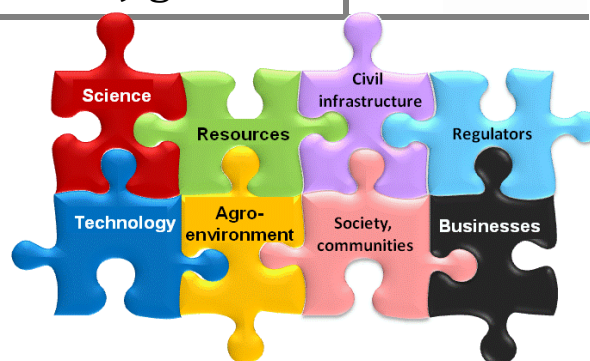


Biofuels Putting together the Green Jigsaw



Project Title:	Capacity Building in South Africa, Namibia and Ghana to Create Sustainable, Bio-oil Supply Chains
Lead	University of Greenwich
Partners	Turner & Townsend (Pty) Ltd, South Africa University of Namibia, Namibia University of Ghana, Ghana Jatropha Africa Ltd, Ghana Goldex 35 (Pty) Ltd, South Africa Consorzio di Ricerca per lo Sviluppo di Sistemi Innovativi Agroambientali (CoRiSSIA), Italy Marine Biological Association, United Kingdom

Background

The history of biofuel technology adoption reveals a repeating pattern of government subsidies and government mandates since the 1860s to promote biofuel use. The aim in general has been to create jobs in the agricultural sector and to decrease reliance on fossil fuels, and government interventions have taken place depending on the price and availability of fossil fuels. In recent times the IPCC Climate Change report (2007) has impressed the need for CO₂ mitigation measures, and biofuel technologies have now been argued as able to play a role in reducing CO₂ emissions.

Climate change mitigation by reducing CO₂ emissions in the atmosphere has a global context, and is evidenced by the 191 states that have signed and ratified the Kyoto Protocol. In turn, biofuel adoption strategies – subsidies and mandates - now come under a similar global spotlight. However there is a commensurate widespread debate as to where society's agricultural outputs should be best directed i.e. food, feed or fuel? This debate is highly relevant in the context of global population growth.

Moreover, the availability and discovery of new seams of fossil fuel continues to place fossil fuel as a cheaper alternative to non-fossil fuel and this suggests that the use of fossil fuels might continue unabated, as in the past, unless Society as a whole acts to pay for the environmental benefits of implementing non-fossil technologies. This adds further impetus to understanding what the costs are to Society, and how the implementation of non-fossil bioenergy technologies might affect local communities.

Tools to assess the value to society of a given bioenergy technology are not well developed. For example, life-cycle analysis (LCA) was introduced only in the late 1980s as a technique for compiling an inventory of material inputs and environmental releases associated with the production, use and disposal of a given product or service. Applied to biofuels, serious differences have started to emerge between different assessments, largely due to the definition of the system boundary; indirect emissions and Indirect Land Use Change; the definition of the fossil fuel baseline, and different methodologies. Unfortunately the different results have been used to support or damn adoption of a bioenergy technology.

The environmental impact of a given biofuel must be considered in the technological and geographical context in which the system performs and this in turn, implies that assessments need to be conducted case by case, in a given local, not global context.

Evolutionary Innovation Systems Analysis (EISA), offers a way of assessing the merits of a given biofuel technology to local communities. EISA involves assessment over a given time frame to deduce the nature and role of two so-called 'change motors':

- Human controversy i.e. how have stakeholders attempted to safeguard their interests in processes of debate, coalition formation, power play and conflict?
- Evolution selection amongst a range of options because they simply 'work better'. EISA complements the idea of Innovation Platforms which seek to integrate stakeholder partnerships and activities to generate, compile and transfer knowledge in order to support the successful adoption of, in this case, biofuel technologies, for impact.

Aim.

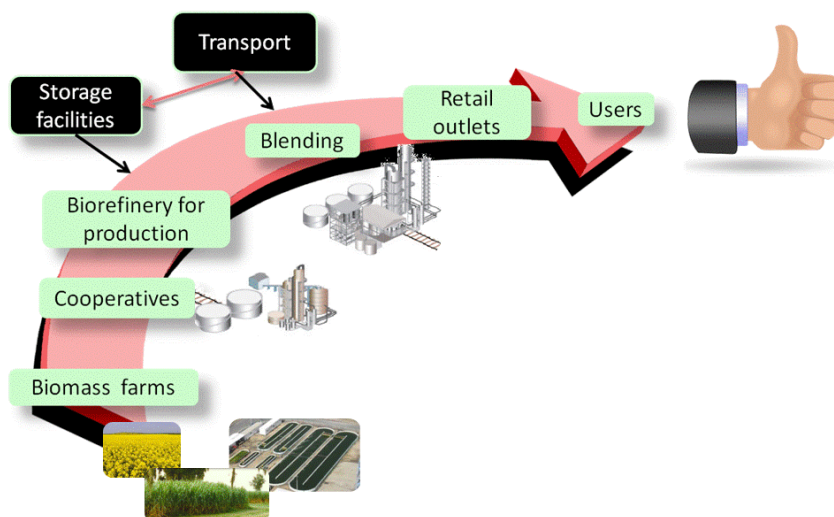
The aim of the investigation is to interrogate case studies that have been aimed at either supporting or adopting biofuel technologies or the biofuel supply chain in order to assess:

- Impact on jobs, women in society, wealth creation
- Impact on agricultural practice
- Contribution of stakeholders (government, local authorities, regulators, other) in the biofuel supply chain.

