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Appropriate Technologies? Inappropriate Question

Chasing the Rope Pump and Finding a Trap

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1. Introduction

On making choices, choosing an area of focus and a technology to study; why is our subject what it is?

It is often peculiar how choices are made. On a rainy evening ride on the [safety] bicycle in Maastricht I started to wonder whether the users of approximately 13 million bicycles in the Netherlands with a population of 16 million have indeed chosen the most appropriate means of transportation in a country where it rains in average on every second day[1]. The Dutch society's assessment of the advantageous and unfavourable characteristics of bikes and their choice to use this technology is however not my choice of focus of study. Drying my soaked papers at home I finally realized that water is in the centre of attention that makes riding inconvenient, roads slippery and books and papers wet that are meant to be kept dry. It may be however much more beneficial to take a look at a totally opposite context in which dryness is the problem and water is the sought-for element.

Studying the choice of appropriate technology starts with practically the most the difficult choice for the researcher to make: choose a technology and choose a group of users to test cases, ideas and theories. The initial question may rise: why is a certain technology more appropriate than another for a certain society and why does one technology suit one society and not suit another; in other words, why is a certain society more appropriate for a technology than another? One thing should be clear and it is the interrelatedness of technology and the group of users (or non-users). Therefore in the following pages we are going to study society and technology.

In search of an appropriate technology we are looking for technologies that are widely available. Choose a simple technology, a general purpose one. We hope at the outset that by the end of this paper we will be able to show that even an easily definable, easily localisable technology has enough points of direct interaction with an easily localisable society to provide a sound basis of analysis, whereas expanding the

[1] About the numbers: some claim there are more bikes than people in the country, the figure used here is according to the data published by The Netherlands Board of Tourism and Conventions (NBTC 2006)

affected society and talking about more complex technological systems may easily eclipse certain important aspects.

The choice is made – our technology will deal with water supply, the broadening of accessibility in developing countries' rural areas. The issue is as important as it can be; according to WHO (2006), 58% of the population is not served in Sub-Saharan Africa, 27% not served by drinking water in Latin America, although in the case of the last there have been considerable improvements[2]. In order to provide access to communities that live in areas where groundwater is available, several very simple technologies have been developed. Moving further from the basic idea of digging wells and boreholes that only needs a sort of a shovel, we are exploring reliable sources of water based on wells, but enhanced in a way to provide constant and safe water. Some of these simple pumps are not far from the idea of a rope and bucket version; some are more witty mechanical constructions using human power, some others rely on animal or wind/solar power. But in most cases, remote villages with lack of electricity considerably limit the list of available technological solutions. By seeking to follow a social constructivist view, we will take a look at different examples where there has been a choice for a certain technology and dig deeper into them to find out what social aspects contributed to the decision.

By putting the question of *choosing a technology* in the centre of our investigation, intended or not, we can easily find ourselves talking about technology or artefact as an externally given object. Even in the case of relatively simple technologies as we shall see in the following, the *development* of a technology has important consequences on its adoption by different users. By trying to use three models indicated by Bijker (1995b) (materialistic / cognitivist / social shaping models) on the given water pump, we can see that even simple technology like a rope pump where materialistic approach might seem to suffice, have many differently realised versions that show interesting signs of social shaping as well.

[2] As shown by WHO (2006), there was a 13% increase from 1990 to 2004 in the Latin America & Caribbean region, however, only 6% increase in the case of Sub-Saharan Africa in the same period.

Let us leave now the latitude of 50°51'N of Maastricht southbound and from the Netherlands let us make pay some visits in Central America and Sub-Saharan Africa.

2. The Rope Pump

A workshop, a technology, the societies that use it and the deconstruction of all of it

A low-income developing country in Central America, with a GDP per capita of 2900$ and whose main export items are coffee, beef, shrimp and lobster, tobacco, sugar, gold and peanuts (CIA, 2006), Nicaragua, together with the World Bank and a number of NGOs set out for holding a workshop on technology transfer. Contrary to previous expectations, it was Nicaragua that had a technology to disseminate: something that solves basic needs. The World Bank, Swiss development aid organizations, UNICEF, several water, sanitation and development related NGOs as well as private companies attended the First International Rope Pump Policy Workshop in Managua in 2001. The idea was to share knowledge of a the technology that have proved to work to provide drinking water for communities and families in rural Nicaragua, an experience that may be useful in other parts of the developing world. As identified by the representative of the World Bank (SKAT, 2001: 19)[3] identifies that in the water sector the 1970s focused on technology, the 1980s on coverage, the 1990s on demand driven initiatives, it is then the role of the 2000s to broaden cooperation to include users, private sector and NGOs. Something we may call a social constructivist attitude.

