID commits itself to promoting 'better education, health and opportunities for poor people' through various means. These range from providing direct support to education and health to helping to provide safe drinking water and emergency assistance in times of crisis.

What is human capital?

Human capital represents the skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives. At a household level human capital is a factor of the amount and quality of labour available; this varies according to household size, skill levels, leadership potential, health status, etc.

Human capital appears in the generic framework as a livelihood asset, that is, as a building block or means of achieving livelihood outcomes. Its accumulation can also be an end in itself. Many people regard ill-health or lack of education as core dimensions of poverty and thus overcoming these conditions may be one of their primary livelihood objectives.

Why is it important?

As well as being of intrinsic value, human capital (knowledge and labour or the ability to command labour) is required in order to make use of any of the four other types of assets. It is therefore necessary, though not on its own sufficient, for the achievement of positive livelihood outcomes.

What can be done to build human capital for the poor?

Support to the accumulation of human capital can be both direct and indirect. In either case it will only achieve its aims if people themselves are willing and able to invest in their own human capital by attending training sessions or schools, accessing preventative medical services, etc. If they are prevented from doing so by adverse structures and processes (e.g. formal policies or social norms that prevent girls from attending school) then indirect support to human capital development will be particularly important.

In many cases it will be necessary to combine both types of support. The most appropriate mechanism for such combined support may well be a sector programme. Sector programmes can adopt an integrated approach to human capital development, drawing on information gathered through livelihoods analysis to ensure that effort is focused where it is most needed (for example, on disadvantaged groups).

DFID sustainable livelihoods objective: Improved access to high-quality education, information, technologies and training and better nutrition and health. Achieved through, for example:

Direct support to asset accumulation

- To health/education/training infrastructure
- To health/education/training personnel
- To the development of relevant knowledge and skills (these should be developed with and made readily available to the poor)

Indirect support (through *Transforming Structures and Processes*)

- Reform of health/education/training policies
- Reform of health/education/training organisations
- Changes in local institutions – culture, norms – that limit access to health/education/training (e.g. for women)

Feedback from achievement of livelihood outcomes (virtuous circles)

- Health status is directly related to income/food security (with relevant knowledge)
- Higher income is often reinvested in education
- Reduced vulnerability can reduce the birth rate (with knock-on effects on nutrition and labour)

Another indirect way of promoting education is to increase its value, by helping to open up opportunities for those who have invested in education. This can be done through providing direct support in other areas, for example through extending access to financial capital thereby enabling people to put their knowledge to productive use. Helping to reduce the drudgery of day-to-day activities can also help free people up so that they have the time for education and can then make better use of that education.

Specialist training – as opposed to general education – will be effective only when trainers have access to relevant information. If investments in knowledge generation (research) are considered in terms of the contribution that they make to human capital it is immediately apparent that:

- The knowledge generated must be relevant to existing or potential future livelihood strategies. One way to ensure this is to adopt participatory processes of knowledge generation that build upon and complement existing local knowledge.
- Provision must be made for extending access to the knowledge generated. Just as school buildings do nothing for human capital if they are not brought to life with learning, so new technologies and ideas are redundant if they do not reach people. Sharing knowledge with the poor has proved to be a particular problem in the past, hence the need to consider new options for supporting information networks using new types of communication channels, etc.

Knowledge generation should be based upon a broad understanding of the current livelihood strategies of the poor and the internal and external factors that may cause these to change.

What type of information is required to analyse human capital?

There are many quite well-developed indicators of human health, though some – such as life expectancy – may be difficult to assess at local level. Rather than focusing on exact measures, it may be more appropriate to investigate variations. Do different social groups have obviously lower or higher life expectancy? Are the children of indigenous groups, for example, more poorly nourished than other children? Does the quality of health care available to different groups differ markedly?

Education indicators may be easier to assess. It is relatively simple to determine the average number of years a child spends in school, or the percentage of girls who are enrolled in school. What is far more difficult is understanding the quality, impact and value to livelihoods of these years in school, the correlation – if there is one – between years in school and knowledge, and the relationship between either of these and leadership potential.

Formal education is certainly not the only source of knowledge-based human capital. It is equally important to understand existing local knowledge, how this is shared, added to and what purpose it serves. For example, some knowledge can be highly useful for production – think of knowledge about modern, intensive farming techniques – but be neutral or negative in terms of its effect upon the environment and environmental sustainability. Or some knowledge – again, think of knowledge for production, either agricultural or industrial – may be effectively useless unless it is coupled with other types of knowledge (knowledge about how to market goods, about appropriate quality standards, etc.)

The following types of questions are likely to be important when thinking about human capital:

- How complex is the local environment (the more complex the problems, the greater the importance of knowledge)?
- From where (what sources, networks) do people access information that they feel is valuable to their livelihoods?
- Which groups, if any, are excluded from accessing these sources?
- Does this 'exclusion' affect the nature of information available? (e.g. if women are excluded, then knowledge of traditionally female production activities may be limited.)
- Are knowledge 'managers' (e.g. teachers or core members of knowledge networks) from a particular social background that affects the type of knowledge that exists in the community?
- Is there a tradition of local innovation? Are technologies in use from 'internal' or 'external' sources?
- Do people feel that they are particularly lacking in certain types of information?
- How aware are people of their rights and of the policies, legislation and regulation that impact on their livelihoods? If they do consider themselves to be aware, how accurate is their understanding?

Clearly there is a close relationship between the way that knowledge is generated and transmitted and social capital (see 2.3.2). High levels of social capital can therefore substantially add to human capital. Minimum levels of other types of capital – plus broadly conducive transforming structures and processes – may be necessary to give people the incentive to invest in their own human capital.

FRAMEWORK SOCIAL CAPITAL 2.3.2

What is social capital?

There is much debate about what exactly is meant by the term 'social capital'. In the context of the sustainable livelihoods framework it is taken to mean the social resources upon which people draw in pursuit of their livelihood objectives. These are developed through:

- **networks and connectedness,** either vertical (patron/client) or horizontal (between individuals with shared interests) that increase people's trust and ability to work together and expand their access to wider institutions, such as political or civic bodies;
- **membership of more formalised groups** which often entails adherence to mutually-agreed or commonly accepted **rules, norms and sanctions**; and
- **relationships of trust, reciprocity and exchanges** that facilitate co-operation, reduce transaction costs and may provide the basis for **informal safety nets** amongst the poor.

Some people choose to distinguish between social capital and 'political capital', derived from access to wider institutions of society. Though we do not make this distinction here, this should not be taken to suggest a 'downgrading' of the importance of political factors and issues of access beyond the community.

The above are all inter-related. For example, membership of groups and associations can extend people's access to and influence over other institutions. Likewise trust is likely to develop between people who are connected through kinship relations or otherwise.

Of all the five livelihood building blocks, social capital is the most intimately connected to *Transforming Structures and Processes* (see 2.4). In fact, it can be useful to think of social capital as a product of these structures and processes, though this over-simplifies the relationship. Structures and processes might themselves be products of social capital; the relationship goes two ways and can be self-reinforcing. For example:

- when people are already linked through common norms and sanctions they may be more likely to form new organisations to pursue their interests; and
- strong civil society groups help people to shape policies and ensure that their interests are reflected in legislation.

Why is it important?

As well as having its own intrinsic value, social capital may be particularly important as a **'resource of last resort'** for the poor and vulnerable. It can:

- provide a buffer that helps them cope with shocks, such as death in the family;
- act as an informal safety net to ensure survival during periods of intense insecurity; and
- compensate for a lack of other types of capital (e.g. shared labour groups compensating for limited human capital within the household).

