



Towards a sustainable strategy for implementing a waterless sanitation system with urine diversion in East Africa – Lessons learned from Austria

This paper aims to derive a strategy for sustainable implementation of a waterless sanitation system with urine diversion under East African conditions that is based on an analysis of the situation in Austria.

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Abstract

Waterless sanitation systems with urine diversion are considered as a suitable solution for East African cities. To successfully implement the sanitation system, functioning organisational structures and a sustainable financial strategy are needed. For waterless sanitation systems other institutional settings are needed than for sewer-based sanitation systems. In waterless sanitation systems the logistics and organisational structures needed to collect the sanitation products are similar to solid waste management. Based on an analysis of sanitation and solid waste management in Austria, organisational structure and a financial strategy for implementing a waterless sanitation system are developed. As part of the financial considerations also the possible value chain is described.

Introduction

For resources-oriented sanitation systems other institutional settings are needed than for sewer-based sanitation systems. Therefore, the idea is to learn from existing organisational and financial systems in Austria's solid waste and wastewater sector. Conventional sewer-based sanitation systems, as existent in Austria show shortcomings, especially, regarding financing. Subsidies are necessary for investments and even for maintenance. Learning from solid waste management (SWM) practices in Austria, however, can help to improve the operation of resources-oriented sanitation systems. Similar to SWM, they strongly rely on good organisation of collection, storage, treatment, transport, and reuse of material. For a waterless sanitation system with urine diversion, possibilities for applying best practices from solid waste and wastewater organisational structures in Austria are discussed. Furthermore, a value chain for sanitation

products and a possible financial strategy for a resources-oriented sanitation system under East African conditions are described.

The paper is based on the results from the master thesis „Solid Waste and Wastewater Management in Austria and its Possible Application in Resources-Oriented Sanitation Systems in East Africa“ (Kleemann, 2010).

Analysis of solid waste and wastewater management in Austria

In Austria solid waste and wastewater management are organised in different ways. Wastewater treatment is mainly sewer-based with wastewater treatment plants (WWTPs). Therefore, also the organisational structure in wastewater management is linked to the watershed. Solid waste management (SWM) that is based on collection from households is organised by the federal

Key Messages:

- Resources-oriented sanitation systems need an institutional setting closer to solid waste management than to conventional sewer-based sanitation
- The sewer-based sanitation and solid waste management systems in Austria are very effective but have been built with and can only be sustained with high financial subsidies
- For introducing new sanitation systems their financial sustainability is crucial.
- A certain number of facilities and users are needed in a sanitation system to become attractive for the private sector to be involved and to make profit.
- Demand for sanitation products and facilities are the driving forces for the development of sustainable sanitation systems.
- Education and legal regulations are needed to create a supportive environment.

states. Municipalities are responsible to provide a service but also engage private businesses. Both sectors are characterised by a strong interconnection with authorities and associations on different levels. The Austrian Water and Waste Association (ÖWAV) is acting on both sectors, and provides an important platform for all involved stakeholders for the exchange of knowledge and experiences. Another important part of the ÖWAV portfolio is the education and training program. Regularly, seminars, workshops and conferences on relevant topics are organised (ÖWAV, 2010). On lower levels (federal state, district, municipal) smaller networks and associations are common in the solid waste sector. Sanitation is usually organised in smaller associations and partnerships of neighbouring WWTP operators.

Waste Sector

SWM in Austria is based on thermal utilisation or mechanical biological pre-treatment (MBP) and subsequent final disposal. The organisational structures are influenced by nationwide and European legal regulations. However, there are differences in federal states and municipalities. Especially, concerning collection schemes and waste disposal fees municipalities are independent. Private companies play an important role in Austria's solid waste sector. Often alliances are built, involving companies for all stages of waste management.

Organisation:

Collection schemes can vary between municipalities and can be organised as bring or collection service for the households. Households are bound to use the provided service and have to pay for it. Public private partnerships (PPPs) are popular and some municipalities totally outsource SWM. To avoid the disadvantaging of areas lacking in infrastructure a predominance of public institutions in PPPs seems reasonable. The collection of recyclable material such as paper, plastic, metal, or glass is often done by the producer of secondary raw material itself or intermediary retailers. In Austria, the separate collection of organic waste is compulsory.

In most federal states of Austria waste management is organised in umbrella associations with smaller associations for districts and municipalities as members. The organisational structure follows strictly the political boundaries (i.e. municipalities, districts, federal states). In many cases, they cooperate with private companies, which are active in the field of waste recycling and disposal. In the capital city Vienna and the federal state Burgenland, waste management is centrally organised. The waste and recycling material is often brought to intermediate collection points for further transportation and end up either in production industries, incineration plants or MBP plants.