2.1. What is the rope pump?

Instead of the tedious efforts to lower a bucket at the end of a rope, this is a recipe to make easier to gain water from the well. Take a (hand)dug well, secure the hole with bricks; install a wheel on over the well that is moves a number of pistons attached to an endless rope that goes down to the bottom. On the upward part, the rope and pistons go through a pipe all the way to the tap of the well: the pistons

[3] SKAT 2001: Proceedings of the First International Rope Pump Policy Workshop in Managua. The interpretation of the workshop is based on the details of this document.

ensure that water will rise in the tube; the rope ensures continuous supply. (See figure 1.)

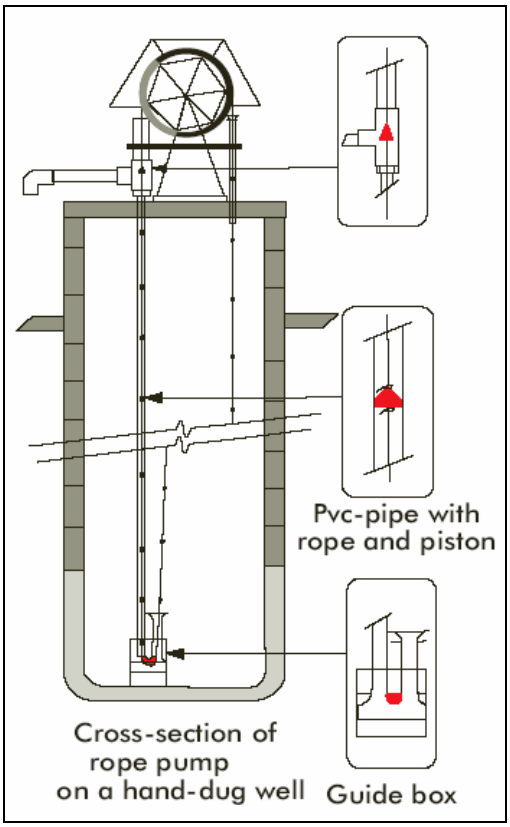

Figure 1. (WSP, 2001)

The problem the workshop addresses is clearly appealing. It is clearly a form of a *policy dialogue.* It embraces the basic need to achieve sustainable, demand driven supply chains for water, confirming that the global water and sanitation problems provide a clear basis of needs to develop technological solutions. To mention but a part of it:

- Falling water tables due to inappropriate or uncontrolled water abstraction for commercial purposes
- Pollution of viable water resources due to poor water resources management
- Damage to water resources by natural phenomena such as arsenic contamination
- Global environmental changes and natural disasters which impact negatively on water resources

- Rural water supply and sanitation systems coverage: some success in Asia, critical, declining state in Africa
- Some technical choices of the 1980s have proved sustainable; affordability remains a crucial factor

2.2. The Rope Pump Discussed

This will be now our moment to start our analysis of technology and society. Taking a SCOT approach, through the deconstruction of these two we shall gain insights to what may stand behind the choices made for or against rope pump technology.

Rusty or well maintained, open or covered and closed, there are thousands of working examples of rope pumps throughout the world. Around 25 thousand in rural Nicaragua, several thousand in Sub-Saharan Africa ranging from Madagascar to Ghana, from Zimbabwe to Kenya. Most of them serve well with a low percentage of breakdowns, suggesting that it may be an appropriate technology. But what factors were contributing when the choice for this technology was made? The setting of the Managua workshop provides a useful opportunity to gain insight into the relevant actors, the relevant social groups (as used in the social constructivist views of a technology – see Bijker, 1995a) and hopefully their articulated interests. So who are the main actors? Let us examine the workshop participants and their deliberation. We know that it is not a complete list, but it did include a fairly wide enough set of actors.

International Organisations:

UNICEF, who identifies global problem of access to safe water, sanitation and its implied effect on children, the child deaths due to water-related diseases. The organization is open to technologies like the rope pump in principle and in practice it is committed to help technology transfer, information sharing.