Mutual trust and reciprocity lower the costs of working together. This means that social capital has a direct impact upon other types of capital:

- By improving the efficiency of economic relations, social capital can help increase people's incomes and rates of saving (financial capital). (Isolated studies have shown that communities with 'higher levels' of social capital are wealthier – but questions remain about measuring social capital.)
- Social capital can help to reduce the 'free rider' problems associated with public goods. This means that it can be effective in improving the management of common resources (natural capital) and the maintenance of shared infrastructure (physical capital).
- Social networks facilitate innovation, the development of knowledge and sharing of that knowledge. There is, therefore, a close relationship between social and human capital.

Social capital, like other types of capital, can also be valued as a good in itself. It can make a particularly important contribution to people's sense of well-being (through identity, honour and belonging).

Is it always positive?

Social capital can be used in negative as well as positive ways.

- Those who are excluded from strong groups that convey multiple benefits may be disadvantaged in a variety of other ways (e.g. landless women with few skills).
- Networks may be based upon strictly hierarchical or coercive relationships that limit mobility and prevent people from escaping from poverty.
- Membership of a group or network often entails obligations (e.g. to assist others in times of distress) as well as rights (to call upon assistance). Calls for assistance may come at difficult times.

What can be done to build the social capital of the poor?

Social capital has the fortunate quality of being, in some cases, self-reinforcing; stocks can be increased, rather than depleted, by the right type of use. Neglect, on the other hand, can undermine social capital and trust (unlike savings in the bank which, if neglected, continue to accrue). Social capital can also be actively, though often unintentionally, destroyed through heavy-handed interventions that impose new social relations without taking into account the strengths of the old.

Most attempts to build social capital focus on strengthening local institutions, either directly (through capacity building, leadership training or injection of resources) or indirectly through creating an open, democratic environment in which they flourish.

DFID sustainable livelihoods objective: A more supportive and cohesive social environment.
Achieved through (for example):

Direct support to asset accumulation

- To improve the internal functioning of groups
  - leadership
  - management
- To extend external links of local groups

Indirect support (through *Transforming Structures and Processes*)

- To group/network formation and structure
- To the development of more open and reliable policy environment ('good governance')
- To organisations to help them develop systems for external consultation with civil society

Feedback from achievement of livelihood outcomes (virtuous circles)

- Self-reinforcing relationships (e.g. success in increasing the sustainability of natural resource use can strengthen the managing group)
- Greater household income may extend scope for participation in external activities

While empowerment of groups may be a primary objective, social capital can also be a by-product of other activities (e.g. participatory research groups formed to develop and test technologies may develop a life of their own). Most commonly, increases in social capital are pursued in conjunction with, or as a necessary component of, support in other areas. Thus joint responsibility savings and credit groups rely on social capital, as do integrated pest management efforts which require joint action to combat a problem.

What type of information is required to analyse social capital?

Levels of social capital are hard to gauge from the outside. They may be discernible only after lengthy analysis (which may be beyond project/programme resources) and it is unlikely that they will be quantifiable. For example, simply counting the number of registered groups in a community is not likely to yield a measure of social capital; group nature and quality is as important as group numbers. Often we will be looking at trends – whether the state of social organisation appears to be becoming better or worse for livelihoods – rather than trying to gauge exact levels of social capital.

It is very important not to permit these difficulties to cause neglect of social factors when working with communities. Over time it will be vital to develop an understanding of the nature of civic relations at a wider community level, of the types of social resources upon which households rely and of who is excluded from these benefits. Groups with overlapping membership can be particularly problematic if it emerges that people with a particular social profile are excluded from all groups. Another important point for observation is people's coping strategies in times of crisis and the extent to which they have relied on social resources to see them through.

(For further suggestions in this area see the *Key Sheet* on social capital. *Key Sheets* are available on the Internet at: http://www.oneworld.org/odi/keysheets/)

There is clearly much to learn about building social capital, including:

- how best to support groups (especially of the poor who may lack time for group activities);
- what are appropriate indicators of effective group functioning; and
- what is the relationship between various types of government structure and ideology and the 'density' of social capital at the community level.

FRAMEWORK NATURAL CAPITAL 2.3.3

Examples of natural capital and services deriving from it:

- land
- forests
- marine/wild resources
- water
- air quality
- erosion protection
- waste assimilation
- storm protection
- biodiversity degree and rate of change.

For all these it is important to consider access and quality and how both are changing.

What is natural capital?

Natural capital is the term used for the natural resource stocks from which resource flows and services (e.g. nutrient cycling, erosion protection) useful for livelihoods are derived. There is a wide variation in the resources that make up natural capital, from intangible public goods such as the atmosphere and biodiversity to divisible assets used directly for production (trees, land, etc.).

Within the sustainable livelihoods framework, the relationship between natural capital and the *Vulnerability Context* is particularly close. Many of the shocks that devastate the livelihoods of the poor are themselves natural processes that destroy natural capital (e.g. fires that destroy forests, floods and earthquakes that destroy agricultural land) and seasonality is largely due to changes in the value or productivity of natural capital over the year.

Why is it important?

Clearly, natural capital is very important to those who derive all or part of their livelihoods from resource-based activities (farming, fishing, gathering in forests, mineral extraction, etc.). However, its importance goes way beyond this. None of us would survive without the help of key environmental services and food produced from natural capital. Health (human capital) will tend to suffer in areas where air quality is poor as a result of industrial activities or natural disasters (e.g. forest fires). And although our understanding of linkages between resources remains limited, we know that we depend for our health and well-being upon the continued functioning of complex ecosystems (which are often undervalued until the adverse effects of disturbing them become apparent).

What can be done to build the natural capital of the poor?

Past donor rural development efforts focused largely on building natural capital. Indeed concern with natural capital itself has tended to detract attention from the more important issue of how natural capital is used, in combination with other assets, to sustain livelihoods. The livelihoods approach tries to take a broader view, to focus on people and to understand the importance of structures and processes (e.g. land allocation systems, rules governing extraction from fisheries, etc.) in determining the way in which natural capital is used and the value that it creates.

DFID sustainable livelihoods objective: More secure access to, and better management of, natural resources. Achieved through (for example):

Direct support to asset accumulation

- To conserve resources and biodiversity (through technology and direct action)
- To the provision of services/ inputs for forestry, agriculture, fisheries

Indirect support (through ***Transforming Structures and Processes***)

- Reform of organisations that supply services to those involved in forests/agriculture/fisheries
- Changes in institutions that manage, and govern access to, natural resources
- Environmental legislation and enforcement mechanisms
- Support to market development to increase the value of forest/ agricultural/fisheries produce

Feedback from achievement of livelihood outcomes (virtuous circles)

- More sustainable use of natural resources has a direct impact upon stocks of natural capital
- Some positive correlation between higher income and investment in natural capital

These structures and processes govern access to natural resources and can provide the incentives or coercion necessary to improve resource management. For example, if markets are well-developed, the value of resources is likely to be higher, prompting better management (though in some cases, developed markets can lead to distress sales by the poor resulting in increased poverty).

Though indirect support to natural capital through *Transforming Structures and Processes* is very important, direct support – focused on resources themselves as opposed to people's ability to use those resources – still has a place when it comes to conservation for future use (e.g. *in situ* biodiversity conservation). One of the foundations of the sustainable livelihoods approach is the belief in and pursuit of various types of sustainability (see 1.4). This includes, but is not limited to, environmental sustainability (i.e. sustainability of natural capital and the services that derive from it, such as carbon sinks and erosion control).

What kind of information is required to analyse natural capital?

It is not only the existence of different types of natural assets that is important, but also access, quality and how various natural assets combine and vary over time (e.g. seasonal variations in value). For example, degraded land with depleted nutrients is of less value to livelihoods than high quality, fertile land, and the value of both will be much reduced if users do not have access to water and the physical capital or infrastructure that enables them to use that water.

