

Environmental investments as a tool for community development

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Abstract

There is a definite need for development support to poor regions. Still, gift aid is questionable and there are strong reasons to transform the aid for developing regions into self-help. This paper applies a sustainability oriented investment perspective as a framing for description and assessment of a biogas project aiming at carbon emission reductions and improvement of the local living conditions in a poor peri-urban area in Lusaka, Zambia. The biogas investment is aiming to promote enhancement of the bio waste management and the societal awareness. To facilitate a positive continuation of the development process it is a key issue that those improvements are done in such a way that the societal and waste management stakeholders become interested in further projects and investments.

Key words: Biogas, poor urban areas, green business development, human migration, tragedy of the commons, global warming, UNICEF, CDM, carbon trade, waste management

Introduction

There is a need for development support to poor regions. In emergency situations gift aid is important, but from development point of view the effect is rather limited and the long term effect may even be negative. For example, the local agriculture may deteriorate if people get food for free. Consequently, international development actors are trying to transform the aid for developing regions into self-help, i.e. investments in enhancement of the local community's ability to support itself in a sustainable way.

This paper applies a sustainability oriented investment perspective as a framing for description and assessment of a biogas project that is at the same time aiming at improving the local and global environment and for sensitisation and development of the society in one of the poor compounds in Lusaka, Zambia.

The sustainability situation in Lusaka

Densely populated areas in the third world, like Lusaka in Zambia, has experienced immense urban migration that is manifest in the unplanned settlements known as peri-urban areas or compounds. Lusaka has 33 peri-urban areas, some with a population exceeding 200,000. Together they constitute 70% of the population of the city (CSO, 2000). One of the most challenging issues currently being faced is the availability of basic social services like access to safe drinking water, sanitation facilities and solid waste collection. There is an acute shortage of clean water and reliable energy supply and a long-term risk for escalating environmental degradation, caused by litter, pollution and contamination as well as human health problems. This situation means that there is a risk to get caught in a negative spiral of scarcity, degrading conditions, deteriorating health, dejection and resignation.

The compounds are faced with poor sanitation and some are prone to Cholera out-breaks every rain-season when the water table rises resulting in cross contamination of drinking water by pit latrines and rubbish pits. The escalating accumulation of waste in roadways makes the already bad accessibility even worse. In interviews with the residents they express that the solid waste situation is a problem. The residents also say that there is roads that are not passable any more due to the accumulation of solid waste heaps. This is due to the fact that that there is no space in the yards any more to dig rubbish pits. The result is that the inhabitants just dump their waste anywhere, especially along the road or in the drains. Of the waste generated in the compounds less than 30% is collected and transported to the designated disposal site.¹ The rest is buried in rubbish pits, incinerated in open-air fires or indiscriminately disposed off wherever there is some available space. This situation is severe for the local people and the decomposition of the waste also adds to the global environmental problem, since the greenhouse gas methane is produced spontaneously in the rubbish pits and heaps.

The major energy source for households and small restaurants is charcoal. The charcoal is mainly used for cooking; candles and kerosene lamps are used for lighting or when electricity is available it is used for light. The use of charcoal is a major driver for the escalating deforestation in Zambia. It is a tragedy of the commons (Hardin, 1968)² problem that the production of wood, as a useful material and a source of energy is lost. The forest are also important as such as provision of habitats for diverse species, air quality improvement, water quality and quantity management and provision of places for human habitats and tourism. Consequently the deforestation feeds back into even more migration to the compounds and it also adds to the to the global climate change problems.