World Bank Water and Sanitation Program (WSP) is aiming to promote access to safe water and sanitation services for those in need; it identifies the large inequalities between urban and rural services and coverage (scattered rural population exacerbates problems). Activities include promoting sustainable, demand-driven

supply-chains for goods and services in rural areas; facilitating access to small credit schemes; and promoting low-cost technology (e.g. hand pumps). It also promotes coherent management strategies that produce synergy between public and private sector (e.g. rope pump project).

NGOs:

Network for Cost-Effective Technologies in Water Supply and Sanitation (HTN) is a global network of NGOs and individuals that is committed to promote cost-effective, affordable pumping technologies. They hold a strong view one locality with regard to manufacturing and maintenance.

It's related closely related to the Swiss Center for Development Co-operation in Technology and Management (SKAT) is also an umbrella organization for organizations and individuals acting to achieve poverty reduction and safe water for all. It encourages technical cooperation and local capacity building by network and partnership building for South-South and North-South cooperation. By calling attention to large number of faulty pumps especially in Africa (estimates that 50 per cent in not working), it identifies the lack of hand pump standardization to be main cause – pumps not matching wells and lack of interchangeable parts. SKAT also promotes research and development for hand pumps and dissemination of results.

International Water and Sanitation Center's (IRC) aim is to facilitate creation, sharing and use of knowledge to support water and sanitation services spread in the South. It processes over 10 years of satisfactory experience with rope pump technology, including 5 years evaluation; though water pumping support is just a small part of its activities. It has been a facilitator of regional alliances, partnerships and dialogues to spread access to safe water in rural areas.

CARE strives to expand access of population to water and sanitation services, with total coverage as the furthest aim. Long-term sustainability, user-driven, user participatory methods are key issues; they claim that users should select range of services. Also promotes soundly based legal structures; community direction of private projects and health education for communities and schools enjoy priority in their funding. CARE focuses on the involvement of families: experience in Nicaragua shows that families are participating in actual financing for projects.

Save The Children, Nicaragua, again a children-oriented NGO can count positive experience of rope pump vis-à-vis acceptance by users, easy operation that

also entails children as users. It calls attention to the need for contamination-safe wells that work to protect child health.

Last but not least stands a local NGO, a Women's Co-operative. They recognize that water source securing for community is connected to wider effects on agriculture (vegetable production increase experienced despite adverse weather conditions), children's education that further enhances community life. The El Malpaisillo Community W's C embraces 700 families, works on the field for health education; cotton processing. They show how the time saved by water pump allows new manufacturing capacity, such as creating rope pumps; ceramic water filters; sheet metal items. The importance of the active involvement of women in their view as a result is rope pump ownership [an example how rope pump is well accepted].

Governments:

Swiss Center for Development and Cooperation holds the issue of water high on the agenda; it decided to support Bombas de Mecate SA in manufacturing, training and dissemination of rope pump technology. They regard global partnerships of high importance.

The Nicaraguan Government (Gerencia Acueductos Rurales) is the proud holder of the positive examples. It affirms the government's need of poverty reduction and to find sustainable solution to installation and training. It is also open to cooperation with the private sector, with companies such as Bombas de Mecate SA.

The private sector:

Responding to an increasing demand in the 1990s, several companies have engaged in the production of rope pumps enter the market in second half of the decade; though most of them only in small scale. There is a critical question of taxation: categorized as agricultural equipment, rope pumps may face new taxing. Innovativeness is present in the industry, flexibility of design has been also seen: different sources of power also available: Wind-powered, animal-powered versions; pumping from lower depth or pumping to a tank, for instance. (This shows that appropriating technology is going on in this level too.)

The successful company is Bombas de Mecate SA. Its example shows that profit seeking with an eye on local problems and success stories may be a source of

favourable attitude and taking on board into a network. It is stressed to be an example of a private company that can be part of sustainable development. Produces 3500 rope pumps a year, making it the leading manufacturer in the market in Nicaragua. Private costumers are main target, showing that the technology may be a feasible solution that does not require external aid. They manufacture rope-pumps in-house, but are also engaged in technology transfer activities entail in Honduras, Angola, Ghana. Their rope pump's advantageous attributes include characteristics such as:

- Low-cost, easy to maintain, readily acceptable to users (parts such as rope replaceable for a cost of 4$)
- No special tools required for use, local equipment sufficient for installation and maintenance
- 2 versions targeting families and communities
- Quality control of manufactured parts
- High mechanical efficiency

To continue our trip, let us now leave Nicaragua for a short time to visit countries in the neighborhood, or as far as East Asia, Africa. In other words, let's see some more experience:

Useful experience can be gained from El Salvador, just through the fact that details do matter. Multiple manufacturers are present in the country and it proved to be conceivable – in fact, ending the monopoly of a single provider has contributed to lowering prices as well as improving pump quality and making water better protected against contamination. However, well de-contamination faced resistance from communities due to fear of tainting of water, but after some years they found a solution by installing easily disinfectable overhead tanks. A vulnerability aspect is that access to parts is highly dependant on manufacturers; local market cannot provide such components like suitable ropes.

