Co-optimisation through increasing willingness, opportunity and capacity: a generalisable concept of appropriate technology transfer

Harn Wei Kua* and Nicholas A. Ashford

Center for Technology, Policy and Industrial Development,
Engineering Systems Division, Massachusetts Institute of Technology,
1 Amherst Street, E-40, Cambridge, MA, USA
E-mail: harnwei@mit.edu
*Corresponding author

Abstract: We proposed a methodological framework within which technology transfer could be evaluated, designed and implemented. With two case studies, we showed how when any of the factors of 'willingness', 'opportunity' and 'capacity', on the parts of the transferor and transferee, were overlooked or misjudged, success would be compromised. Finally, a scheme that focused on concurrently increasing these three factors was proposed as a checklist for selecting appropriate technology for transfer.

Keywords: appropriate technology; capacity; co-optimisation; opportunity; technology transfer; transferee; transferor; willingness.

Reference to this paper should be made as follows: Kua, H.W. and Ashford, N.A. (2004) 'Co-optimisation through increasing willingness, opportunity and capacity: a generalisable concept of appropriate technology transfer', *Int. J. Technology Transfer and Commercialisation*, Vol. 3, No. 3, pp.324–334.

Biographical notes: Harn Wei Kua graduated from the Technology and Policy Program and the Civil and Environmental Engineering Department of MIT. He is a faculty member of the Department of Building, School of Design and Environment, National University of Singapore.

Nicholas A. Ashford is Professor of technology and policy at MIT, where he teaches courses in environmental law and policy; technology, law and public policy; and sustainability, trade and environment. Dr Ashford is a Faculty Associate of the Center for Technology, Policy and Industrial Development in the School of Engineering; the Institute for Work and Employment Research in the Sloan School of Management; and the Environmental Policy Group in the Urban Studies Department. He holds both a PhD in chemistry and a Law Degree from the University of Chicago, where he also received graduate education in economics. Dr Ashford also holds adjunct faculty positions at the Harvard and Boston University Schools of Public Health.

1 Introduction – current studies on technology transfer

Co-optimisation is a concept introduced by Ashford *et al.* (1985) for devising win – win scenarios for growth and environment in technology development. The necessary and sufficient criteria for achieving co-optimisation were argued to be sufficient willingness, opportunity and capacity of key actors and institutions to change (Ashford, 1994, 2000, 2002). Technology is a composite phenomenon consisting of techniques, values, equipment and a manifestation of intellectual exchanges (Stewart, 1977; Streeten, 1991). To confine its definition to gadgets and pure engineering is to undermine the true implication and potential of technology transfer (TT) – one of the most invaluable bridges between the developing and developed worlds. As such, throughout this work, we use the term 'technology' to depict its multi-domain embodiment. We use the term 'transferor' for the party who provides most of the initial resource support, such as the technology prototype and idea for improvement, and 'transferee' for the party who initially receives the transferred technology.

Another way of understanding the complete embodiment of technology is through the engineering system perspective of analysis. Basically, engineering systems deal with diverse, complex, physical design problems that may include components from several engineering disciplines, economics, public policy, and other sciences. That is, an engineering system entails the incorporation of natural and physical systems, but is also developed in response to (and is regularly influenced by) social systems, which derive from and are governed by human behaviour. Thus, engineering systems are typically characterised by a high degree of complexity as well as unpredictable and often counterintuitive emergent behaviour. So, analysing TT within the framework of engineering systems implies examinations of the different ways and nexus by which the different issues and disciplines are interrelated. From this perspective, it is easy to understand that TT involves the transfer of social systems as well (Galtung, 1979; Karatsu, 1990; Mtewa, 1990), since technology is a means of narrowing the gap between developing and developed countries. Thus, TT has the potential of rectifying much of the economic challenges of many countries, regardless of their current stage of development (Goulet, 1977).

Extensive studies have been conducted on existing models of TT; this includes foreign direct investment (FDI), joint venture, turnkey contracting (Able-Thomas, 1996; Ozawa, 1985), international subcontracting and agreement licensing. Depending on the types of corporate strategies undertaken by the technology transferor, the same kind of TT model may give very different results. The three most common kinds of corporate strategies (Ghoshal, 1987; Porter, 1986) are international strategy, multi-domestic strategy and global strategy. Each of these differs in the extent to which the technology transferors retain their control in the transferee countries.