The actors

The TEM foundation at Lund University has an active role in the presented development as an action research driver for the process and also as observer. Lusaka City Council (LCC) is responsible for the management and development of the city UNICEF is a UN body that works for the welfare and development of the living conditions for children. The Environmental Council of Zambia (ECZ) is the national authority for environmental protection. The Swedish International Development Cooperation Agency (Sida) is the Swedish government's international agency whose "goal is to contribute to making it possible for poor people to improve their living conditions".³

During 2008-2009 TEM made a pre-study in Lusaka in collaboration originally with LCC and in time also with UNICEF, ECZ and Sida concerning waste management, energy utilisation, City status and development progress. The interviews and dialogue was aiming for a multidimensional systems understanding of the present situation and possible dynamics. The main actors in the process are LCC and UNICEF in Zambia and to a smaller extent ECZ and Sida. This pre-study led to cooperation between LCC and UNICEF with the aim to build a biogas plant in Lusaka. The result of the cooperation is so far a memorandum of understanding and an application that was made to be able to enable full funding for the investment.

The biogas technology

Biogas is produced naturally from anaerobic digestion of organic matter in the absence of oxygen by a complex interaction of several microorganisms. The process can be utilised for

the production of methane rich biogas, under controlled conditions in a biogas plant. Methane is an energy rich gas that is readily useful for electricity production, cooking, lighting and local heating. Biogas from waste is considered to be one of the most resource efficient biofuels and in some circumstances the production of biogas from waste can even lower the emissions of greenhouse gases below zero.⁴

The use of biogas technology is new in Zambia and the experiences are limited to family-size digesters. There are no Zambian plants of this size (30 m³) that are using source separated food waste as substrate. The knowledge about the technical details and suppliers of the biogas technology was provided by TEM. The setup is a robust low-tech technology that is proven in numerous installations, mainly in India, i.e. a suitable setup in developing countries. A detailed description of the technology can be found in Heeb (2009).⁵

The biogas project planning

The planning of the biogas investment project was made in collaboration between LCC, UNICEF and TEM. The planning of the technical installation included usual parts like civil works, environmental impact assessment and procurement of material.

It was considered very important that the investment should not be a one time “gift” of a plant design and equipment. Therefore a large portion of the investment budget is allocated for training of personnel, and establishment of a resource centre. This centre and the trained personnel will facilitate the operation of the first plant and the building of further plants, allowing the technology to spread to more regions and companies.

After the establishment of the biogas plant the facility will be operated by a community based enterprise, similar to the ones that is operating the local water and sewerage and the local waste collection. The earning from sales of biogas is assessed to be sufficient to maintain and to expand the biogas business area. The involvement of the local community is regarded as an important issue and crucial to the long-term success of the operation of the plant, since the inhabitants will become future customers. Therefore a part of the budget is aimed at sensitisation of the local community. This will give the community knowledge of what biogas is, how it is produced and used as well as a fair view of the risks with biogas. There is also a need for awareness building in the local community, both for mobilisation, registration and training of the small-scale community enterprises.

Aim

The aim is to clarify why and how the involved parties decided to use investments in a biogas plant as a means to improve the local social, economical and environmental situation. The goal is to assess how the ongoing development process can instigate a continual sustainability oriented development process.

Sustainability oriented investment theory

The basic principle for investments is to enable a product development and more effective future production, through employment of present resources and work in improvement of the production capability. In economics, the connection to the future is accounted as investments and depreciation of the financial capital. However it should be noted that, the financial accounting does not include the full picture. There are also a wide set of effects that are not detected by and included in the financial accounting, i.e. externalities. The environmental

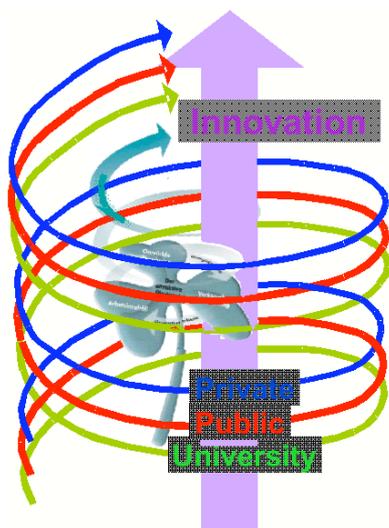
accounting mostly deals with consequences that are likely to lead to negative effects on ecological systems. A company's deeds also risks to diminish the common resource base and to cause negative effects to the stakeholders that it is interacting with, i.e. social externalities.