In Bangladesh we will find the Jibon hand pump widely used. Promoted by the International Development Enterprises, it addresses development problems with entrepreneurial, market-based methods. It targets low-income group customers (with pumps prices varying between 100-500 USD). Bangladesh claims to be a success story. The government, with the help of external governmental and non-governmental organizations (UNICEF–UNDP–HTN) set out criteria to produce a pump that is in

accordance with the wide availability of groundwater in Bangladesh at a depth of approximately 15 meters; it should be locally produced and private sector should take part in the distribution and sales of whole pumps as well as parts of it, that should be easy to maintain and is available at a cost of 100$. The successful innovation resulted in the completion of the Jibon pump by five companies. It had successful sales to users sustained even after subsidy was withdrawn. An independent supply chain developed and it is even providing water for agricultural use on top of drinking. The Jibon proved to be a transferable technology for instance to Africa, although some improvement in quality is still required.

The case of Laos shows a case of technology transfer experience. UNICEF helped the government by cooperation to introduce such pumps. Production was started and test use in communities showed some appealing features: it can be solved by low-cost ways that means 70$ per pump, owing to the fact that materials are locally available. There is a difference however in popular acceptance between dug-wells and boreholes: the former is accepted due to its easy-to-use solution, availability to women and children too; the latter proved difficult to maintain. There were also some complaints about the high noise of a working pump. Vulnerability to damage was also a case, and Laos rope pumps working mainly for less deep wells. Still in the process of *appropriating*, it needs performance improvement.

In Madagascar, Taratra NGO has been supporting southern rural areas. There are around 500 wells present, funded by local communities, operation and maintenance training as well as health education was provided by the NGO. Local production of materials is present and pumps have been well-accepted. The main reasons are that costs of 230$ are affordable, they are easy to maintain and perform in a satisfactory way. A “local specialty” of the Madagascar pumps, due to high risk of contamination, is that above-ground parts are specially covered. An effect of technology on the society was also recognized: the important and high-responsibility *role of a caretaker* appeared in communities with pumps. The NGO also promotes preventive maintenance that proved beneficial.

Zimbabwe may show a more independent case to learn from. It all started with a failure: the introduction of the rope pump technology in the early 1980s was unsuccessful. Poor quality pumps intended to be used for agricultural purposes did not work. The NGO Pump Aid restarted the program in 1996 with a closely-monitored field test of 50 pumps; the technology was appropriated through incremental

innovations, so at the second test-round with 100 pumps 99% operationalability was achieved. There are also certain local distinguishing characteristics, including an above-ground brick housing with pedaled lid. But the main feature is its distinguished name: “Elephant Pump” underlines its durability; in fact the name derives from the coupling of its persistence with its similarity to a tusk of an elephant. Altogether installation costs amount are definitely lower than an elephant, only amounting to 300$. What is interesting and we will return to it soon, is that the Elephant Pump claims a different theory for the transfer of this technology.

Figure 2. The “Elephant Pump” (Pump Aid, 2006)

2.3. What was the impact of rope pump on the Nicaraguan society?

Going back to Nicaragua, it is time now to take a look at how technology affected society. What might show a form of acceptance of rope pumps is that after the devastation of hurricane Mitch, thousands of rope pumps were *rebuilt*, by the joint work of the government and local communities.

The government and local NGOs (including women’s cooperatives) agree that raising available water quantity as well as quality have played a major role in reducing water borne diseases. Spread of pumps is relatively high: after a decrease in 1995, it has constantly been growing; in 2001 there were around 22-28 thousand available with approximately 10-20% of them non functional. (To compare with, we are talking about a country of 5 million, with almost a half living in rural areas).