2 Common problems in TT

In his study of the TT challenges in Africa, Karani (2001) grouped the problems into five categories – inaccessibility of equipment, fragmented and disorganised labour force, lack of skilled labour, seasonal variation in the demand for labour and finished products (especially true in the construction industry) and hampering government policies for approval of new technologies. In fact, this may be the case for many developing countries in other parts of the world as well. Resistance to change (on cultural and/or social grounds) (Ibrahim, 1985), ability to manage the complex social and economic changes brought about by the new technology (Rodriguez, 1985) and poor level of participation and interaction by the transferors and transferees (Achebe, 1959) are some other significant problems.

Many of these problems, which will develop into constraints for TT, concern the three above-mentioned necessary and sufficient conditions for adoption or development of innovations – willingness, opportunity and capacity. For example, the first, second and third kinds of problems mentioned by Karani are problems related to the 'capacity' of the transferees; the fourth is a combination of all three constraints and the fifth is related to 'willingness' of the transferee to adopt the new technology. Of course, this may not absolutely be the case, as the willingness of the transferees may decide dramatically how 'opportunities' are seized and capacities built, even under less than perfect external conditions.

One of the greatest assets in successful TT is an acute sensitivity to dimensional differences of the cultures involved. Results of many of the prior studies can be understood easily in terms of the 'willingness', 'capacity' and 'opportunity' of the parties involved. Wicklein (1998) suggested seven criteria for designing appropriate technology in developing countries. They are

1 systems independence
2 apt individual technology versus collective technology
3 reasonable cost of technology
4 apt mix of single-purpose and multi-purpose technology
5 good image of modernity
6 reasonable risk factor that challenges the growth and development of local environment
7 good evolutionary capacity of technology.

The need for 'systems independence', 'apt individual technology versus collective technology', 'reasonable cost of technology' and 'apt mix of single-purpose and multi-purpose technology' is instrumental because it takes into account the 'capacity' of the transferee. Having a 'good image of modernity', so that the transferor does not appear patronising, is very important, as it will affect the 'willingness' of the transferee to adopt and adapt the technology wholeheartedly. If the transferee sees a good prospect in using and improving the technology, he/she will be able to understand the extra 'opportunities' open to them in the future – for example, equipment upgrading and generation of higher income. However, the above-mentioned seven points presume that the transferor is already willing and capable of carrying out the transfer, and that he/she sees the opportunities to benefit himself/herself in doing so; this may not be the case all the time.

Eric von Hippel (1998) proposed using the concept of 'sticky information' and the Lead User Method (Scheraga *et al.*, 2000) to treat innovation and TT as a distribution of activities between transferors and transferees. He defined three possible patterns in such an activity allocation process:

1 manufacturer-based design
2 iterative user and manufacturer-design
3 user-design.

'Manufacturer-based design' means that the manufacturer designs a product or service according to market feedback and in-house knowledge. In a sense, this is empowering the transferor (who may be, or may be related to, the manufacturer) with knowledge and thus capacity to design an appropriate technology. However, it is unclear how the transferee's 'willingness', 'capacity' and sense of 'opportunity', and the transferor's 'willingness' and 'opportunity' can be enhanced concurrently to ensure success in this pattern. The 'iterative user and manufacturer-based design' shifts the problem-solving activities between the manufacturer's and transferee's sites. While transferee's 'capacity' and 'willingness' may be enhanced, it is still unclear how the manufacturer's 'willingness' and 'opportunity' in the investment can be maximised. 'User-based design' allows the transferees to develop a new product or service that satisfy their own needs. Very likely, the transferees' 'willingness' and 'capacity' can be maximised. However, unless the information that the manufacturer provides permits the transferee to see the 'opportunity' of benefiting from the technology, which is usually more effective via a demonstration project in the community itself and not just by sharing of information, this pattern may also fail.