Finances:

Generally, collection, treatment and disposal of municipal waste are financed through the waste collection fees

paid by the users. Households pay to the municipality, which is responsible for the service. Companies can also contract private waste disposal businesses. In the last years outsourcing of SWM became popular amongst some municipalities. The responsibility, however, remains with the authorities. A study shows that waste collection fees varied between +/-40 % to +/- 70 % for the same service (AK, 2005). Main factors influencing the costs for waste treatment and disposal and therefore the waste collection fees are the service level (emptying frequency, collection or bring system, etc.) and the structure of the catchment area (topography, population density, etc.). The organisational structure such as the involvement of private companies and the cooperation with associations also influences the costs. However, the involvement of the private sector doesn't necessarily lead to lower costs at the same quality level. Cooperation and exchange with other stakeholders, however, can be beneficiary and reduce costs. Usually, the consideration of existing structures and the involvement of available facilities and free capacities lead to lower waste disposal fees.

Wastewater

Wastewater management in Austria is regulated by EU-directives and federal law. Compared to the waste sector federal states play a minor role. More than 90 % of the population is connected to a public sewer (UBA, 2010). A lot of financial effort is necessary to keep the systems running. Compared to the solid waste sector, the involvement of private companies is marginal. The sector is also more decentralised in its organisation.

Organisation:

Also within the Austrian wastewater sector people are obliged to use the system provided by the public sector. If no public system is available, decentralized systems have to be constructed according to legal guidelines. For the cesspits still in use suction trucks are used to de-sludge the cesspits and dispose the sludge to a nearby treatment plant for treatment. Sewage sludge is the link between the wastewater and the solid waste sector. Sewage sludge from municipal WWTPs is defined as a non-hazardous waste. After dewatering and drying sewage sludge is mainly incinerated and landfilled but only rarely used in agriculture.

In contrast to the waste sector, the federal states are not dominant in the organisational structures. WWTPs often work together and cooperate in form of so called "neighbourhoods", initiated by the ÖWAV. The consultation between neighbours and the mutual exchange of knowledge and experiences assures professional and economical handling (KAN, 2010). Small associations can be found where several municipalities, situated close to each other, share a WWTP and operate a sewer system together. Associations have often pollution abatement of waters as a collective target.

Finances:

In the last years, investments were primarily used for the extension of sewer systems and WWTPs as well as to construct new small sewer-based systems. Investments are considered not only to improve the water quality but also to give incentives to the economy and the labour market. Investments in infrastructure have been and are heavily subsidised.

The service, usually provided by the Austrian municipalities, includes wastewater drainage, treatment, and the discharge of purified water. The estimation of cost coverage in the wastewater sector is limited by varying accounting systems and the lack of information about what is considered in the balance. The fees for sanitation are differently calculated all around Austria and are set by the municipalities regarding to the legal situation of the federal state. The fees are split into one part for the connection and another for the running costs and are calculated either on the basis of freshwater use or the usable living area of a household. An average price for wastewater was calculated with € 1.69/m³ with ranges between € 1.29/m³ and € 2.33/m³. As shown before, most of the running costs are covered by the fees, additionally public grants are provided for investments relevant to the environment (BMLFUW, 2005). For 2002 cost coverage of 84 % was estimated. However, cost coverage varies widely mainly depending on the area (urban or sparsely populated rural area).

Situation in East Africa

A general lack of monetary resources is an omnipresent problem in African cities. The rapid increase of population in African cities is another severe problem, as demand for basic infrastructure is rising and cannot be provided. The most common facilities are pit latrines which are often manually emptied and the sludge disposed without treatment. Problems also exist with high water tables. Experiences from

practice underline problems with insufficient financing for sanitation and SWM and not the desired priority on political agendas. These facts could be also observed in the four pilot cities in the ROSA project (Langergraber et al, 2010).

Gacheiya and Mutua (2010) investigated school sanitation and stated that financing of construction by interested institutions is a challenge due to the priorities and budgetary allocation of the schools. Furthermore, they call for adequate monetary resources from the government to schools. Especially in schools, education about sanitation systems is important as the information is also brought to the families.

Operation and maintenance is a crucial part of a sanitation system. Especially, systems, constructed with external funding, have to become financially independent after the start-up phase. Müllegger and Freiberger (2010) state, that more than 70 % of the people in Arusha, Tanzania, indicated to be willing to pay the estimated costs for operation and maintenance required when using Urine-Diverting Dry Toilets (UDDTs). Also private companies showed interest in becoming involved in sanitation and SWM. However, to make profit, a certain number of facilities are necessary. That means initial investments are rather high, before a market can be established. In Arba Minch, products from urine and dried faeces are already used by compost producers, which sell the compost.