Local groups of people of importance to us in rural Nicaragua are families, communities and farmers. Private families are the largest users of water pumps; a large deviation is present with 6-20 users per pump, with a mean of 10. Its primary

use is drinking and household purposes. Private rope pumps account for about 15% of rural water supply, while community pumps account for 50% of it. The Communities are less self reliant as families, and there are less examples for such ownership like the caretaker in Madagascar – the installation of water pumps are mostly as a result of NGO support. Farmers are seeking pumps that can be used for animal watering and irrigation, they are however lesser users of rope pumps and more of other irrigation methods – there is thus a difference in household and larger scale use. So in the big picture, social acceptance is high, as it was demonstrated by families' willingness to contribute financially to pump installation. Families identify the usefulness of the rope pump for agricultural purposes as well and what is the most telling, that there is a high proportion of functional pumps.

3. Alternatives and Findings on Appropriateness

Hand pumps, the Afridev and ram pumps; Concepts taken in mind through SCOT glasses

Making choices means selecting from a wider set of alternatives. To see such a list of alternatives of which one item is the rope pump, let us now take a quick look at what other technologies are used by similar rural communities[4].

There are a set of *hand pumps* that is built on the idea to make water pumping available at areas with a deficiency of electricity but availability of labor force. Most of these pumps are children of the industrial age, with interchangeable parts made of steel, made to be enduring. However, are made with high construction costs and with materials or parts that may not be available in a rural developing countries surrounding.

There are a number of cases in which hand pumps have not been working properly, due to their not fitting to the circumstances, improper use or broken parts that users did not know how to or found too expensive to repair. Despite all the efforts and good intention from the external donors to make an effective system work, a large proportion of these hand pumps are not in use. A good example is that of Lifewater

[4] [In order to prove that the rope pump is the best available technology, we wanted to find another technology and the dissatisfaction of its users (due to costs, required expertise to service and maintain, high proportion of out-of-order, etc.) – who are more satisfied with using the rope pump. We have to admit it here that due to the limit of time to write this paper we did not manage to achieve it. However, the list here may also be telling.]

International's (an NGO engaged in fighting poverty and disease through clean water, hygiene, and sanitation), who in May 2006 spend almost 30.000 USD (without travel costs) to repair 27 broken hand pumps in the northern part of Togo[5]. The most common problem was faulty piston in the pump.

One alternative solution that was designed to be an alternative hand pump is the so called "Afridev", developed through the cooperation of the World Bank and UNDP to be suitable for rural Africa. The intention to produce and maintain by the local community was above others, however, the Afridev, born in the 1970s under the auspices of the Swiss Dupont, consisted of special light weight, non-corrosive, easy-to-assemble materials that required special mould for certain parts. With the high import tariffs on raw material producing the Afridev in developing countries in the end turned out to be a failure. Bringing Afridev production to Africa has not proved successful either, mostly due to the concurrent producers in South-Asia that managed to benefit from economies of scale to produce at half the European price.

There are also pumps, to continue the list, that require and make use of a mountainous terrain. The *ram pump*, as an example, is a useful device that can lift water to a higher lying tank using energy of downhill falling water. Requires no electricity but a meticulously designed hydraulic device, this has proved to be useful in rural developing societies who can invest or receive help to install the ram pump. Its more sensitive side is that parts it uses are in most of the cases not locally available; the costs amount to 700-1000$.

[And the list could go on.]

So, is the rope pump an appropriate technology? It is clear that values and interests of a large number of actors meet in such a technology as the rope pump. Its low-cost installation and maintenance, its reliance on low-skilled, widely available artisanship makes rope pump an ideal choice; it is scarcely harmful for the environment (save for noise-related issues with regard to the Laos example). It is suitable for different relevant social groups, but is it the only appropriate technology? Let's leave the question open for a while and take a look at other issues.

[5] http://www.acjfoundation.org/Togo_hand_pump_repair_report.pdf

3.1. Technology transfer

There may be as many stories as users that trace back the origin of the rope pump. Even different names show that such a practical technology may have been invented independently at different locations at different times. Present activity of development networks have however given an important boost to the spread of this technology. The "Elephant Pump" that has gained popular awareness by having received the St Andrews price (Pump Aid, 2006), currently spreading mostly in Zimbabwe claims that the original idea comes from ancient China and that the technology is over 2000 years old. On the other side of the world, in Latin America, the company Bombas de Mecata SA introduces the rope pump as a 200 year-old technology stemming from a chain pump. Another description adds more details to the story that it needed a European detour and a courier in the form of a Danish engineer to "bring back home" the rope pump to Central America in the 1960s.