3 The basis for selecting appropriate technologies

'Appropriateness' of technology is a quality perceived by both the transferor and transferee. The transferee must feel capable in handling the effects brought about by the technology. One must see a value in adopting changes – an 'opportunity' to obtain certain needs, wants or aspirations. Above all, one must be 'willing' to live with these changes, within the framework of existing cultural and social mores. The 'willingness' of the transferor may be determined by one's ability to see the investment 'opportunity' in the transferee country, via the kinds of technology the latter needs and wants most. However, no TT will be successful if the transferor cannot fully appreciate the constraints faced by the transferee and has the capacity to develop a technology especially for the transferee.

The issues of 'willingness', 'opportunity' and 'capacity' concern both the transferor and the transferee. How can the needs to enhance 'willingness', 'opportunity' and 'capacity' lead to a selection of appropriate technology that the transferee can further develop in a sustainable way?

Madu (1988) extended Van Gigch's systems paradigm to fit the general structure of TT. In his model (p.60), after identifying the development problems of the community in question, the long- and short-term needs should be defined based on factors such as cultural and value system, availability of resources and socioeconomic factors. The goals and objectives, in accordance to the wants, needs, aspirations, priorities and other related factors, are determined, before the search and generation of different options of technology to be transferred begin. We feel that the transferor has a more proactive role to play – in helping the transferee to define its needs; the transferor should aim to introduce the former to more opportunities of solving the identified problems. These opportunities may be in the form of new ways of using indigenous resources, new technology or ways of conducting community projects learnt from similar communities residing in a different part of the world. In fact, before the transferee is to be willing to change from the status quo of doing things, the transferor must make the transferee see the opportunity of gaining what the transferee wants via these changes. Of course, this is only possible provided the transferor has the 'willingness', 'opportunity' and 'capacity' to initiate this.

In general, if the technology is developed in such a way that the transferee finds it reasonably easy to learn the new skills required, then one can say that the transferee's 'capacity' has been addressed. If the technology, besides meeting the main objectives that are identified, serves to 'open the transferee's eyes' to more opportunities for future development, the transferee's 'opportunity' can be said to have been addressed. Finally, if a technology is developed within the existing cultural norms of the transferee communities, it is said to have addressed the 'willingness' of the transferee. Ideally, the technology that is to be transferred must consist of all these three elements.

Using two case studies, we shall analyse how thinking in term of 'willingness', 'opportunity' and 'capacity' can assist us to understand the outcome and progress of the TT better, and determine the appropriateness of a technology according to the dynamic nature of the transferor's and transferee's positions, concerns and constraints.

4 Case study 1: *Sisal fibre-reinforced concrete roofing tiles in Tanzania*

When these new products were developed in the partnership between Tanzania and a European multinational corporation (MNC), most of the marketing effort was targeted at major construction companies. The problem was that many small-scale construction projects obtained their supplies from independent building materials vendors (a common sight along the sides of major highways, such as Bagamoyo Road, which runs along the east coast of Tanzania). The small vendors had no access to the technologies. A lack of knowledge on the part of the vendors meant that this new technology could not reach a large consumer group. The main reason behind the popularity of roadside building material vendors was the lower cost. Building elements, such as tiles, were usually made with very simple, hand-operated machines made by the vendors themselves. Therefore, if sisal fibre reinforced tiles were to infiltrate into the market, these vendors must find the technique accessible and viable with existing methods of production.

However, in order for the vendors to explore the new technology, consumers must first indicate an interest in the innovation, and find the new tiles easy to work with in the field; for example, the sisal fibres in the tiles must not pose extra difficulties in shaping and cutting with simple field equipment. That is, consumers must be willing to convert. Since the 'capacity' and 'opportunity' of one of the key stakeholders – vendors – were not addressed by this transfer effort, it was to no surprise that sisal fibre reinforced roofing tiles did not find their way to many houses.

Any 'opportunity' that the vendors see in the new roofing tiles reflects the 'willingness' in the consumers, whose further interest in turn depends on the 'capacity' of the vendors to produce trustworthy tiles; therefore, the initial marketing effort should 'break into this feedback cycle' and work with at least a few bigger vendors and villagers concurrently in order to give the product a reasonable publicity. Then again, this is possible only if the MNC has the required resources (capacity), and is willing, to connect to the vendors at this level.