Development of a strategy for implementing a waterless sanitation system with urine diversion

Figure 1 and 2 show simplified waterless sanitation systems with urine diversion with double and single-vault UDDTs, respectively (according to Tilley et al., 2008). Based on the Austrian experience it is aimed to develop the operational and financial strategy for these two sanitation systems.

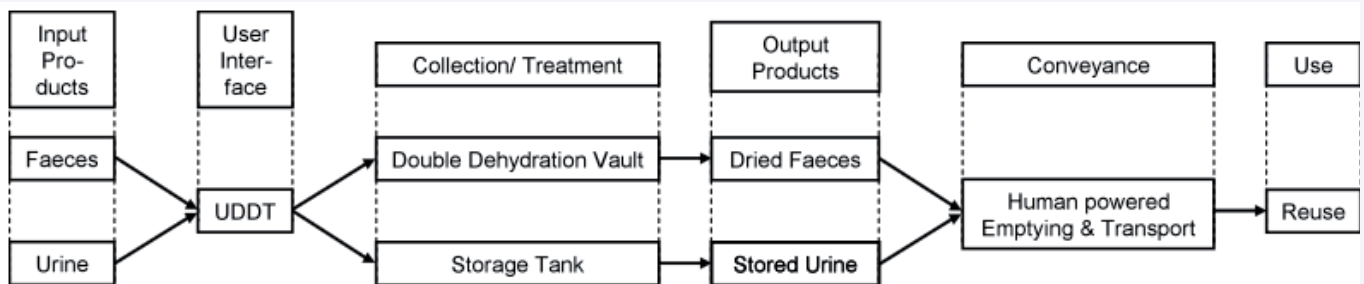


Figure 1: Simplified sanitation system with urine diversion toilet (double-vault)

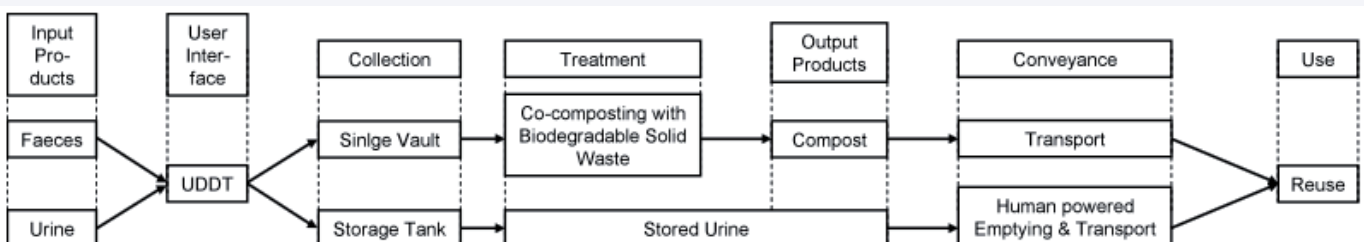


Figure 2: Simplified sanitation system with urine diversion toilet (single-vault)

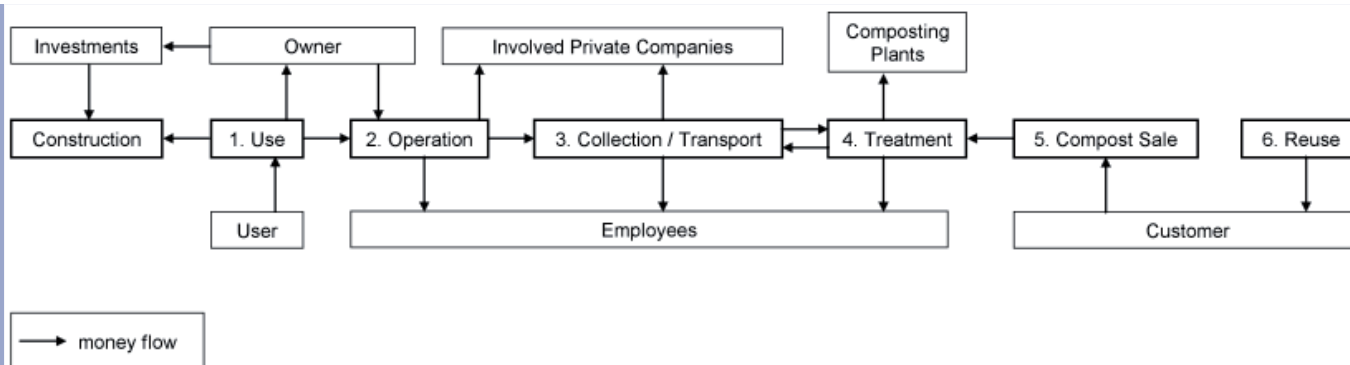


Figure 3: Possible money flow in a resources-oriented sanitation system

Development of a value chain

The possible money flow in a resources-oriented sanitation system is shown in Figure 3. Money flow can be generated by:

1. The fees for using the provided facilities. If landlords provide sanitation facilities for the residents, a higher rent can be charged to finance the service. For public facilities fees can be charged per use.
2. The operation of facilities (e.g. public toilets) creates income and employment for workers but at the same time expenses for the owners of the facility.
3. Private sector companies can be functionally involved in collection and transport. Fees can be charged for the emptying of the facilities. Depending on the market value of compost, the fees will vary.
4. For single vault facilities or where the acceptance of compost from faeces is low, further treatment is necessary. Through co-composting with biodegradable solid waste also the SWM sector can be involved. Composting plants can charge for the takeover of the raw material again depending on the market value of quality compost.
5. The selling of compost depends on the acceptance and the quality of the product. A functioning market for compost is essential for the introduction of a resources-oriented sanitation system.
6. Finally, the reuse of quality compost can yield in a rich harvest and an improved situation for farmers and the population.

Sustainable Financial Strategy

Ideally, resources-oriented sanitation systems are sustainable also by economical means and independent of financial support. A weaker approach is to “allow” financial aid in the start up phase of a project but to require self-financed operation and maintenance. However, as mentioned before, also in developed countries, subsidies are needed to provide the services.

Cost intensive concepts for both sanitation and SWM are not suitable for East Africa. Investments in more decentralised solutions with involvement of the private sector seem therefore more promising.

Assuming that improved sanitation positively influences the health of the population and healthier people can better contribute to strengthen the economy of a nation, investments into sanitation systems in general and resources-oriented sanitation systems in particular pay off. Some money for the construction and the start up phase of a system should therefore be provided by the authorities responsible for health issues. However, also the environment and urban development are positively influenced. Instead of shifting responsibilities and avoiding expenses, authorities would do well to contribute and allow the wise sharing of costs. Persuading policy makers seems to be the major challenge in this regard. Cooperation between experts from different fields and countries and policy makers could help here to scientifically emphasize the importance of SWM and sanitation, and also show that money is well invested in these sectors. Money can also be provided by international NGOs, private investors or donors. At the latest, after overcoming the high initial costs, the introduced system has to be financially self-running. Valuable recycling products such as liquid and solid fertilisers have the potential to be marketed and to make waste and wastewater management an affordable if not profitable business. At all stages of resources-oriented sanitation systems there is potential for generating income (Figure 3). After first profits are made, initial costs will become less significant. However, private businesses can only profit from resources-oriented sanitation if a certain number of facilities are available in an area.

In every case it is necessary to develop a market for the products of resources-oriented sanitation. In Austria, paper production strongly relies on recycling material, which is collected for free from the households. In former times, paper was simply deposited in landfills as it was seen as worthless. If there is demand for natural fertiliser, also production will be stimulated and all connected areas will follow. Demand for better sanitation and a cleaner and healthier environment can also be a driving factor for the development of sanitation systems. Fees for usage, operation, or maintenance and the marketing of fertilizer products are the basis for financing a resource-oriented sanitation system.

Organisational issues

Separate organisation of sanitation and SWM as in Austria does not seem suitable for resources-oriented sanitation systems. In fact it would be desirable if one organisation is responsible for both. Especially, transport of sanitation products and solid waste need similar logistical solutions. In this regard, it is important to utilise existing facilities and cooperate in networks to efficiently collect and transport sanitation products and solid waste. Strategic intermediate collection points as known from Austria SWM can be a good option here.

Networks and associations generally have the potential to improve the performance of sanitation and solid waste management as ideas, knowledge and experiences can be shared. Another advantage of cooperation is the possibility to share highly educated personnel and provide training to a wider range of stakeholders. For the management of solid waste and wastewater, cooperation in form of networks or associations means having the possibility to introduce strategies and optimise operating processes. Benchmarking or strength- and weaknesses-analysis can help to detect potentials for improvement. Cooperating partners orientate themselves on the current state of the art and examples for good or better practice (Strömer, 2006). Within a network, management means to have more resources available, but at the same time to share them with others. Therefore, communication is essential to efficiently use the advantages of cooperation.

The involvement of the private sector in form of Public Private Partnerships (PPPs) became popular in Austria in the last decades, especially in the solid waste sector. The main incentive for outsourcing is the chance to reduce costs. Under East African conditions an advantage of PPPs can be the sharing of investment costs between authorities and private companies. Further, private businesses often work more efficient. In this context it seems, however, important that authorities retain control to avoid the neglect of poor and underdeveloped regions.

Additionally, a very important condition for the profitability of sanitation and SMW is the creation of a market for reuse and recycling products. A supportive environment based on education, cooperation, and institutional support is required for this, including a supporting legal framework.

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