The shining feature of the rope pump is that it irrelevant where it really came from, as all stories may be true. Since it is built on simple mechanics and relatively widely available parts, *it is not fixed to any special location*, as long as it is possible to find drinking water within 15-30 meters below the surface, it is most likely feasible to install.

We have seen its sporadic presence in rural areas of developing or least developed countries, that not only suggests certain success of external help typically in accordance with the North-South pattern of dialogue, but also there are traces of past and a wide range of opportunities for further South-South cooperation.

In a concise economic analysis one could find where its success lies in characteristics such as: (1) stronger focus on demand; on the needs of local communities and families; (2) complete supply chains are also established. Mostly as opposed to other transfers that are technology driven and focusing less on demand, more on supply.

Facilitating the actual process, we can also find the fact that of the open access to the technology. The documentation is relatively simple and several companies such as the Bombas de Mecate has offered the "design and all related data" to the public.

It is in accordance with Shrum and Shenhav's concept of technology transfer between organization, public and private (1995: 635). The success is a two channel flow of information: not only by NGOs and development networks, but also firm level

dissemination takes place in a South-South relation, intercontinental paths can be traced leading from Nicaragua to Laos, Ghana, near inter-African ones

3.2. Vulnerability of a rope-pump based culture

Claiming to follow the constructivist approach, interesting findings may lie in analyzing the rural societies that "hang" on rope-pump technology.[6] Although from a view from thousands of kilometers away we may lack the more appropriate anthropological description, we can not call it a non-complex society. Although distribution of labor and production activities is at a lower level than in an urban society of an industrialized country, providing water is satisfying one of the basic needs. The distinctively lower level of "interconnected subsystems" and "feedback loops" clearly means that this is not a technological society in the sense meant by Bijker (2006: 5), however, it is the technology that determines whether as many people can live in a certain village and whether they can continue their farming activities in place or need to move to different locations due. To the extreme, technology means life - in this sense, the society hangs on the rope of technology. What is clearly different is that the *use* mechanical technology does not hang on other technologies but human power. (Apart from the case of solar- or wind-powered versions.)

But is the choice of appropriate technology a way to reduce vulnerability? The answer to this question is more difficult, since it entails an answer given to the question of what is appropriate technology. To move further, we will try to seek to answer it (or solve the question in a way).

3.3. What are appropriate technologies?

There are as many definitions as examples. At the Nicaragua workshop, Jo Smet of IRC, The Netherlands identified four characteristics of appropriateness: (1) continuous effective and reliable functioning; (2) can be used by all user groups; (3) management and finance should be autonomous or only in a limited way dependant on external sources; (4) shall have no lasting detrimental effect on the environment.

[6] Here I am elaborating a statement based on Bijker (2006)

Fair enough. Schumacher (interpreted by Eckaus, 1987), who is claimed to be one of the founding fathers the concept (though using a different term, *intermediate technologies*) has started off with criticizing inappropriate technologies that did not help development, or proved harmful by causing unemployment and various social problems. In contrast, appropriate technologies take in mind local needs and are more adjusted. But to come out with a definition, Eckaus says:

> "The adjective *appropriate* (italics in original) typifies the vagueness of the AT movement's reasoning. Try *appropriate* in a dictionary. The definitions include: 'especially suitable,' 'fit,' and 'proper' – terms whose meaning depends on the specific circumstances and the criteria of sustainability. In short, *appropriate* can mean almost anything." (1987: 64)

Following Eckaus' argument that users of the term, are seeking certain goals, or are policy oriented, and may easily follow determinist paths. So is it possible to choose from the several features that may determine appropriateness, such as:

- The high level of indigenousness? The presence of external assistance?
- Are technologies environmentally sound? Are they labor intensive in an appropriate way? Are they small scale? Is the selection and use decentralized? (Simon, 2003)
- Or is it on a lower, individual level that technology is appropriate, and not social groups but all users are to be examined, so that the higher the flexibility for individuals to be part of various groups, the easier it is for them to be identify that a certain technology is more appropriate?

We shall argue that it may all be valid, but the solution lies somewhere else.

4. The revelation

What is the key to choosing appropriate technologies?

Is appropriateness answered by one of the above-mentioned criteria, or are these characteristics complementary and all of them are defining?