With natural resources it is also very important to investigate long-term trends in quality and use. This is familiar territory for those skilled in the practice of rural appraisal techniques (mapping, transect walks, etc.). Typical issues for analysis might include:

- Which groups have access to which types of natural resources?
- What is the nature of access rights (e.g. private ownership, rental, common ownership, highly contested access)? How secure are they? Can they be defended against encroachment?
- Is there evidence of significant conflict over resources?
- How productive is the resource (issues of soil fertility, structure, salinisation, value of different tree species, etc.)? How has this been changing over time (e.g. variation in yields)?
- Is there existing knowledge that can help increase the productivity of resources?
- Is there much spatial variability in the quality of the resource?
- How is the resource affected by externalities? (For example: the productive potential of different parts of watersheds is affected by the activities of other users and the way in which resource systems operate; the value of fisheries depends upon the number of other users who have access and the choices they make about their catches; biodiversity is often damaged by intensive agriculture.)
- How versatile is the resource? Can it be used for multiple purposes? (This can be important in cushioning users against particular shocks.)

Various organisations (including the World Bank, the Royal Tropical Institute in the Netherlands, various CGIAR centres and the University of Bradford, Development and Project Planning Centre) are currently working on the development and refinement of (participatory) indicators of environmental sustainability and resource quality.

Environmental economists have invested considerable effort in trying to determine overall values for natural assets that take into account:

- direct use value (e.g. of land used for agricultural production or of recreational areas);
- indirect use value (e.g. biodiversity, erosion protection and other ecological services); and
- non-use value, or existence value (often calculated on the basis of the amount people would be willing to pay to see the continued existence of a given resource, regardless of whether they use it).

This type of valuation exercise helps remind us of the many uses of natural resources and also of our obligations as 'custodians' rather than 'owners'. However, most livelihoods analysis of natural capital will not go this far. Indirect use values are likely to feature prominently in calculations only when they are problematic or where they offer significant income prospects. For example:

- Problems might arise where tree felling has caused knock-on erosion problems, or over-exploitation of coastal areas is leading to increased storm damage in adjacent areas.
- Significant income earning opportunities might exist in areas of high natural biodiversity.

What is physical capital?

Physical capital comprises the basic infrastructure and producer goods needed to support livelihoods.

- Infrastructure consists of changes to the physical environment that help people to meet their basic needs and to be more productive.
- Producer goods are the tools and equipment that people use to function more productively.

The following components of infrastructure are usually essential for sustainable livelihoods:

- affordable transport;
- secure shelter and buildings;
- adequate water supply and sanitation;
- clean, affordable energy; and
- access to information (communications).

Infrastructure – such as roads, rails and telecommunications – are key to the integration of the remote areas where many of the poor live. Not only are people able to move between rural and urban areas more easily if the transport infrastructure is good, but they are also more likely to be better informed about opportunities (or the lack of them) in areas to which they are thinking of migrating, either temporarily or permanently.

Infrastructure is commonly a public good that is used without direct payment. Exceptions include shelter, which is often privately owned, and some other infrastructure that is accessed for a fee related to usage (e.g. toll roads and energy supplies). Producer goods may be owned on an individual or group basis or accessed through rental or 'fee for service' markets, the latter being common with more sophisticated equipment.

Why is it important?

Many participatory poverty assessments have found that a lack of particular types of infrastructure is considered to be a core dimension of poverty. Without adequate access to services such as water and energy, human health deteriorates and long periods are spent in non-productive activities such as the collection of water and fuel wood. The opportunity costs associated with poor infrastructure can preclude education, access to health services and income generation. For example, without transport infrastructure, essential fertiliser cannot be distributed effectively, agricultural yields remain low and it is then difficult and expensive to transport limited produce to the market. The increased cost (in terms of all types of capital) of production and transport means that producers operate at a comparative disadvantage in the market.

Insufficient or inappropriate producer goods also constrain people's productive capacity and therefore the human capital at their disposal. More time and effort are spent on meeting basic needs, production and gaining access to the market.

What can be done to build physical capital for the poor?

In the past DFID has supported the direct provision of producer goods for poor people. This can be problematic for a number of reasons:

- Acting as a direct supplier of producer goods can cause dependence and disrupt private markets.
- Direct provision can detract attention from the need to reform *Structures and Processes* to ensure that gains are sustainable and producer goods are put to the best use.
- Many producer goods are private goods – direct provision through an external agency entails favouring one set of potential recipients over another. This can be divisive and counter-productive. In addition, when goods are 'rationed', the rich often manage to gain access at the expense of the poor, for whom the goods were intended.

Development of physical capital must be led by demand from the intended users. Without a perceived need for the service it is unlikely that the required infrastructure maintenance will be carried out, meaning that the service is likely to become unsustainable.

The livelihoods approach therefore focuses on helping to provide access to appropriate infrastructure that enables poor people to achieve their livelihood objectives. Participatory approaches are essential to establish users' priorities and needs.

Physical capital (in particular infrastructure) can be expensive. It requires not only the initial capital investment but an ongoing commitment of financial and human resources to meet the operation and maintenance costs of the service. The emphasis is therefore on providing a level of service that not only meets the immediate requirements of users but is affordable in the long term. It can also be important to provide simultaneous support to skill- and capacity-development to ensure effective management by local communities.

Infrastructure is only an asset in as far as it facilitates improved service provision to enable the poor to meet their needs. For example, a participatory assessment may reveal that a key constraint to the livelihoods of a particular group is the difficulty of carrying produce to market, especially during the rainy season. A livelihoods `response' to this problem will include not only improvements to the physical infrastructure to improve water crossings, or drain a track during the rains, but also would also consider encouraging an affordable transport service using appropriate vehicles, for example ox carts.

'Assistance for basic infrastructure provision is most effective when it is part of a broader plan for improving the effectiveness and coherence of government.'
Basic infrastructure for poor people. London: DFID (March 1998).

DFID sustainable livelihoods objective: Better access to basic and facilitating infrastructure.
Achieved through (for example):

Direct support to asset accumulation

- Service provision (e.g. development of intermediate means of transport)
- Infrastructure provision (e.g. pumped wells and latrines)

Indirect support (through *Transforming Structures and Processes*)

- Reform within managing ministries (possibly through sector programmes)
- Support to sector strategies and regulatory frameworks – including participatory processes with the poor
- Support to the development of private sector alternatives
- Capacity building for community-based construction and management

Feedback from achievement of livelihood outcomes (virtuous circles)

- Increased income is often spent on shelter, water and power supplies
- Better domestic infrastructure is often a core component of well-being

What kind of information is required to analyse physical capital?

The approach to analysing physical capital must be participatory. Users may place a greater importance on some services than others and these priorities must be taken into account. For example, people may prefer to use a surface water supply a long way away rather than to pump a well near at hand.

- Does the infrastructure support a service? There is little benefit in a school building if there are no teachers, or the pupils cannot get to it when classes are being held.
- Is the infrastructure appropriate? Can the physical capital provided meet the needs of the users in the long term. This involves not just the sustainability of the service as it stands but an analysis of the ability of the capital to be adapted and upgraded in response to changing demand.

Access is also a key concern. Sometimes costly infrastructure exists in an area, but this does not mean that the poor have access to it. This might be because the user-fees are too expensive for them, or because richer groups use their strength and influence to control or monopolise access.

FRAMEWORK FINANCIAL CAPITAL 2.3.5

What is financial capital?

Financial capital denotes the financial resources that people use to achieve their livelihood objectives. The definition used here is not economically robust in that it includes flows as well as stocks and it can contribute to consumption as well as production. However, it has been adopted to try to capture an important livelihood building block, namely the availability of cash or equivalent, that enables people to adopt different livelihood strategies.