After the partnership ended, the Tanzanian participants did attempt to produce the tiles locally, although still not at the vendor's level. However, they found that the iron moulds for shaping the tiles would have to be imported from the former transferor's country and the local producers could not afford them. This is an example of how the transferor's master plan, and thus 'willingness' and the priority of the 'opportunity' it sees in its investment, can change with time, posing obstacles in the overall TT effort.

5 Case study 2: *Promotion of solar cookers in Haiti*

A team from the Fairfield University, USA (Scheraga *et al.*, 2000), designed a project to introduce and promote solar cooking to the village of Fondwa, south of the capital city of Port-au-Prince, Haiti. One of the reasons behind selecting Fondwa as the transferee community was that the villagers had begun a village-wide effort to reforest the land around them, and had a leadership team that managed their daily affairs. Besides, the villagers had successfully undertaken projects such as the construction of water faucets at central points throughout the village to channel spring water from the surrounding hills, and constructing a gravel-paved road leading to the main road. In this sense, it was reasonable to assume that Fondwa had the 'capacity' to handle another community project. A survey carried out by the team indicated that the village management team had heard about the advantages of solar cooking, and the villagers were also familiar with the idea of using solar energy as the orphanage in the village had a solar cell that generated a few hours of electricity for use at night. In general, the villagers were 'willing' to give solar cooking an initial try. Hence, Fondwa had had the 'opportunity' to experience the benefits of solar energy before.

Before this project, a few members of the Fairfield team were involved in a similar project in Kenya, whereby jiko ceramic and metal stoves that used charcoal fuel more efficiently were introduced. Even though Fondwa provided a unique set of environmental challenges, the team had reasonable 'capacity' to handle a similar project. The 'opportunity' for the team to work hand-in-hand with the village management team was desirable, as it allowed the Fairfield team to redesign the cookers to suit the local conditions better.

However, the project overlooked several decisive factors. One of which is that solar cooking takes a longer time than when using charcoal, which implies that cooking for unannounced guests, a common occurrence in a communitarian society, is almost always impossible. Solar cooking also causes inconvenience while preparing breakfast and frying food. These factors seriously compromise the long-term 'willingness' of the villagers to adopt the new technology. Nonetheless, this project was successful in encouraging the villagers to venture into a large-scale bakery, which improved the village income considerably.

As the two real-world examples above have alluded to, the attitude of the transferee and transferor toward the same technology is very likely to change over time. By identifying their degrees of 'willingness', 'opportunity' and 'capacity' at every stage of the TT, strategies can be modified accordingly; this will ensure that the technology, or type of technology, stay as relevant as possible. The examples also show the significance of a systematic approach to the study, and a complete understanding of the attitude of the transferee and transferor.

6 Increasing the 'willingness', 'opportunity' and 'capacity' of the transferor and transferee

The heart of selecting appropriate technology is increasing the 'willingness', 'opportunity' and 'capacity' of the transferee and transferor. There are two stages in this process; each is based on the asking and answering of these questions:

6.1 Stage 1

This begins with the identification and articulation of problems that are to be solved by the TT. A list of possible technology solutions is compiled according to past experience of the transferee and transferor. This list comprises indigenous and 'foreign' technology. The objective of the selection exercise is to choose the most appropriate option for the TT purpose. The following questions are addressed in this stage:

- given the available resources and socioeconomic factors, can the identified needs or wants of the transferee be further expanded, by introducing to them more 'opportunities' for changes?
- has the transferee ever had any 'opportunity' to be involved in similar TT in the past?
- based on their cultural and value norms, will these additional opportunities be a threat to their social integrity?
- is their 'willingness' to change hampered by their inability to handle the new technology or reluctance to do things differently from preceding generations?
- how will their attitude, and thus 'willingness' and 'capacity', change in the near future and over longer times?