It may all be true. However, it is all entrapped. It is all connected in a way to a technologically deterministic view. In most of the mentioned cases, there is a given society that can choose from a variety of given technologies (some of them more appropriate than the other). Most often there is a foreign agent, a donor, an NGO that

is there to help, as we have seen – that will point out a simple technology that best suits the society. We may even talk about interaction of the society with that technology and local development, adjustment, or using the appropriate term: appropriation, or the technology's effect on the society.

But while digging deeper and deeper for the details, we may forget the whole context. We are constantly talking about a *given* society, *given* donors, *given* set of technologies.

Why is our focus rural Nicaragua, Zimbabwe or South-Madagascar? Why water pumps and why the rope pumps?

There are easy answers for this question. The territories are chosen because of the availability of information through NGO reports and conference material that are published on the internet. The choice of territories was in fact made by the NGOs and pump manufacturing companies that chose their area of activity. The choice of the set of NGOs and companies is an implication of the topic – these are visible and active NGOs and manufacturers in the field of drinking water pumps. (The choice of the field, well, it has been described in the introduction how the author's problems with water triggered the subject.)

How does all this relate to science and technology studies? In a clearly straight-forward, constructivist way. What should be striking is that all NGO-developing country issues, all rural society – [appropriate] technology relation is socially constructed. We can never find given groups of people in a rural developing country, a given set of external actors and technologies.

A well-composed menu of different technologies is in least of the cases present, but it is not only the information that is missing; transfer/introductory capacity is often missing. But it is not only the possibility for a rational choice to be made that is hampered, rather that the choice it is heavily reliant on social interactions. The reality is that the composition of the list of alternatives is a complex social selection process. It is a result of internal power games as well as the work of external players that (together) the so called needs of the society are composed; these so called needs are then met with constructed list of alternatives where the items even for similar choices may be different. To show with an example: a village community in Zimbabwe as a group of human beings may look for a practical solution that helps increase access to permanent and safe drinking water; certain group of peasants in the same village may want to look for solutions that include pumping for vegetable

irrigation or for animals; the importance of quality over quantity may be a result of disease and health history in the community; other cultural factors can also depend on local values, beliefs attributed to water access and who can control it; and the list can go on and on. Apart from the internal dynamics of the community, there is then the fact that the cases we learn about are most often cases where an NGO with its accumulated experience of possible needs and feasible solutions, prejudices and expectation approaches a community, (hopefully) maps out the social relations and articulated needs and offers its list of a then-and-for-them-available water pumping technologies. Very likely simple, mechanical pumps and not integrated sewage systems, but if the NGO is a well-to-do private company or a government that for certain reasons plans to create a showcase, may just as well invest in a spectacular, hi-tech, high installation (and maintenance) costs system. Had such list of alternatives been conceived earlier?

Why a certain external development assistance partner emerges and why does he choose a given territory is once again far from being haphazard: historical ties emerging from colonial past, favorability of political situation (sometimes as down-to-earth as whether the activists of an NGO can receive a visa); accessibility of the territory – to mention just a few. (Even NGOs and governments when working to increase "water coverage", are interpreting this word differently: no wonder – it is technology based, whether a well or a pump or a certain member or non-member of a family is defined.)

What does it imply? How does this revelation help to provide water for those in need? An important conclusion is that despite the fact that we were focusing on rural societies where technological interconnectedness and reliance on technology therefore vulnerability is less present, we came to see that finding appropriate technology is far from an easy challenge; though at a common-sense first glimpse it may have looked so compared at a "technological society".

We have already known that an appropriate technology is understood as relative to a certain society. The *choice* of appropriate technology is thus lies in making limitations: limiting the extent of a society in number and in territorial aspect, but also in knowledge and skills they possess; the broadness of the group of agents

(technology diffusers, spreaders or transfer-agents). It is therefore the choice to engage in the activity of looking for appropriate technology as well as the actual decision that construct societies, technologies and fields of research.

Coda

So is the rope pump inappropriate for rural Nicaragua? Those management-theories that provide a map may be useful in concrete circumstances, but we should never forget, that the limitation of those societies, problems, set of technologies is arbitrary. Deconstructing technologies may very often prove useful for the analysis.

As for the pumps, they are proved to be practical solutions, but certainly to a limited extent. If it contribute to providing safe drinking water for at least a small proportion of the 1 billion in need: yes, bring together contributors and help disseminating this technology – or by dialogue, training and other means, raise the frontier of possibilities to include different ones as well.

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