There are two main sources of financial capital.

- **Available stocks:** Savings are the preferred type of financial capital because they do not have liabilities attached and usually do not entail reliance on others. They can be held in several forms: cash, bank deposits or liquid assets such as livestock and jewellery. Financial resources can also be obtained through credit-providing institutions.
- **Regular inflows of money**: Excluding earned income, the most common types of inflows are pensions, or other transfers from the state, and remittances. In order to make a positive contribution to financial capital these inflows must be reliable (while complete reliability can never be guaranteed there is a difference between a one-off payment and a regular transfer on the basis of which people can plan investments).

Two important characteristics of savings are varying levels of:

- productivity (how much value do they gain when they are left untouched?)
- liquidity (how readily they can be turned into cash?).

Generally speaking, both are desirable characteristics, though liquidity also has a downside: the more liquid one's savings, the more difficult it tends to be to defend them from claims from family members or others.

There may also be trade-offs between liquidity and productivity as well as between productivity and risk.

Why is it important?

Financial capital is probably the most versatile of the five categories of assets.

- It can be converted – with varying degrees of ease, depending upon *Transforming Structures and Processes* – into other types of capital.
- It can be used for direct achievement of livelihood outcomes – for example when food is purchased to reduce food insecurity.
- Rightly or wrongly, it can also be transformed into political influence and can free people up for more active participation in organisations that formulate policy and legislation and govern access to resources.

However, it is also the asset that tends to be the least available to the poor. Indeed, it is because the poor lack financial capital that other types of capital are so important to them.

There are, in addition, assets or desirable outcomes that may not be achievable through the medium of money (such as different components of well-being and knowledge of human rights).

What can be done to build financial capital for the poor?

Development agencies are not in the business of handing out money to poor people (direct support to financial capital). Access to financial capital is instead supported through indirect means. These may be:

- **Organisational** – increasing the productivity of existing savings and financial flows by helping to develop effective, tailored financial services organisations for the poor. So long as they are well-trusted, accessible and widely-known they may encourage people to save. Another option might be to help develop organisations that transit remittance income more efficiently to final recipients.
- **Institutional** – increasing access to financial services, including overcoming barriers associated with poor people's lack of collateral (either by providing some sort of umbrella guarantee or by identifying mechanisms that enable people's existing assets to act as collateral).
- **Legislative/regulatory** – working to reform the environment in which financial services operate or to help governments provide better safety nets for the poor (including pensions).

The issue of **institutional sustainability** is of particularly importance in the area of micro-finance. Unless people believe that financial service organisations will persist over time, and will continue to charge reasonable rates of interest, they will not entrust their savings to them, or be reliable in making their loan repayments.

Although financial capital tends to be quite versatile, it cannot alone solve all the problems of poverty. People may not be able to put their financial resources to good use because:

- they lack knowledge (and cannot purchase this knowledge with small amounts of money); or
- they are constrained by inappropriate *Transforming Structures and Processes* (e.g. under-developed markets, a policy environment that hinders micro-enterprise, etc.).

It is important to take these factors into consideration when planning support. On the positive side, it is also important to be aware of the way in which existing social structures and relations (forms of social capital) can help facilitate group-based lending approaches.

When savings are held in unconventional forms, particular to the needs and culture of owners, different modes of support may be appropriate. For example, pastoralists may be more likely to benefit from improved animal health or marketing systems that reduce the risks associated with their savings (held in the form of livestock) than the establishment of a local bank.

There is ample literature on the subject of building financial services. For a summary of issues in rural areas, please refer to the *Key Sheet* on rural finance. This *Key Sheet* stresses the importance of considering credit as one of a range of financial services to which the poor should have access.

DFID sustainable livelihoods objective: More secure access to financial resources.
Achieved through (for example):

Direct support to asset accumulation	Indirect support (through ***Transforming Structures and Processes***)	Feedback from achievement of livelihood outcomes (virtuous circles)
• NONE	• Support to the development of financial services organisations (savings, credit, insurance) • Extending access to financial services organisations • Reform of financial sector legislation/regulation • Support to develop marketing (e.g. for pastoralists)	• Increased income increases the scope for saving • More sustainable resource management prolongs financial flows from natural capital

What kind of information is required to analyse financial capital?

First it is important to gain a straightforward understanding of:

- Which types of financial service organisations exist (both formal and informal)?
- What services do they provide, under what conditions (interest rates, collateral requirements, etc.)?
- Who – which groups or types of people – has access? What prevents others from gaining access?
- What are the current levels of savings and loans?

Understanding the nature of savings behaviour requires finding answers to questions such as:

- In what form do people currently keep their savings (livestock, jewellery, cash, bank deposits, etc.)?
- What are the risks of these different options? How liquid are they? How subject to changes in value depending upon when they are liquidated?

In the past, the existence and effects of what can be quite sizeable flows of remittance income have often been over-looked. To correct this, it is important to understand:

- How many households (and what type) have family members living away who remit money?
- How is remittance income transmitted?
- How reliable are remittances? Do they vary by season? How much money is involved?
- Who controls remittance income when it arrives? How is it used? Is it reinvested?

FRAMEWORK TRANSFORMING STRUCTURES & PROCESSES 2.4

It is through activity at the level of structures and processes that DFID aims to secure its sixth livelihood objective: **a policy and institutional environment that supports multiple livelihood strategies and promotes equitable access to competitive markets for all.**

Transforming Structures and Processes within the livelihoods framework are the institutions, organisations, policies and legislation that shape livelihoods. Their importance cannot be over-emphasised. They operate at all levels, from the household to the international arena, and in all spheres, from the most private to the most public. They effectively determine:

- **access** (to various types of capital, to livelihood strategies and to decision-making bodies and sources of influence);
- the **terms of exchange** between different types of capital; and
- **returns** (economic and otherwise) to any given livelihood strategy.

In addition, they have a direct impact upon whether people are able to achieve a feeling of inclusion and well-being. Because culture is included in this area they also account for other 'unexplained' differences in the 'way things are done' in different societies.

Examples: Access to shelter and land

In order to understand the basis for the asset distribution at the level of the individual or community, it is necessary to extend the analysis well beyond to the relevant *Transforming Structures and Processes*. Table 2 provides an example of the various types and levels of structure and process that affect access to shelter and land.

Table 2

	ACCESS TO Shelter	ACCESS TO Land
STRUCTURES		
Public sector	• Efficacy of organisations that make and enforce legislation	• Efficacy of organisations that make and enforce legislation
Private commercial	• Existence of building organisations, material suppliers, transport, credit organisations	• Existence of credit organisations and land traders
Civil society	• Existence of self-help, self-build groups	• Existence of local resource management organisations
PROCESSES		
Policy	• National land use policies • Policies on settlement priorities, credit availability, etc.	• National land use policies • Policies on decentralisation of resource management
Legislation	• National/district land legislation • The rule of law in general (security of persons/transactions) • Housing, health and social law	• National/district land legislation • The rule of law in general (security of persons/transactions)
Institutions	• Local conventions on land allocation/inheritance • Informal restrictions on shelter ownership • Existing ownership rights and power relations • The state of housing/land markets	• Local conventions on land allocation/inheritance • Informal restrictions on land ownership • Existing ownership rights and power relations • The state of land markets
Culture	• Within household power relations and conventions on access to shelter	• Within household power relations and conventions on access to land

The value of shelter and land

The value to livelihoods of assets depends upon a further range of structures and processes, for example:

- **Shelter**: the value of shelter is particularly affected by the existence of organisations that supply services, such as water, waste disposal and electricity, and policies/institutions that regulate access to these. The value of the location of any shelter may be affected by cultural beliefs.
- **Land**: the value of land will be affected by policies and laws on agriculture, environment, import/export, marketing, etc. It will also depend upon the existence and effectiveness of agricultural technology organisations, private sector trading/financing organisations and membership organisations that can influence policy and draw down services for those engaged in agriculture. Cultural issues will affect land and labour use and local institutions will govern share-cropping percentages (where relevant).