6.2 Stage 2

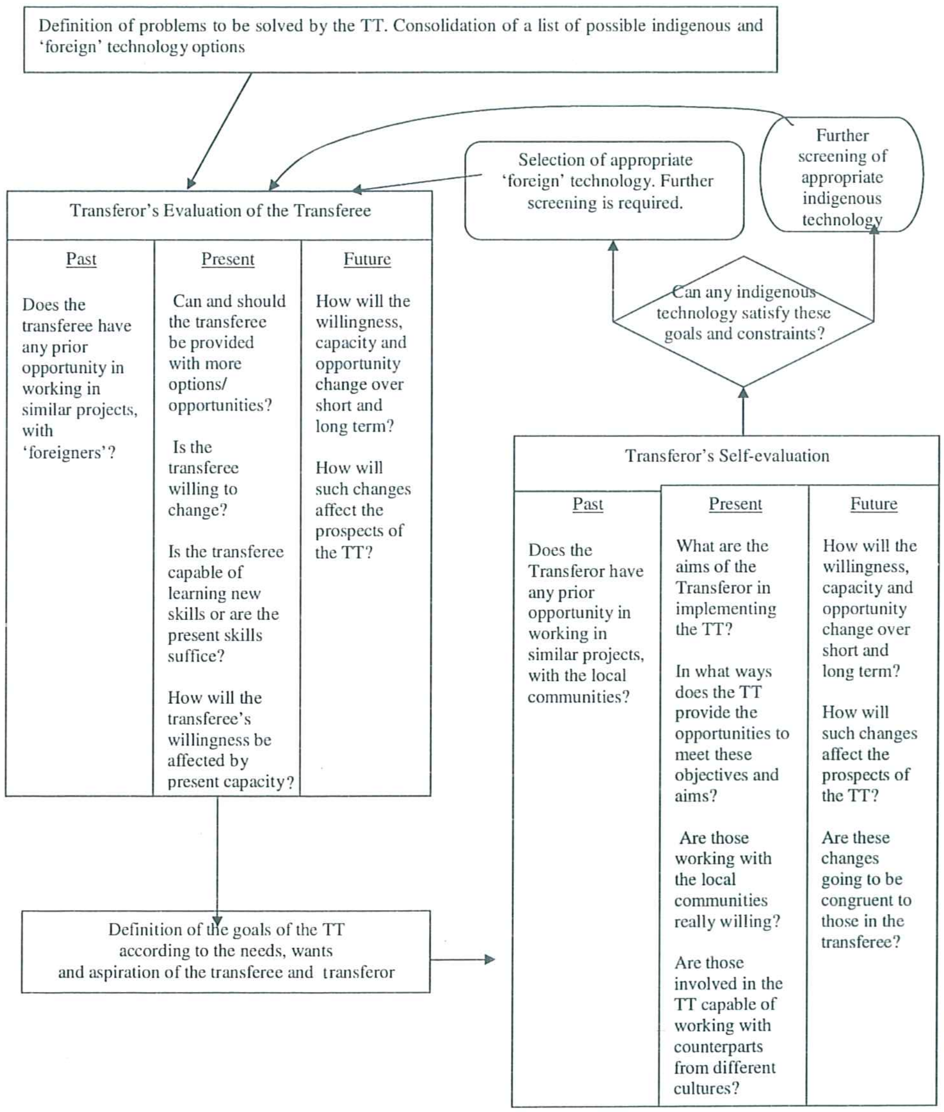
Without evaluating the technology as yet, the transferee must be clear of what are the needs, wants and aspirations that can be realistically satisfied based on the constraints identified above. The answers to the above questions will help to draw up the goals that the transferee can hope to achieve with the TT. Next, the transferor needs to self-evaluate to ensure that he/she is the right partner for the project. Addressing the following questions can do this:

- what are the types of technology that the transferor is 'willing' to and 'capable' of transferring, which can, at the same time ensure that the 'willingness', 'opportunity' and 'capacity' of the transferee to embrace the technology is enhanced, provide the transferor with the 'opportunity' to achieve his/her aims in transferring this technology?
- does the transferor have the 'opportunity' to work closely with the transferee on the project?
- has the transferor had any 'opportunity' to be involved in similar projects in the past?
- how will the attitude of the transferor change with time? Will these changes be congruent to those of the transferee?

Indigenous solutions should first be sought, before deciding on transferring a 'foreign' technology. As illustrated in Figure 1, regardless of which technology is finally selected, it is important to re-evaluate the attitude of the transferee and transferor based on the selected technology in order to further critique its appropriate.

To illustrate how this concept can be applied to a real-world problem, we examine the promotion of rice hush ash as affordable building material as a technology for transfer.

