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Review

Land reclamation efforts in Haller Park, Mombasa

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Land reclamation of derelict landscapes, until in recent times, was a rare experience, especially in developing countries. This has however changed with the adoption of environmental policies and legislative frameworks in most countries in the world. This drive was mainly inspired by the conservation strategies developed and promoted by the International Union for the Conservation of Nature and Natural Resources (IUCN). This article is a presentation of the findings and observations that led to successful land reclamation by the cement factory. Steps taken for this reclamation effort were of prime interest to the author and were retraced resulting in this position paper. A comparative approach is used, given the conventional methods that most projects of this nature employ. Most of the environmental and land degradation are caused by profit motivated industries who do nothing or very little to repair the damage caused in the course of their work. The Haller Park at the Bamburi cement factory in Mombasa, Kenya is a rare success of land reclamation in Africa. The common approach in land reclamation in the past 20 years has been through the use of economic valuation techniques such as the contingent valuation method (CVM) to put a value on public goods such as land. This technique is done through the employment questionnaires that solicit for the willingness to pay (WTP) or the willingness to accept (WTA) from the affected respondents. This technique may be used together with a travel cost method (TCM) that is an indirect method that attempts to find the price for an environmental good. In this case no such method was used, but the result is a big success perhaps owing largely to workable strategies by the cement factory. The steps taken, using selected plant species, to reclaim the derelict landscape, resulting from excavation for limestone required for the cement factory are traced to give the perfect park for tourists, both local and foreign.

Key words: CVM – contingent valuation method, TCM- travel cost method, WTP- willingness to pay, WTA- willingness to accept.

INTRODUCTION

Land reclamation schemes usually seek to restore an abandoned and derelict landscape as close as possible to the original state so as to offer alternative land use options. Further, land reclamation may seek to reclaim additional landscapes for modification to alternative use, such as in the case of Dutch Dykes and the most recent Palm Island Project in Saudi Arabia.

Land dereliction may occur as a result of long periods of anthropogenic activities like quarrying and mining or due to natural effects such as a receding ocean and erosion. Land reclamation efforts therefore involve re-grading spoilt heaps, cultivation, tree planting and any other such measure that will restore landscape beauty.

Intervention decisions for carrying out land reclamation schemes in the last two decades have often been reached through the use of economic valuation techniques such as the contingent valuation method (CVM). Through this method, one solicits measures of willingness to pay (WTP) or willingness to accept (WTA) an environmental improvement by way of a direct questionnaire to both likely users and non-users respectively. This method is widely used in other environmental programmes such as water quality improvement and natural resource utilization schemes like hunting and fishing.

The cost of reversing land degradation in any given situation is of interest to economists. The CVM technique has, in recent times, been the common tool as an evaluation technique. The success is therefore a lesson for environmental managers in industry, natural resources managers and biologists at large.

The Haller Park, in Mombasa, offers a unique lesson in land reclamation. This discussion looks at the success of the land reclamation that has resulted in the Haller Park without a prior economic valuation survey. This is not to say that the cement factory did not make economic consideration for the creation of the Haller Park. The

Figure 1. Aerial view of Mombasa.

article is not any way a critic of the CVM technique or a demonstration that the CVM is not necessary for economic evaluation of public goods. It is however, an attempt to demonstrate that intervening decisions by an institution can equally yield desired results. It is written as a point of view and not from empirical data about land reclamation.

THE HALLER PARK, BAMBURI

Situated in Bamburi, 10 km north of Mombasa, on the Mombasa - Malindi road along the Indian Ocean coastline is the Haller Park. The Park, named after founder Dr. René Haller, is a success story of the land reclamation effort by the Bamburi cement factory. The Park is now part of a large complex of Baobab farm, comprising Bamburi forest trails, the farm and the park under the Lafarge Ecosystems (Figure 1).

Mombasa is a coastal city in Kenya, Africa, on the Indian Ocean. The city is situated at 4 degrees South and 39 degrees East. The area has two wet seasons, with an average rainfall of 750 - 2000 mm per annum. The temperatures vary from 18 and 32°C (Haller et al., 2001).

The Bamburi cement factory opened four years after feasibility studies in 1954. The factory raw materials are mainly Pleistocene coral limestone and Jurassic shale clay, which were exposed when the sea receded some 130 - 200 million years ago. Quarrying for raw materials is done up to 30 and 50 cm above groundwater level. The resulting ground water in the quarry is saline and connected to the Indian Ocean aquifer through the porous coral rock layer that is below. This created a sterile and inhospitable wasteland. From its inception, the resulting open quarry pits were a source of concern for the cement factory management because of the damage they were causing.