Analysing transforming structures and processes

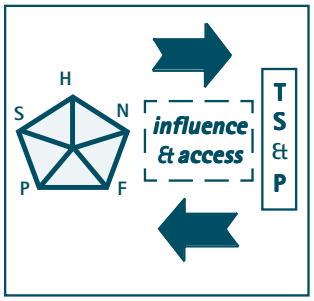
Methods for conducting cost effective, linked policy and institutional analysis at multiple levels are not well developed. However, a useful starting point for analysis may be to investigate the overall relationship between *Transforming Structures and Processes* and communities/individuals. This is the context – or governance structure – that confers legitimacy on different organisations and provides the framework within which they operate.

The following general ideas – drawn from work in progress at IIED – may be useful when thinking about both governance and the individual structures and processes that affect livelihoods.

- **Roles:** Who (which organisations) *actually* does what? (i.e. reality as opposed to theory)
- **Responsibilities:** What responsibilities do different organisations have? Is there adequate responsibility at lower levels and outside formal structures? How are responsibilities established and enforced? Are they reflected in policy/legislation?
- **Rights:** How aware are different groups/organisations of their basic human and political rights? Do given groups have other rights (including rights to collect revenue)? Are these commensurate with responsibilities? How are they enforced/safeguarded?
- **Relations:** What is the current state of relations between different groups? How do policies (and the bodies that make them) relate to legislation (and the bodies that implement this)?

It is always important to think beyond the state of the structures and processes themselves to the effect that these have on the livelihoods of different groups.

Governance has much to do with the two-way 'influence & access' arrows between people's assets and *Transforming Structures and Processes.*



Relationships within the framework

The influence of *Transforming Structures and Processes* extends throughout the framework:

- There is direct feedback to the ***Vulnerability Context***. Processes (policies), established and implemented through structures, affect trends both directly (e.g. fiscal policy/economic trends) and indirectly (e.g. health policy/population trends). They can also help cushion the impact of external shocks (e.g. policy on drought relief and the density of relief providing agencies). Other types of processes are also important. For example, well-functioning markets can help reduce the effects of seasonality by facilitating inter-area trade.
- Institutions can absolutely restrict people's choice of ***Livelihood Strategies*** (e.g. in rigid caste systems). More common are policies and regulations that affect the attractiveness of particular livelihood choices through their impact upon expected returns.
- There may also be a direct impact on ***Livelihood Outcomes***. Responsive political structures that implement pro-poor policies, including extending social services into the areas in which the poor live, can significantly increase people's sense of well-being. They can promote awareness of rights and a sense of self-control. They can also help reduce vulnerability through the provision of social safety nets. Relationships between various policies and the sustainability of resource use are complex and sometimes quite significant.

A priority for future work will be to develop both:

- a better understanding of overall governance structures and their effect on livelihoods; and
- better ways to understand the relationships between the micro and the macro to enable us to pinpoint, with confidence, where constraints to the development of more sustainable livelihoods lie.

FRAMEWORK STRUCTURES 2.4.1

What are structures?

Structures in the framework are the hardware – the organisations, both private and public – that set and implement policy and legislation, deliver services, purchase, trade and perform all manner of other functions that affect livelihoods. They draw their legitimacy from the basic governance framework.

Structures exist at various levels. This is most obvious in the case of governmental organisations. These operate in cascading levels with varying degrees of autonomy and scope of authority, depending upon the extent and nature of decentralisation. Private commercial organisations also operate at different levels from the multi-national to the very local; it is not only the local level that is relevant to livelihoods. Analysis should therefore be sensitive to the roles and responsibilities of the different levels of structures and seek to identify those that are of greatest importance to livelihoods.

Farmers make their cultivation choices based upon a number of factors, including the availability of germplasm. If they are purchasing germplasm, their choice will be limited to the varieties stocked by local traders. These, in turn, will depend upon the R&D choices made by giant, multinational seed companies. Farmers are therefore affected by the actions of both local and very distant private organisations.

Public sector

- Political (legislative) bodies at various levels from local through to national
- Executive agencies (ministries, departments)
- Judicial bodies (courts)
- Parastatals/quasi-governmental agencies

Private sector

- Commercial enterprises and corporations
- Civil society/membership organisations (of varying degrees of formality)
- NGOs (international, national, local)

Why are structures important?

Structures are important because they make processes function. Without legislative bodies there is no legislation. Without courts to enforce it, legislation is meaningless. Without traders, markets would be limited to direct trades between buyers and sellers. An absence of appropriate structures can be a major constraint to development. This is a particular problem in remote rural areas. Many important organisations – both private and public sector – do not reach these areas. As a result services go undelivered, markets do not function and people's overall vulnerability and poverty increases. Moreover, when people do not have access to organisations of the state they often have little knowledge of their rights and only a very limited understanding of the way in which government functions. This disenfranchises them and makes it hard for them to exert pressure for change in the processes (policies, legislation, etc.) that affect their livelihoods.

What can be done to build structures for the poor?

One of the most common problems in development is that *Transforming Structures and Processes* do not work to the benefit of the poor. This can be a deliberate outcome driven by the failure of prevailing – elite controlled – governance arrangements to recognise the legitimate interests of the poor. Or it can be more accidental, the result of an evolutionary process in which the poor have played little part.

External support can help solve these problems through building structures for the poor. However, structures on their own – without accompanying processes – have only 'potential' or 'option' value; the two must be considered together. It is not effective to invest in building impressive organisations if the processes that govern their activity prevent them from providing benefits to the poor. For example, it is not a good use of money to provide capacity-building support to micro-finance organisations if national legislation precludes the provision of financial services except by registered banks. Likewise, it makes little sense to invest in building up networks of para-veterinarians if legislation outlaws practice by non-registered vets. In such instances the primary, or at least simultaneous, focus must be on processes and ensuring that these work to the benefit of the poor.

As long as due consideration is given to processes, the following types of activity at the level of structures can achieve positive outcomes.

- **Building structures that represent the poor**: Membership organisations can help people to draw down services, increase local information flows and innovation, exert influence on higher-level structures and processes and perform numerous other functions. These can all be thought of as dimensions of empowerment. However, capacity-building support is frequently required to ensure that membership organisations remain representative of all their members – including the poorest – and that they develop financial and internal management systems that facilitate effective operation and interaction with other organisations.
- **Promoting reform within structures that make policy and provide services to the poor**: Increasing the responsiveness of various organisations to the poor is an important objective. Sometimes this can be achieved through helping organisations to extend the scope of their activity. There may also be a need for structural change within organisations (e.g. decentralisation, rationalisation of departments, etc.). More often it is a question of facilitating change in the way that organisations operate, their organisational behaviour, reward systems and culture – i.e. processes rather than structures.
- **Providing support to the establishment or expansion of scope of private sector organisations**: Competitive markets are valued for their economic efficiency and 'built in' responsiveness to clients. But they will not function in the absence of traders (individuals and organisations). Where missing markets seem to be a particular constraint, it may be appropriate to provide short-term support (information, start-up finance, training, etc.) to certain types of private sector organisation to stimulate their development.
- **Supporting joint forums for decision-making and action**: There are many dangers associated with the creation of entirely new organisations. However, it can be important to support the establishment and operation of new forums that bring together existing interests and organisations. Such forums may be problem-oriented and temporary (e.g. if they are formed to resolve a particular conflict) or more lasting (e.g. if they oversee common resource management). Problem-oriented organisations may also develop into more permanent bodies if are successful and gain the trust of local people.

