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Implementing environmental technologies in development situations: The example of ecological toilets

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ABSTRACT

Traditional technology transfer models typically employ a four-stage approach: planning, selection, implementation, and evaluation. This paper examines the value of such an approach in promoting the use of environmental technologies in community development. The TepozEco Urban Ecological Sanitation Pilot Project in Tepoztlán, Morelos State, Mexico, provides a case study. Thirty interviews with recipients of ecological toilets, project staff and volunteers, and local and state government representatives were conducted during 2007. The steps required to implement this 'extreme' environmental technology are tested against traditional models of technology transfer. A revised model is proposed. This sets out an iterative process centred on the need to recognise evaluation at all steps and phases of the transfer process, not simply as one stage in a linear progression.

1. Introduction

The application of science-based innovations is widely accepted as offering powerful support for growth and development that improves living standards and increases the quality of life [1,2], and [3]. Indeed, the spread of innovations, including management practices, physical products, processes and services is widely recognised as a major driver of development [3,4], and [5]. Low-income groups often lack access to resources and developing countries commonly rely on the transfer of new technologies from developed nations [2]. Such transfers are promoted by non-governmental organisations (NGOs), national governments, international organisations and a multiplicity of other agents [6].

At the same time, much development around the world is now recognised as inappropriate and unsustainable in terms of its impact on the environment [7–9], and there is abundant evidence of the declining state of many natural resources as a consequence of unsustainable practices [8] and [10]. Indeed, most conventional development has sought to achieve economic growth without proper consideration of its ecological and social impact [11]. In the face of this situation, sustainability has now been accepted as an overarching goal of economic and social development. Supporters of this stance include United Nations agencies and many individual countries, corporations, businesses, and NGOs [8] and [12]. Technological innovations are an important means of achieving sustainability [13]; hence the adoption of sustainable technologies is a key element in translating sustainability into practice [5,14,15].

Against this background there remains a continued emphasis on the transfer of industrial-scale technology (see, for example [16–18]). Yet, at least to date, although there is evidence that industrial-scale technology transfer can increase a nation's GDP, it is not guaranteed to improve living standards and quality of life [2]. Furthermore, an increase in GDP invariably comes at the expense of environmental integrity or income equality. Schumacher in 1973 [19] argued in his seminal book, *Small is Beautiful*, the urgent need for small-scale, appropriate, sustainable technologies to improve the everyday lives of the poor. Almost 40 years later, that urgency has surely increased. Yet there is still a relative paucity of information regarding the transfer and

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implementation of small-scale appropriate environmental technologies. This paper aims to help fill this gap by using a case study of the successful adoption of an appropriate, domestic technology, to explore established approaches to technology transfer. The findings from this are then applied to develop an alternative transfer approach for appropriate technologies designed to better meet current social needs.

2. Conventional approaches

Research to improve environmental management is increasingly accepted as requiring a participatory approach involving intensive and prolonged interaction between scientists and community members (see, for example [20–22]). The transfer and adoption of an established technology, however, commonly remains reliant on processes framed by a number of similar approaches (see, for example, [2]). Most commonly, these involve four linear stages: planning the project, selection of an appropriate technology; implementation of the technology; and, usually, some form of evaluation (see Fig. 1).

Comprehensive planning is recognised as essential for the successful transfer of a new technology [1,2,23]. Planning includes an emphasis on the importance of a community assessment to identify the needs, aspirations and priorities of potential recipients and gauge the level of financial, technical and human resources available. Any assessment typically also includes consideration of the community's socio-cultural or religious norms and practices, the technologies available, and attitudes toward change and risk. Other factors including geology, soil type, and climate, have also been identified as potentially important [2,4,23].

The selection phase includes the choice of technology, identification of potential recipients, and determination of the project's scale and duration. Many authors emphasise the importance of the information acquired in the prior planning phase to support selection and ensure that decisions are appropriate to community needs and aspirations (see, for example, [2,19,24]). Traditional models of technology transfer also commonly emphasise the importance of community involvement in the selection of the technology [25–27]. Implementation involves the construction or installation of the new technology, usually accompanied by the training required to 'up-skill' potential recipients in its use [2]. Evaluation usually occurs after implementation (Fig. 1). It offers the opportunity for feed-back and so allows the modification and adaptation of the technology in any future programme. Some follow-up and technical support for recipients is also frequently proposed and incorporated in this phase [28,29].

3. Case study

The TepozEco Urban Ecological Sanitation Pilot Project was based in the town of Tepoztán, and offers a case study of the successful implementation of an environmental technology. The research described here involved 30 semi-structured, in-depth interviews, conducted over a ten-day period in April, 2007. Those interviewed included the majority of project staff (the director, the coordinator, the communications coordinator, a number of educators, an architect, a biologist, builders, and support facilitators); toilet recipients (males and females drawn from a variety of ages and socio-economic classes), local and state government representatives, and other community members. In most cases, logistical factors meant that toilet recipients were approached without prior warning and so only those at home at the time and willing to give interviews did so (see [30]).

Fig. 1. The traditional model of technology transfer.

A significant component of the project was based on the experience of a previous unsuccessful ecological toilet project in San Juan. Although little information was available from official records, there was physical evidence (in the form of the now poorly maintained toilets) as well as abundant anecdotal evidence from the recipients. One of the main criticisms of this earlier project was a lack of consultation with recipients in its design. Operation and maintenance education was scant and there was no follow-up technical support. Consequently, the toilets had quickly fallen into disrepair, compromising their use. Lessons from this earlier project were applied in the new project to increase its likelihood of success.

The interviews included an examination of the barriers encountered when introducing the toilets, how these barriers were overcome and the extent to which the project informed ideas concerning technology transfer. The interviews were conducted face-to-face and, where permission was given by those interviewed, recorded for future reference. A questionnaire specific to the role of each interviewee was designed with a clear list of issues to address and a series of open-ended questions. These issues were presented in a manner that allowed the interviewees to emphasise and elaborate any of their own particular concerns.

The project was organised and overseen by SARAR Transformación SC, a multidisciplinary Mexican consulting group, focused on water conservation and ecological sanitation. Between 2004 and 2006 SARAR built 30 dehydrating-style ecological toilets in the rural community of San Juan Tlacotenco (San Juan), near the town of Tepoztlán, approximately 80 km south of Mexico City (Fig. 2). Its principal objective was to establish within four years, a fully functioning example of urban ecological sanitation. The longer-term aim was to encourage the wider adoption of ecological sanitation systems in Latin America.

San Juan's population of 2000 is predominantly rural. Most residents are poor even by Mexican standards, with an average weekly family income of around MEX$1200 or US$90 (TepozEco staff member, personal communication, Tepoztlán, 11 April, 2007), and are involved in agriculture, particularly the growing of maize and nopal cactus (a staple vegetable crop). Mean annual rainfall is 1200 mm; however, virtually all of this falls between May and August, with little in the remaining eight months. There is no reticulated water supply, so residents capture rain water during the rainy season, but for the rest of the year must