Figure 1 The concept flow chart for using willingness-, opportunity-, and capacity-co-optimisation as a selection process for appropriate technology for a TT project



7 Promoting the use of rice hush ash (RHA) as affordable and sustainable building material in developing countries

Rice husk is an agro-waste material that is produced abundantly worldwide, especially in Asia (Cook, 1986). Approximately 20 kg of rice husk are produced for 100 kg of rice. Because of the high silicon dioxide content, RHA has been considered as a cement replacement material. This is important for reducing reliance on cement since cement poses a financial challenge for many rural communities in developing countries, where the shortage of durable housing is most serious. For this very reason, RHA, amongst other agricultural materials, has long been studied as a technology option for transfer to developing countries. The ability to exhibit cementious properties is known as being pozzolanic. The pozzolanic nature of RHA has to be activated, or brought out. There exist many methods to activate RHA; the most common methods are via mechanical, chemical and thermal catalysis (Paya, 2000). In most studies on thermal activation, a mixture of RHA and cement or lime is subjected to curing under certain experimental temperatures. The degree to which RHA in the mixture is activated is indicated by measuring the remaining concentration of calcium hydroxide ($Ca(OH)_2$) of the mixture. It has been observed that higher curing temperatures tend to increase the pozzolanic activation. The more the RHA is activated in the mixture, the stronger it is mechanically, thus the more suitable it is for construction.

Conventional studies focused on the comparisons of the properties of such mixture samples under different curing temperatures. Recommendations are then made regarding an optimal set of preparation conditions, including curing temperatures. How useful is this approach to designing a technology that can be successfully transferred to the transferee?

For one, the equipment required for thermal curing may not be readily available in the transferee countries. Therefore, the experimental research should be modified while addressing the following questions:

- How will the local community prepare the mixture? Do they have machines with efficiency equivalent to the laboratory equipments with which the samples are prepared for studies? (This addresses the indigenous 'capacity' of the transferee).
- Regarding curing temperatures, how can the transferee achieve the desirable temperatures in order to activate the RHA to a satisfactory level for construction? Given their available native methods, what is the range of attainable temperatures, hence possible structural strength of the construction members? (This addresses the 'capacity' of the transferee; since it also allows the transferee to see the range of structural strength of the construction members made from RHA within which their present 'capacity' can help them achieve, it serves to introduce the transferee to more 'opportunities').
- According to the architectural and engineering norms of the transferee, in what ways are structural members normally employed? To achieve the required strength for these purposes, what are the ranges of curing temperature and RHA-cement mixing ratio required and how can these be achieved using existing technology? (This addresses the indigenous 'capacity' and 'willingness' of the transferee).

If the existing technology in the transferee community cannot yield satisfactory performance for which RHA – cement building materials are meant, then the transferor would need to consider transferring *new* technology[1] to facilitate the use of RHA. This technology would have to meet the following criteria:

- able to be learnt by the transferee (addressing the 'capacity' of the transferee to acquire new skills)
- able to achieve the investment aims of the transferor (addressing the 'opportunity' and 'willingness' of the transferor)
- presence of resources, for example capable staff members, to carry out education and interaction with the transferee community (addressing the 'capacity' and 'willingness' of the transferor)
- presence of core group within the transferee community who is not only keen on the idea but also 'willing' to work with the transferor (addressing the 'opportunity' of the transferor to work with the local experts).

In fact, similar questions can be posed for other kinds of technologies.

8 Conclusions

By increasing the 'willingness', 'opportunity' and 'capacity' of the transferee and transferor of a TT project at every stage of the TT process, the inadequacy of a chosen technology can be more accurately identified. The TT effort can then be rectified. As a result, appropriate technology can be selected. We analyse the degrees to which the 'willingness', 'opportunity' and 'capacity' of the transferees and transferors have been addressed and neglected in two past projects, which had experienced different degrees of success. We go on to show how this economic way of thinking provides a systematic framework in which a technology can be screened and current research effort directed.

Acknowledgements

H.W. Kua is indebted to the National University of Singapore Overseas Graduate Scholarship for supporting his work at the Massachusetts Institute of Technology.

References

Able-Thomas, U. (1996) 'Models of renewable energy TT to developing countries', *World Renewable Energy Conference.*

Achebe, C. (1959) *Things Fall Apart*, New York, NY: Ballantine Books.