Economic investments are aiming for improvements of, and also for, its own system. The primary aim is to improve the company's future earnings and to reduce the costs. Companies are aiming for a safe return on their investments and a short pay-back period. However this is difficult. Various factors may change and the production may become obsolete. Negative externalities tend to have a negative impact on the company's image. There is no certain connection between the amount of money that is invested and the resulting earnings and the future capital value.

A company's performance can result in positive externalities, for example knowledge and other societal improvements that are not accounted, and not owed or controlled by the company. There is a rich set of methods for economic assessment of investments. Analogous ways of thinking can also be applied in the social and environmental dimensions:

- Money is invested to reduce future costs and to improve the production.
- Environmental load is often unavoidable in investments that are made to reduce the future environmental load.
- Reflection of social considerations can improve future social situations.

Environmental load can be invested in such upgrading of material that it can be used in a more eco-effective way. In an analogous ways, investment thinking is relevant for all kinds of sustainability issues (WCED, 1987)⁶, in all their dimensions and also for many interactions between the different dimensions. Modern innovation theory also highlights that there are a number of interacting development (Trott, 2005)⁷



One multidimensional investment promoting perspective is the Triple-Helix business development process. *The term Triple Helix is used to describe the interaction between actors in the fields of business, science and politics, which produces effective innovation systems.* (Vinnova, 2002)⁸

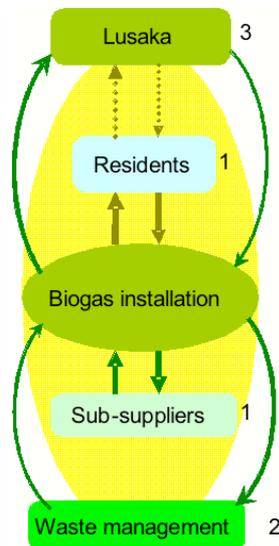
The Triple-Helix concept aims to compile a varied support capability through involvement of actors from the private, public and research sectors, see Figure 1. The innovation support is enhanced through parallel advancements in the three development spirals. The Triple-Helix aim is to enhance the business development process and the total result through constructive collaboration among the three spheres. As a tripod, the triple helix idea is somewhat analogous to the sustainable development inclusion of economic, social and environmental sectors.

Figure 1 Triple helix growth process.

The sustainable development and triple helix concepts focuses on which kinds of actor groups it is that ought to be involved in the societal development process. From an investment perspective it is desirable to clarify what it is that should be improved. The sustainable development and Triple-Helix concepts are rather abstract and here we want to be more specific. The assessment in this paper relates to a framing with the three dimensions:

- Production, physical products and systems
- Organisation and networking for development oriented collaboration
- Leadership training as a method to develop the human resource

These three dimensions can be conceptualised as a part of the total societal development – like the clover plant is a part of the process in figure 1. The selection to focus the assessment



Coherent growth process

1. The biogas installation and related activities should improve the daily life for the residents and promote enhancement of the sub-suppliers capabilities.
2. Green business operations should promote a sustainable development of the society's management of potentially useful resources, in particular the ones that also are hazardous..
3. Sustainable businesses should promote a positive development of the societies where they operate; i.e. sensitization, motivation, learning, and advancement of business culture and infrastructure.

on improvement of production, organisation and leadership capability has a starting point in a study by Karlsson et al. (2009)⁹, which show that the green business development perspective, see figure 2, is relevant in case studies for these three kinds of investments. The key issue is that we are aiming for a framing to clarify that and how the actions, investments and perceptions of the different groups of actors and stake-holders influence each other and the development of the total system. The best is if the biogas investments can promote improvement in all the levels in figure 2.

Figure 2 Green business development

Casual loop diagrams

The Lusaka project is aiming to instigate a process of continual learning, as a form of learning organisation (Senge 1990)¹⁰. There is a need for systemic and transformative collaboration, not only delimited actions and incremental changes in practices and policy. This is in accordance with the sustainable development and systems thinking idea to *think global and act local* (Senge and Sterman, 1992)¹¹.