In some cases appropriate membership organisations may not exist, in which case they can be externally catalysed, though this can create problems of unsustainability and dependence and is usually best avoided.

What type of information is required to analyse structures?

It is relatively straightforward – though time-consuming – to analyse through observation and survey which structures exist and what they do. What is more difficult to understand is how different structures relate to each other (the processes that govern their interactions) and how, in conjunction with various processes, they impact upon the poor, and *vice versa*.

Depending upon the importance attributed to various structures it may be important to understand their:

- legal/constitutional basis, authority and jurisdiction (including degree of decentralisation);
- membership/ownership structure;
- leadership/management structure;
- objectives and activities;
- financial basis (sustainability); and
- geographic location/extent.

At the same time it is obviously important to understand **how** they operate (processes), the extent to which they are held in popular trust and the nature of their relations with other structures.

This type of information is required in order to establish whether and how existing structures can act as building blocks for the promotion of the interests of the poor.

At various times and in various places, private sector – particularly civil society – organisations have been either ignored or outlawed. As a result, many of the private sector organisations that exist now are quite 'young', under-developed and rather informal. This can make them more difficult to understand. However, it may also mean that they have significant unrealised potential to contribute to livelihoods.

What are processes?

If structures can be thought of as hardware, processes can be thought of as software. They determine the way in which structures – and individuals – operate and interact. And like software, they are both crucial and complex: not only are there many types of processes operating at a variety of different levels, but there is also overlap and conflict between them. The box shows just some of the transforming processes of importance to livelihoods.

Policies	Legislation	Institutions	Culture	Power Relations
• Macro • Sectoral • Redistributive • Regulatory	• International agreements • Domestic	• Markets • Institutions that regulate access to assets • 'Rules of game' within structures	• Societal norms and beliefs	• Age • Gender • Caste • Class

When people engage in market transactions they have certain expectations of how different parties will behave. Markets cannot function in the absence of this reliability (and associated sanctions for those who 'break the rules').

- **Policies** inform the development of new **legislation** and provide a framework for the actions of public sector implementing agencies and their sub-contractors.
- **Institutions** have been variously defined as the 'rules of the game', 'standard operating practices', 'routines, conventions and customs' or 'the way things are done'. They are informal practices that structure relationships and make the behaviour of organisations somewhat predictable. Thus, informal arrangements on land access are institutions, as are markets. 'Rules of the game' operate both within structures and in interactions between structures.
- Institutions are embedded in and develop out of the **culture** of communities or larger societies.
- This culture will often include widely recognised hierarchies of **power relations** that confer a particular status on people and constrain their behaviour and opportunities according to factors that are essentially out of their control (age, gender, etc.).

Why are processes important?

Processes are important to every aspect of livelihoods – these are just some examples.

- They provide the incentives – from markets through cultural constraints to coercion – that stimulate people to make particular choices (about which livelihood strategy to pursue, where to pursue it, how much to invest in different types of livelihood assets, how to manage a resource, etc.).
- They grant – or deny – access to assets.
- They enable people to transform one type of asset into another (through markets).
- They have a strong influence on inter-personal relations – how different groups treat each other.

It may sometimes be in the interests of the poor to substitute 'formal' processes for 'informal' ones, extending the reach of the state into new areas (for example, when a government enacts legislation on equal opportunities or gender discrimination or when customary land tenure arrangements are superseded by formal legislation). Before such changes are made, the impact on livelihoods of existing arrangements should be fully understood – formal is not always better.

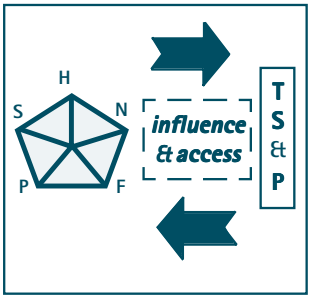
One of the main problems faced by the poor is that the processes that frame their livelihoods systematically restrict them and their opportunities for advancement. This is a characteristic of social exclusion and it is one reason why it is so important that governments adopt pro-poor policies. If higher-level policy is genuinely pro-poor and designed to protect the rights of excluded minorities, this may in time filter down and influence not only legislation but also less formal processes.

What can be done to build processes for the poor?

The fact that processes can 'transform' livelihoods makes them a key focus for donor activity. The aim is to build or reform policies, laws and institutions (culture is not an area for direct donor activity) so that they provide better opportunities for the poor.

This may entail, amongst other things:

- providing information to support a more pro-poor policy-making process;
- deepening and strengthening the contact between the poor and policy makers (reinforcing the arrow that runs from the asset pentagon towards *Transforming Structures and Processes*);
- supporting participatory processes of policy formulation;
- increasing the accountability and transparency of public decision-making (a key objective of decentralisation, also achieved by separating delivery from the regulation and financing of services);
- assisting with the planning, drafting and implementation of legislation of importance to the poor (e.g. land tenure legislation);
- promoting the adoption of redistributive policies and the establishment of social safety nets that directly benefit the poor;
- promoting the expansion of fair and competitive markets;
- providing support to help local organisations adopt pro-poor ways of operating; and
- improving the institutional context of private decision-making (reducing risk, streamlining regulation, ensuring fairness, etc.).



One comprehensive means of addressing problems in this area is through **sector programmes**. The potential of these to benefit the poor has not yet been fully realised. While their intentions may be very good, they can become too concerned with the structures that execute processes and fail to ensure that the processes themselves adequately represent the interests of the poor.

Amongst other things, sector programmes are concerned with defining the appropriate role of the state and helping it to execute this role better. This improves the efficiency of public sector management. It also helps to **promote markets** both directly (the state has a role in facilitating markets) and indirectly (as the state retreats from areas of the market in which there is no justification for it to remain).

Markets can provide enormous opportunities for poor people (think, for example, of the production boom when Chinese agriculture was liberalised), but they can also discriminate against the interests of poor people. Local culture frequently prevents women from accessing markets and markets often fail to reach the poorest rural areas, thereby further marginalising them. Donors may be able to help address this problem by both supporting the extension of structures into remote areas and reducing the costs associated with market development (standardising weights and measures, helping to make financial regulations more conducive to trading, etc.).

What type of information is required to analyse processes?

In order to understand the impact of existing processes on livelihoods, it is necessary to be able to trace through the effects of given processes on particular groups. The understanding gained through this analysis will then assist with the development of more effective processes, if this is a priority.

Analysis of processes should be selective, casting a wide net at the outset and then - with the help of participatory exercises with various groups of local people - homing in on key areas for more in-depth work.

Analysis of policies and legislation is complicated by the need to know:

- what is written in statute books;
- what the intended effects of policies and associated laws are; and
- what happens in practice.

Some policies and legislation – including some of governments' more impressive pronouncements - are never acted upon or are not enforced. In other cases they may have perverse outcomes (e.g. legislation preventing tree-felling may reduce the amount of trees planted, changes in factor prices under adjustment policies may not have the expected impact on production). Unless this is known, it will not be easy to think about the effects of processes on livelihoods and whether change is a priority.

Further work is required to develop more effective methodologies for analysing policies, their effects on livelihoods and how they themselves are influenced by what happens at local level.

FRAMEWORK LIVELIHOOD STRATEGIES 2.5

The livelihoods approach seeks to promote choice, opportunity and diversity. This is nowhere more apparent than in its treatment of livelihood strategies – the overarching term used to denote the range and combination of activities and choices that people make/undertake in order to achieve their livelihood goals (including productive activities, investment strategies, reproductive choices, etc.).

Some versions of livelihoods analysis use the term 'adaptive strategies' instead of 'livelihood strategies'. Adaptive strategies are distinguished from 'coping strategies' adopted in times of crisis.