Ashford, N.A, Ayers, C. and Stone, R.F. (1985) 'Using regulation to change the market for innovation', *Harvard Environmental Law Review*, Vol. 9, pp.419–466.

Ashford, N.A. (1994) 'An innovation-based strategy for the environment, worst things first? The debate over risk-based national environmental priorities', in: A.M. Finkel and D. Golding (Eds.) *Resources for the Future*, Washington, DC, pp.275–314.

Ashford, N.A. (2000) 'An innovation-based strategy for a sustainable environment, in innovation-oriented environmental regulation: theoretical approach and empirical analysis', in: J. Hemmelskamp, K. Rennings and F. Leone (Eds.) *ZEW Economic Studies,* Heidelberg, New York: Springer Verlag, pp.67–107.

Ashford, N.A. (2002) 'Government and innovation in environmental transformations in Europe and North America', in: D. Sonnenfeld and A. Mol (Eds.) *A Special Issue on Ecological Modernization, American Behavioural Scientist*, Vol. 45, No. 9, pp.1417–1434. Available at http://hdl.handle.net/1721.1/1579

Cook, D.J. (1986) *Rice Husk Ash. Cement Replacement Materials*, R.N. Swamy (Ed.), UK: Surrey University Press, pp.171–196.

Galtung, J. (1979) *Development, Environment and Technology: Towards a Technology for Self-Reliance.* New York: United Nations.

Ghoshal, S. (1987) Global strategy: an organizing framework', *Strategic Management Journal*, Vol. 8, pp.425–440.

Goulet, D. (1977) *The Uncertain Promise: Value Conflicts in Technology Transfer,* New York: IDOC and Overseas development Council.

Ibrahim, R.L.R. (1985) 'Computer usage in developing countries: Case Study Kuwait', *Inf. Manage. (Netherlands)*, Vol. 5, No. 5, pp.351–363.

Karani, P. (2001) 'Constraints for activities implemented jointly (AIJ) technology transfer in Africa', *Renewable Energy*, Vol. 22, pp.229–234.

Karatsu, H. (1990) 'Right tech: transferring technology that's needed', *Intersect,* October 10–13.

Madu, C.N. (1988) 'An economic decision model for technology transfer', *Engineering Management International*, Vol. 5, No. 1, pp.53–62.

Mtewa, M. (1990) *International Science and Technology: Philosophy, Theory and Policy,* London: Macmillan.

Ozawa, T. (1985) 'Entrepreneurship and technology on economic development', *Asian Development Review*, Vol. 3, No. 2.

Paya, J. (2000) 'Studies on crystalline rice husk ashes ad the activation of their pozzolanic properties', *Waste Materials in Construction*, UK: Elsevier Science Ltd., pp.45–55.

Porter, M. (1986) 'Changing patterns of international competition', *California Management Review*, Vol. 28, No. 2, pp.9–40.

Rodrigues, C.A. (1985) 'A process for innovators in developing countries to implement new technologies', *Columbia J. World Bus.*, Vol. 20, No. 3, pp.21–28.

Scheraga, C.A., Tellis, W.M. and Tucker, M.T. (2000) 'Lead users and technology transfer to less-developed countries: analysis, with an application to Haiti', *Technology in Science*, Vol. 22, pp.415–425.

Stewart, F. (1977) *Technology and Unemployment,* London: Macmillan.

Streeten, P.P. (1991) 'The impact of the changing world economy on technological transformation in the developing countries', in: H.W. Singer, N. Hatti and R. Tandon (Eds.) *Joint Ventures and Collabourations,* New Delhi: Indus, pp.39–56.

von Hippel, E. (1998) 'Economics of product development by users: the impact of 'sticky' local information', *Manage Sci.*, Vol. 44, No. 5, pp.629–644.

Wicklein, R.C. (1998) 'Design for appropriate technology in developing countries', *Technol. in Soc.*, Vol. 20, No. 3, pp.371–375.

Note

1 Note that in this case study, the 'starting' technology under consideration for transfer is the method of using RHA with cement for building construction. One of our conclusions is that additional technologies may be required to be transferred as well, so as to facilitate the transfer of the 'starting' technology.