The main tool for illustration of the feedback effects and is casual loop diagrams. The quantitative interrelation between various flows and stock level changes can be analysed with system dynamics modelling Sterman (2000)¹². This paper uses casual loop diagrams as a tool for description of the self-reinforcing (positive), self-correcting (negative) feed-back loops and the interaction between upper and lower loops in figure 2.

Research method

The sustainable development issues in the compounds in Lusaka are serious, complex and multifaceted. There is no obvious single theoretical basis or mono-disciplinary research method to clarify the potential and probable effectiveness of a biogas investment as a tool for societal advancement. In one way this paper builds on a case study. However, it is not a case study of an investment project that has been done or the societal process that is going on.

This paper “only” aims to describe the development process that the biogas project is intended to create and in particular the interaction between the different stakeholder ambitions. The study uses a hermeneutic approach for assessment of the circumstances, the respondents’

views, the application text and the process that lead to the project application. The assessment framework has a basis in sustainability oriented investment theory.

The interviews were performed as open dialogues, aiming for qualitative understanding. The information gathering method is inspired by case study methodology (Yin, 1994)¹³. The interviews were done as a form of action research in that they were aiming to produce a plan for the investment project and to find a way to get funding to be able to carry out the biogas investment.

A multidimensional investment view on the project

The authors have evaluated the application for the investment project, results from the open interviews and the process so far in relation to an investment theory perspective. The assessment below focuses on investments in the three dimensions: production, organisation and leadership. The real situation has many more and alternative dimensions and there are numerous interactions between the different dimensions. When assessing the circumstances, the respondents' views, the application text and the process that lead to the application in relation to sustainability oriented investment theory we find the following structure of relevant aspects.

- Production
 - Additional installations
 - Enhancement of the production capability
 - Additional companies
 - Improvement of the existing companies
- Organisation
 - Additional organisations and networks
 - Improvement of the existing organisations
 - Development of an innovations system
- Leadership

The pre-study showed that there is a basis to build a large number of additional bioreactors – that was an important part of the foundation for the decision to make the application. Furthermore the pre-study showed that the region has a number of companies with potential to enhance their level of business development. Still, innovation theory suggests that it normally is difficult to change the path of development (Christensen, 1997)¹⁴, in particular for thoroughly established organisations. Such experiences show that it often is more or less indispensable to establish a new separate business unit to be able to get truly started with new kinds of business idea.

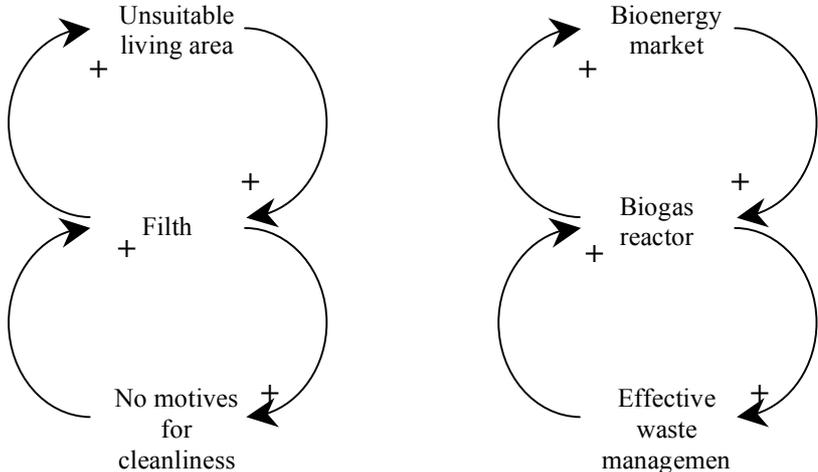
According to Christensen the resistance to change resides in tradition and basic human behaviours. Rational aspects tend to be overlooked. In principle similar aspects may apply also in the organisational dimension. From rational point of view it seems as if the existing organisations for waste management and energy issues could take on the additional task to promote the biogas developments as a driver for sensitisation. However, the *not invented here* syndrome and various kinds of resistance to change may reduce the interest and driving force for the biogas initiated sensitisation process. Consequently, the production and organisation perspectives indicate that there is a need for an ongoing innovation support and a clear leadership. During the establishment of the biogas plant there will be a project organisation for promotion and coordination of the development process. The plan aims to involve local people in the process and that seems to be a crucial issue to establish a sustainably growing development process for concerted improvements of biogas and waste management