Diversity, straddling and linkages

Recent studies have drawn attention to the enormous diversity of livelihood strategies at every level – within geographic areas, across sectors, within households and over time. This is not a question of people moving from one form of employment or 'own-account' activity (farming, fishing) to another. Rather, it is a dynamic process in which they combine activities to meet their various needs at different times. A common manifestation of this at the household level is 'straddling' whereby different members of the household live and work in different places, temporarily (e.g. seasonal migration) or permanently.

Social patterns such as this clearly complicate analysis and underline the importance of viewing households and communities within their wider context. Since goods, financial resources and people are all mobile, an accurate picture of livelihoods cannot be gained if artificial boundaries are drawn. Thus links between urban and rural centres will need to be explored, as will the implications for decision-making and asset usage of split families .

What can be done to assist poor people with their livelihood strategies?

In the past rural people were essentially viewed as farmers, foresters or fisherfolk and urban people were generally considered to be wage labourers seeking employment or participants in the `informal sector'. Development efforts sought to improve the services and opportunities available to these categories of people. The sustainable livelihoods approach, by contrast, seeks to develop an understanding of the factors that lie behind people's choice of livelihood strategy and then to reinforce the positive aspects (factors which promote choice and flexibility) and mitigate the constraints or negative influences. It does not try to promote any given livelihood strategy simply because the `raw materials' (e.g. forests, land, employment opportunities) for this exist.

The more choice and flexibility that people have in their livelihood strategies, the greater their ability to withstand – or adapt to – the shocks and stresses of the *Vulnerability Context*.

This expansion of choice and value is important because it provides people with opportunities for self-determination and the flexibility to adapt over time. It is most likely to be achieved by working to improve poor people's access to assets – the building blocks for livelihood strategies – and to make the structures and processes that 'transform' these into livelihood outcomes more responsive to their needs.

Access to assets

People's access to different levels and combinations of assets is probably the major influence on their choice of livelihood strategies. Some activities require, for example:

- particular skills or may be very labour intensive (high levels of human capital required);
- start-up (financial) capital or good physical infrastructure for the transport of goods (physical capital);
- a certain type/level of natural capital as the basis for production; or
- access to a given group of people achievable only though existing social connections (social capital).

Different livelihood activities have different requirements, but the general principle is that those who are amply endowed with assets are more likely to be able to make positive livelihood choices. That is, they will be choosing from a range of options in order to maximise their achievement of positive livelihood outcomes, rather than being forced into any given strategy because it is their only option.

Structures and Processes

Transforming Structures and Processes can reinforce positive choices. If they function well, they will facilitate mobility in labour markets and reduce risk and the transaction costs associated with embarking

This sheet draws on the work of Frank Ellis at UEA.

upon new ventures. They can also increase the efficiency of investment. However, in other cases they can act as a major constraint to choice, restricting access (e.g. in the case of rigid caste systems or state-dominated marketing systems), reducing the mobility of goods and labour and manipulating returns to given activities to make them more or less attractive (e.g. heavy-handed pricing policies). Under such circumstances, people might be viewed as making 'negative choices' as to their livelihood strategies, or they may have no choice at all. Effort in this area should therefore focus on turning the negative into positive – widening choice, reducing costs and extending access.

Strategies are intimately connected with people's objectives – the beneficial *Livelihood Outcomes* that they seek.

What type of information is required to analyse livelihood strategies?

It is very important that preconceptions about what the poor do – what their livelihood strategies are – should be put aside. It has been common in the past to make untested assumptions about the poor, and as a consequence, to misdirect support (e.g. supporting agriculture on the assumption that most of the poor are farmers, when the poorest of the poor may be wage labourers outside agriculture).

The following types of issues are important when thinking about livelihood strategies.

- What does the livelihood 'portfolio' of different social groups look like (percentage of income from different sources, amount of time and resources devoted to each activity by different household members, etc.)?
- How and why is this changing over time? (Changes may be, for example: long-term, in response to external environmental change; medium-term as part of the domestic cycle; or short-term in response to new opportunities or threats.)
- How long-term is people's outlook? Are they investing in assets for the future (saving)? If so, which types of assets are a priority?
- How 'positive' are the choices that people are making? (e.g. would people migrate seasonally if there were income earning opportunities available closer to home or if they were not saddled with unpayable debt? are they 'bonded' in any way? are women able to make their own choices or are they constrained by family pressure/local custom?)
- Which combinations of activities appear to be 'working' best? Is there any discernible pattern of activities adopted by those who have managed to escape from poverty?
- Which livelihood objectives are not achievable through current livelihood strategies?

As always, it is important to take a socially differentiated view of livelihood strategies in order to focus support in the most appropriate area. This means thinking about variations in livelihoods strategies between different social groups, why these exist and what effect they have.

IDS has developed a useful checklist of questions about livelihood strategies.

- **Sequencing** – what is the starting point for successfully establishing a particular livelihood strategy? Is one type of resource essential?
- **Clustering** – is there a clustering of particular livelihood assets associated with particular livelihood strategies?
- **Trade-offs** – in pursuing a particular portfolio of livelihood strategies, what are the trade-offs faced by different people with access to different assets?

Adapted from: Scoones, I. (1998) *Sustainable rural livelihoods: A framework for analysis*. IDS Working Paper 72. Brighton: IDS.

Caveat: Competing livelihood strategies

One of the many problems of development is that projects while favouring some, can disadvantage others. When considering livelihood strategies it is important to recognise that people compete (for jobs, for markets, to secure better prices, etc.). This makes it difficult for everyone to achieve simultaneous improvements in their livelihoods.

The sustainable livelihoods approach values social sustainability, inclusion and equity and prioritises the interests of the poor. But the poor are themselves a heterogeneous, and internally competitive, grouping.

There is no 'solution' to this problem. However, its existence does underscore the importance of:

- extending choice and opportunities for the poor and building up their ability to take advantage of these opportunities (through building capital assets) while leaving them to make the final choice of what they will do; and
- thinking about safety nets for those who remain unable to achieve their livelihood objectives in what will always be a competitive environment.

FRAMEWORK LIVELIHOOD OUTCOMES 2.6

Livelihood Outcomes are the achievements or outputs of *Livelihood Strategies*. Once again, the important idea associated with this component of the framework is that we, as outsiders, investigate, observe and listen, rather than jumping to quick conclusions or making hasty judgements about the exact nature of the outcomes that people pursue. In particular, we should not assume that people are entirely dedicated to maximising their income. Rather, we should recognise and seek to understand the richness of potential livelihood goals. This, in turn, will help us to understand people's priorities, why they do what they do, and where the major constraints lie.

Why are livelihood outcomes important?

Livelihood outcomes are important because they help us to understand:

- the 'output' of the current configuration of factors within the livelihoods framework (a first step to understanding the nature of causality);
- what motivates people to behave as they do;
- what their priorities are (as a basis for planning support activities);
- how they are likely to respond to new opportunities; and
- which performance indicators should be used to assess support activity.

Terminology: Outcomes not objectives

In the framework the term 'outcomes' is used in preference to 'objectives' for two main reasons.

- **Sustainability**: The framework provides a way of thinking about livelihoods and tries to promote responsiveness. However, it also has a normative dimension: DFID's objective is to promote *sustainable* livelihoods (sheet 1.4 investigates the various dimensions of sustainability). The difficulty is that this broad sustainability objective is unlikely to be shared by all those involved. Hence the *Livelihood Outcomes* component of the framework is something of a hybrid, combining the aims of both DFID and its clients. Using the term 'objectives' would raise the question of 'whose objectives?' while the term 'outcome' is more neutral and encourages us to focus on what actually happens.
- **Achievement-orientation**: The framework is not just an analytical tool. It is intended to provide the basis for action. Thinking about 'objectives' can be descriptively interesting. Thinking about outcomes focuses attention on achievements, the development of indicators and progress in poverty elimination.