DECISION CRITERIA

The results from quarrying activities by the cement factory, revealed the environmental damage that the industry had done to the landscape. To address this concern, management created an Agriculture and Garden Department. The initial task for the new department was to supply factory staff and their families with fresh farm produce, but above all to take care of the factory environment, especially the excavated quarries.

LAND DEGRADATION CONCEPT

Land degradation implies loss of land productivity through various processes, such as erosion, salinization, waterlogging and nutrient depletion, deterioration of soil

Figure 2. Quarrying for limestone in Bamburi.

structure and pollution. In the case of the Bamburi Cement Factory, land degradation is as a result of quarrying (Figure 2).

Dudal (1981), notes that land degradation, globally, is the most serious problem in recent years. Most accounts of land degradation are given only in physical measures. He further notes that land degradation processes are largely driven by man-made activities. Natural factors are the least contributors as opposed to human induced. The cost of reversing any environmental change is what matters to most land economist. The empirical data at a project level may be used to make rational decisions directly related to an environmental good. The cost-benefit analysis, for example, is one such tool for economic analysis that is well established and relies on CVM techniques to estimate the social benefits of environmental goods. The resulting macro-economic policies and global assessments rely on empirical data from such methods.

HALLER PARK LAND RECLAMATION PROCESS

Land reclamation started in 1971, by initially planting 26 tree species in open quarries. After six months only three species had survived. These were *Casuarina equisetifolia* sp., *Conocarpus lancifolius* sp. and coconut palm. *Casuarina* sp. was identified as a better pioneer because it can tolerate saline water despite being adapted to dry conditions; it can fix atmospheric nitrogen in the root system; it is an evergreen tree which constantly drops and renews foliage; and it grows fast, reaching 2 m in six months.

The *Casuarina* tree or 'Whistling Pine', *C. equisetifolia* originated from Australia, but is now a common tree along the East African coast. *Casuarina* trees have leaves with high tannin content (Figure 3). This makes their decomposition by micro-organisms difficult. In order to contain the problem, the Millipede (*Epibolus pulchripes*) was introduced, which was able to digest the *Casuarina* needle leaves and create the desired humus for the system (Figure 4). For more than 20 years humus has been created partly in this way.

As a result of the re-vegetation, insects and other life forms colonized the initial two square kilometers area which was under rehabilitation. The most important fauna were fruit bats and monkeys which acted as seed dispersers for plants and trees not initially planted. By 1989, systematic introduction of indigenous coastal vegetation began. By the year 2000 more than 300 indigenous plant species had been introduced, 30 species of mammals and 180 species of birds had found a home in the park. Some of the animals were introduced as 'orphans'; others took refuge while some were deliberately introduced.

Table 1 shows the species in the park as at 2001. Some of these have been introduced while others have invaded the park and found their respective niches.

Figure 3. The millipede.

Figure 4. Casuarina tree plantation.

Table 1. Park species diversity.

No.	Species	Species introduced	Stock end of 2000
1	Trees Planted	-	2 200 000
2	Indigenous	320	-
3	Palm Trees	100	-
4	Mammals	27	-
5	Birds	180	-
6	Crocodiles	-	2 500
7	Snakes	30	-
8	Eland and Oryx	-	210

Source: Industry and Nature Bamburi Cement, 2001.

LAND USE

Although the Haller Park is a tourist attraction it was not the original vision of the company in carrying out the land reclamation. Its main aim was to re-vegetate the area with suitable tree species and other forms of flora and fauna in order to mitigate the impact of land degradation. The resulting beauty, together with the fascination of the man-made ecosystems, attracted visitors desiring an afternoon recreation break and prompted the beginning of the initial nature trails.

By 1977, the Garden Department was seen as a potentially self-sustaining economic enterprise and was incorporated into a company, the Baobab Farm Limited. By 2000, the park land use involved tourism, game farming and a complex aqua-culture system involving fish, crocodile and paddy rice farming.

Over five years from 1997 the cement factory spent US$12 million on various environmental improvements (Baer et al., 2001). These have been mainly in six areas, namely: dust suppression in the factory, road-work improvements, factory environment improvements, quarry rehabilitation, beautification of the surrounding area and waste recycling.

The integrated aqua-culture farming system is unique in that it is a self-cleaning system, using and recycling the brackish groundwater as a medium. The groundwater is pumped into the fish farm; from there it flows through crocodile tanks and is finally re-circulated through rice paddies and Nile cabbage ponds back to the pumping site. The fish species, the tilapia, is a prolific breeder and can tolerate saline/brackish water. From this comes a higher concentration of nitrates dissolved in water. The crocodile ponds produce high concentrations of dissolved phosphates because of the feeding habits of crocodiles. Combinations of these nutrients fertilize the paddy rice fields and the 'Nile' cabbage filters the rest. The water is initially pumped into the fish tanks, and then circulates by gravity through a network of ponds interconnected with small canals. The circulation is assisted with a pump into the fish ponds. The Nile cabbage is regularly harvested as manure for the banana plants. This keeps the system run purely on biological principles as no pesticides or chemical fertilizers are used.