businesses. In light of the figure 2 complexity, it seems as if there is a need for a something like an innovation system.

Results and discussion

In a system dynamics perspective, the present growth of the peri-urban areas of Lusaka is causing self-reinforcing feedback loops that tend to make the compounds unsuitable for living. The litter in the neighbourhood makes people care less and consequently they throw ever more garbage on the streets since they are filthy anyway, i.e. litter leads to more littering. The interaction between living conditions, littering and motivational aspects can be illustrated as two interacting feedback loops, see figure 3 (left side). The filthy conditions make the population insensitive, which tends to worsen the situation.

Littering and accumulation of waste is one example of self-reinforcing feedback loops that is making the compounds unattractive. It is a pressing issue to find ways to get out of the depressing development.



*Figure 3. The + means that it is a reinforcing effect
 To the left: negative impact of visible waste in urban areas. The experience of the unsuitable living conditions tends to increase the littering and make the city filthier, which makes it even more unsuitable.
 To the right: positive feedback effect of a biogas reactor. The reduction of waste makes the people more sensitive, which will improve their handling of waste. A biogas reactor can also promote a start for development of a local bioenergy market.*

In their ambition to get out of the destructive feedback-loops LCC and UNICEF are at the same time also acting locally and working on alleviation of a global problem. The thinking is holistic and the action is explicit. The idea with the biogas reactor is that it will create change, and change in many forms. Figure 3 (right hand side) illustrates the potential effect of the investment. The biogas plant has the ability to improve the waste management locally since waste is transformed into a valuable resource. With better waste management the city environment improves and together with reliable water supply the environmental investment can be an important part of and driver in the community development.

The investment in the bioreactor is enabling societal and waste management improvements that are intended to build motivation for further investments, as illustrated in figure 4. From business point of view it is the business actors that ought to take a driving role. However, it is

important that a wider range of societal actors also become positive to additional investments in more and better bioreactors and improvements of the waste management system. To enable a sustainable development process there is a need for a wide range of organisational learning.

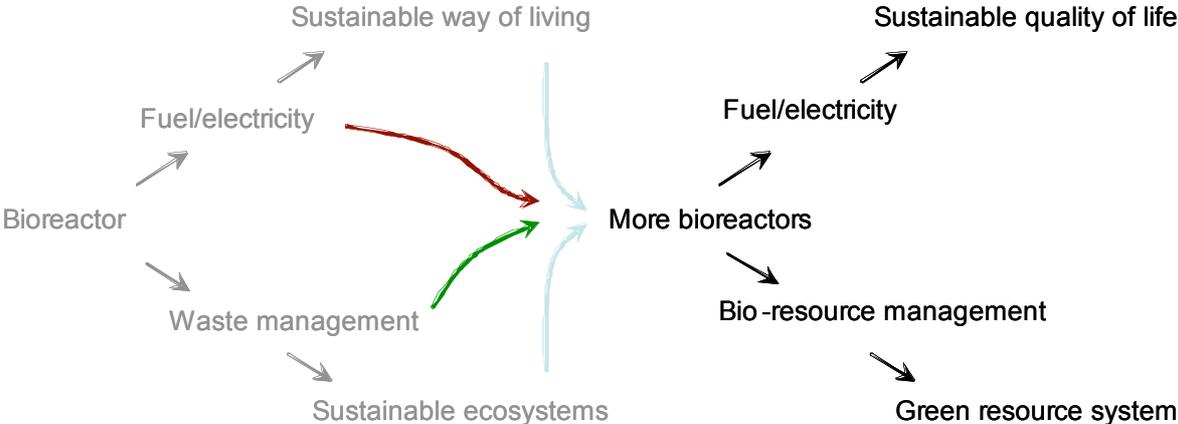


Figure 4. The societal and environmental improvements that the investment in the biogas reactor investment is aiming for a feedback effect into build up of a higher interest in additional investments.