What are livelihood outcomes?

The livelihood outcomes that appear in the generic framework are effectively categories introduced to make this section of the framework manageable. Each one may or may not be relevant in any given situation – this can only be established through participatory enquiry.

- **More income**: Although income measures of poverty have been much criticised, people certainly continue to seek a simple increase in net returns to the activities they undertake and overall increases in the amount of money coming into the household (or their own pocket). Increased income also relates to the idea of the economic sustainability of livelihoods.
- **Increased well-being**: In addition to income and things that money can buy, people value non-material goods. Their sense of well-being is affected by numerous factors, possibly including: their self-esteem, sense of control and inclusion, physical security of household members, their health status, access to services, political enfranchisement, maintenance of their cultural heritage, etc.
- **Reduced vulnerability**: Poor people are often forced to live very precariously, with no cushion against the adverse effects of the *Vulnerability Context*; their livelihoods are to all intents and purposes unsustainable. For such people, reducing their vulnerability to the downside and increasing the overall social sustainability of their livelihoods may well take precedence over seeking to maximise the upside.
- **Improved food security**: Food insecurity is a core dimension of vulnerability. It appears as a separate category in the framework in order to emphasise its fundamental importance, and because this helps to locate the activities of those governments and donors that focus on food security. It is also worth noting that participatory poverty assessments have shown hunger and dietary inadequacy to be a distinct dimension of deprivation.
- **More sustainable use of the natural resource base**: Environmental sustainability, or sustainability of the natural resource base, is not the only dimension of sustainability that is important to DFID. However, it is a major concern that is not adequately captured in the other livelihood outcome categories. Although often viewed as a donor objective, it is of course shared by many who recognise the long-term benefits of prudent resource use.

The right to 'a standard of living adequate for health and well-being, including food and housing' is enshrined in international agreements. It is not, however, achieved for many of the poor whose primary day-to-day objective continues to be to secure enough food to eat.

Trade-offs between livelihood outcomes

One of the main difficulties with this part of the framework is that livelihood outcomes are not necessarily coherent and are certainly incommensurable. It is hard to weigh up the relative value of increased well-being as opposed to increased income, but this is the type of decision that people must make every day when deciding which strategies to adopt.

There may also be conflict between livelihood outcomes. An obvious example is when increased income for particular groups is achieved through practices that are detrimental to the natural resource base. Or perhaps different family members prioritise different livelihood objectives – some seeking to reduce vulnerability, while others seek to maximise income streams. The framework does not offer any answers to these dilemmas but does provide a structure for thinking them through, considering how they affect other aspects of livelihoods (e.g. strategies adopted) and perhaps coming to a mutually acceptable 'solution'.

There is a close relationship – note the feedback arrow in the framework – between *Livelihood Outcomes* and *Livelihood Assets*, the two being linked through *Livelihood Strategies*. For example, a person may choose to reinvest most or all of any increased income in assets, with a view to catalysing a virtuous circle of asset accumulation and increased income.

Outcomes as a basis for indicator development

The sustainable livelihoods approach is about supporting people to achieve their own livelihood goals (with the proviso about sustainability). Livelihoods programmes should therefore be judged on whether they contribute to the achievement of the livelihood outcomes that people consider important. One way of ensuring this is to negotiate indicators with particular groups and to draw these groups into monitoring processes. Care should also be taken to observe unplanned changes associated with development activity (for example, changes in social relations, accumulation or loss of assets by particular groups, etc.).

There are, though, several difficulties in this area, including that:

- different outcomes may conflict (as above);
- some outcomes (such as increased well-being) may be extremely difficult to translate into monitorable indicators; and
- it is hard to ensure objective monitoring of impact by groups with different interests, especially when they themselves do not prioritise a given outcome (e.g. environmental sustainability).

As always with development activity, it is hard to achieve an adequate understanding of the nature of causality, though the comprehensive approach of the livelihoods framework may provide some assistance here.

Following sections of the *Guidance Sheets* will address issues of indicator development and monitoring in more detail. This is certainly an area that requires further work.

What information is required to analyse livelihood outcomes?

When thinking about *Livelihood Outcomes*, it is important to understand not only the aims of particular groups but also the extent to which these are already being achieved. If certain social groups are systematically failing to achieve their aims, it may be because their aims conflict with the aims of other, more powerful groups. Or it may be because they do not have the means (assets) to achieve them. This distinction will help inform activity in support of the weaker groups.

Assessing non-tangible outcomes, that may be very subjective and private, is a challenge. When thinking about well-being, for example, the following types of issues might be important:

- To what extent are people aware of their rights (political, human, social, and economic)?
- Do they have any access to means of ensuring that their rights are met?
- How 'secure' (against physical damage, violence, seizure by the state, natural and economic shocks, etc.) are people and their assets?
- What sources of information are open to people? How high is the quality of that information?
- To what extent are particular groups represented within the political process?
- How good is the access of different groups to core services (e.g. education, sanitation, health)?

For all issues it will be important to investigate what the current situation is, how it is changing over time, and whether securing change is a priority for local people.

Participatory poverty assessments provide some important lessons about the wide range of people's objectives and how best to gather reliable information on these.

Appendix 4: Business Model Canvas

The Business Model Canvas	Designed for:	Designed by:	Date:	Version: V1.0
Key Partners Who are our key partners? Who are our key suppliers? Which Key Resources are we acquiring from partners? Which key activities do partners perform?	**Key Activities** What key activities do our Value Proposition require? Our Distribution Channels? Customer Relationships? Revenue streams? **Categories** Production Problem solving Platform/Network	**Value proposition** What value do we deliver to the customer? Which one of our customers problems are we solving? Which bundles of products and services are we offering to each customer segment? Which customer needs are we satisfying?	**Customer relationships** What type of relationship does each of our customer segments expect us to establish and maintain with them? Which relationships have we established? How are they integrated with the rest of our business model? How costly are they? Examples Personal assistance/self service Communities Co-creation	**Customer Segments** For whom are we creating value? Who are our most important customers?
Motivation for partnerships Optimization & economy Reduction of risk and uncertainty Acquisition of resources and activities	**Key Resources** What Key Resources do our value proposition require? Our Distribution channels? Customer Relationships? Revenue streams? **Types of resources** Physical, Intellectual, Human, Financial	**Characteristics** Newness Performance Customization Getting the job done Design Brand/status Price Cost reduction Risk reduction Accessibility Convenience/Usability	**Channels** Through which channels do our customer segment want to be reached? How are we reaching them now? How are our channels integrated? Which ones work best? Which ones are most cost-effective? How are we integrating them with customer routines? **Awareness, Evaluation, Purchase, Delivery, Aftersales**	Mass Market Niche Market Segmented Diversified Multi-sided Platform
Cost Structure What are the most important costs inherent in our business model? Which key resources are most expensive? Which key activities are most expensive? **Is your business more** Cost driven (salaries, rent, utilities) Value driven (value creation, premium value proposition) **Sample Characteristics** Fixed costs Variable costs Economies of scale Economies of scope			**Revenue Streams** For what value are our customers willing to pay? For what do they currently pay? How are they currently paying? How would they prefer to pay? How much does each revenue stream contribute to overall revenues?	

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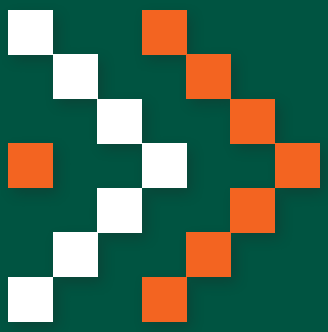
TECHNOLOGY STATION

Design & layout: UJ Graphic Design Studio



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