The context of the investigation is: biofuel supply chains (see Fig 1) in both Africa (Ghana, Namibia and South Africa) and Europe (Italy and the UK).

Fig 1

Biofuel Supply Chain



Interrogation methods

- Case studies should be interrogated deeply using a variety of tools:
 - Publicly available literature i.e. Internet, company literature, public databases
 - Contact with stakeholders by for example, email, telephone, one-to-one interviews, interrogation of stakeholder groups at a workshop.

Questions

- Questions for which answers are sought are shown in appendix 2 and should be adapted to suit a given stakeholder.
- Wherever possible, interviews with stakeholders should be recorded by video or tape-recorder, with their permission.

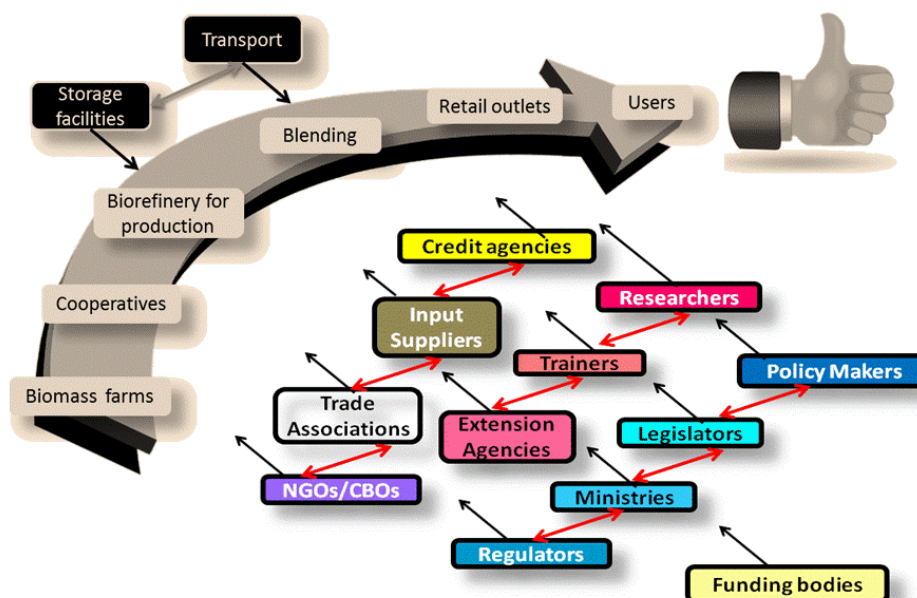
Stakeholders

In order to understand the identity of stakeholders, case studies should aim to contextualise the whole biofuel supply chain *first*, as broken down in Fig. 1 i.e.

- Biomass farms** – stakeholders involved in the cultivation of the biomass/feedstock in the agricultural sector, or collection of biowaste
- Biomass transportation**– stakeholders involved in transporting biomass from biomass farms to biofuel refineries

- 3) **Co-operatives** - stakeholders involved in managing the storage of biomass before processing, if this step occurs
- 4) **Biorefineries** – stakeholders involved in the production of the energy carrier/biofuel in a conversion plant
- 5) **Blending operations** (where this occurs): - stakeholders involved in blending with fossil fuel
- 6) **Product distribution** - stakeholders involved in transportation to deliver the final biofuel product from biofuel refinery to consumer.
- 7) **Stakeholders involved in the strategic and operational planning** of the whole supply chain to achieve maximum efficiency.
- 8) **Other stakeholders that have contributed to development of components of the biofuel supply chain** (see fig. 2). These might include
 - Agencies supporting the implementation of biofuel policies in the region including policy makers, legislators, ministries, regulators
 - Financiers including venture capitalists, grant agencies etc
 - Trainers
 - Trade associations etc

Fig. 2



Useful references:

- The Jatropha biofuels sector in Tanzania 2005–2009: Evolution towards sustainability? (2011) Henny A. Romijna, Marjolein C.J. Caniëls *Research Policy* 40 618–636
- Biofuels and sustainability in Africa Bamikole Amigun, Josephine Kaviti Musango, William Stafford (2011) *Renewable and Sustainable Energy Reviews* 15 1360–1372
- A Zamboni, R J. Murphy, J Woods, F Bezzo, N Shah (2011) Biofuels carbon footprints: Whole-systems optimisation for GHG emissions reduction *Bioresource Technology*, 102(16) 7457-7465.