The Park makes additional income from over 90 000 visitors who visit per year. Other income comes from the sales of fish, crocodile meat and skins, rice, fruits, vegetables, *Casuarina* poles, firewood and ornamental plants.

CVM TECHNIQUES

CVM techniques were first used by Davis (1964). The technique relies on a well prepared and designed questionnaire, which is presented directly to individuals about a well defined public good. All individuals will respond to the same situation.

The analysis of CVM results is often straight forward. The method relies on responses to hypothetical questions on the improvement or decrease of a defined environmental good. CVM techniques may be used together with the Travel Cost Method (TCM). Unlike the CVM techniques the TCM is an indirect method that assumes that travel costs of a visitor to a site of a public good such as park or a lake can be used to as a proxy for a price of an environmental good. Such a price can be used to derive a demand curve.

LESSONS FROM THE HALLER PARK, BAMBURI

In land reclamation and related schemes intervention by local authorities or government, where economic valuation methods are employed, one observes that these are more common in the developed northern countries as compared to countries in the south. The reasons may be many but it is important to point out that this could be due to their capacity to handle such interventions. Apart from this one would probably be right to speculate that there is a sense of ownership of environmental goods by respective communities. In addition one may argue that, respondents in the developed north experience higher incomes and have a wider education base and that there

is a basic difference in the resource utilization in respective cases. Subsequently, economic valuation results from such efforts are often quite reasonable.

Pearce (1989), in the Polluter Pays Principle, argues that the idea of charging polluters in the developing world is no less applicable because fiscal authorities tend not to have the institutional capacity to implement them, even if they were an article of an environmental policy. Similarly, when employing CVM methods in carrying out environmental improvement assessment, responses in the developing world would more often than not be less than the economic cost of such an improvement because of low individual incomes. However, in cases where individuals experience the welfare benefits from an environmental improvement or a natural resource management plan before the assessment, the CVM is likely to be positive (Siachoono, 1995).

CVM methods have been used in Africa (Siachoono, 1995; Brown et al., 1989), but these have been used jointly with other methods like the Travel Cost Method (TCM), with a bias to foreign tourists to estimate a reasonable consumer surplus.

Mitchel and Carson (1989) discuss in detail the use of CVM in surveys to value public goods and the relation with welfare economics. They argue that CVM has many advantages because of its reliance on controllable variables. However, they caution that methodological imperatives require that the scenario be understandable and meaningful to the respondents and free of incentives which might bias the results.

The adoption of realistic environmental policies by the majority of governments in the developing world was only realized after the publication of the World Conservation Strategy in 1980 by the International Union for the Conservation of Nature and Natural Resources (IUCN). This document created opportunities for respective governments to make their own national strategies that led to the evolution of environmental policies. Lessons from the Haller Park show that individual institutions can evolve workable policies that will yield desired results. In this case, the set up is a private initiative hence the parameters were none existent and sustainability was assured. However, this is not to say that land dereliction caused by natural forces, or external causes like acid rain in northern Europe, does not need environmental assessment intervention by concerned authorities.

CONCLUSION

In land reclamation efforts, one may classify such efforts into two views. The first view would be the Dutch experience of creating land where none existed before, using polders (Volker, 1982). This is a sophisticated form of land reclamation found mainly in low-lying coastal areas, river valleys, marshes, tidal embankments and gulf areas. Most of these areas have a high potential for agriculture. These methods are common in Egypt, Bangladesh, Thailand, Venezuela, Japan and the traditional home of the dykes in Holland. One may also include the recent success in Dubai of creating Palm Island in the ocean.

The second view is land reclamation for derelict landscapes which are a result of land degradation through natural or man–made activities. These include erosion, salinization, water-logging, nutrient depletion, deterioration of soil structures through quarrying and open pit mining and pollution as seen in acid rain in northern Europe (Bojo, 1991). Successes from such efforts are seen and described in physical terms and may be used as data for economic evaluations. These can in turn contribute greatly to environmental evaluation methods and impact on land management.

CVM and other economic valuation techniques for environmental assessment require that participants understand the problem. Education therefore becomes a critical factor. Secondly, income levels experienced by respondents may have a bearing on the results in that in most cases the economic value will not be realistic. Thirdly, institutional capacities in the developing countries are limited unless outside help is obtained. However, sustainable development can only succeed in a given area if the methods of environmental improvements are employed. The Haller Park is a living and exceptionally unique example of sustainable development because of the internal policies of the Bamburi Cement Factory.

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