The crucial issue with the biogas investment project is if it can be used as a catalyst to instigate a more sustainable societal development process. A development of a renewal oriented interaction between explicit investments and the wider societal development aspects that both are made visible in a coherent and attractive way. It is not the single investment that will make the city more sustainable; it is rather the start of a process.

The stakeholders are using a physical investment as a focus to get positive attention. When the investment is successful this can be used as a driver for societal sensitisation, i.e. a perceptual change to a higher level of awareness. It is essential to create such reinforcing feedback loops that the interest that is generated by one generation of explicit investments makes the wider society interested in ever more new and more advanced explicit focuses.

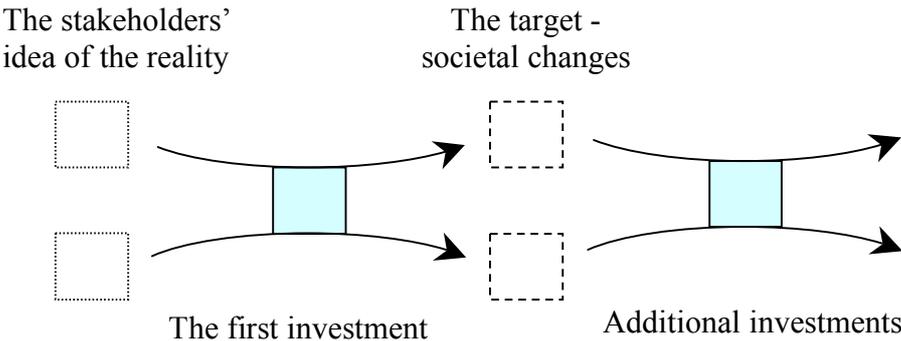


Figure 5. An investment can cause a multitude of effects. At least that is the interpretation made by the stakeholders, which are involved in the project and the reason for them to engage in this process.

It is essential to create such reinforcing feedback loops that the interest generated by one generation of explicit investments makes the wider society interested in ever more new and more advanced explicit focuses.

Figure 5 illustrates an organisational learning process. The explicit focusing is building interest and a better systems understanding. When this is organised as a continual process it

can serve as a basis for organisational learning in a somewhat analogous way an environmental management system does. However, this is not easy. Learning is important, but there are also other human aspects.

In an analogous way as it is a tragedy of the commons (Hardin, 1968) that the natural resources are overused it is also a kind of “tragedy of the commons” that so much people are migrating to cities like Lusaka, in a hope that the city will enable them to make a better living. When they get to the compounds they hardly find any paid jobs and the bad living conditions and gloomy culture tend to punch them into dejection, resignation depression and health problems. This superior level of mechanism is not automatically rectified even if the biogas activities create a lot of positive interest.

Systems thinking tell us that it is important to find act on the real root of the problematic development. At a higher level of thinking it is important to make environmental and sustainable development improvements within all the regions where people are living, in order to avoid problematic migration. From this point of view it seems important to highlight the existing environmental advantages of countryside living, in comparison to the compounds. It is essential to improve the countryside living conditions. Introduction of biogas technology may be just as important for countryside areas as it is in the compounds.

Conclusion

Production of biogas from bio waste can promote a substantial reduction of greenhouse gas emissions. The investment and the biogas start up project are also aiming to promote enhancement of the waste management and the societal awareness. To facilitate a positive continuation of the development process it is a key issue that those improvements are done in such a way that the societal and waste management stakeholders become interested in further projects and investments.

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