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# An Analytical Study on Cultural and Financial Aspects of Roof Gardening in Dhaka Metropolitan City of Bangladesh

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## ABSTRACT

The green cover of urban areas around the world is being replaced with concrete and brick. Urban dwellers no longer live and work intimately with the plant that provide the oxygen they breathe, the clothes they wear, the food supply they find so abundantly around them. Dhaka - being an over populated city, meanwhile has exceeded her carrying capacity. Roof gardening is fashionable activities mainly for the solvent people. If the city dwellers are well motivated in roof gardening, it may potentially contribute in changing the highly polluted capital city into healthy one. In this regard, a sort of government and non-government support is required to train and motivate people with regards to technical aspects of roof gardening including marketing. The study clarifies physical and cultural aspects of roof gardening. It also clarifies that roof gardening is financially viable in addition to amenity and recreational gain.

**Key Words:** Roof gardening; Dhaka; Cultural aspect; Investment; Return

## INTRODUCTION

Dhaka - the capital of Bangladesh is one of the most densely populated cities in the world. The Metropolitan area of Dhaka is about 1,500 $km^2$ out of which Dhaka City Corporation (here after DCC) includes an area of 360 $km^2$ (Alam, 2000). The population of the Dhaka Metropolitan area and DCC is about 10.9 and 8 million, respectively. Rapid population growth, migration and poor urban planning of Dhaka city resulted in unhealthy and fragile environment which is alarming to the city dwellers (Gupta, 1992; Khan & Titumir, 1992). Yet almost without exception, people have the desire to be near green foliage (Bienz, 1980).

The planners have recognized the values and importance of greening its immediate surroundings for aesthetic, economic and protection purposes (Gupta, 1992). Initiatives like urban afforestation programs have played and is still playing vital role in this context. Agricultural Extension Division offers training and necessary logistics to the individuals for roof gardening and horticultural development. Roof Garden Association in Bangladesh is also playing vital role focusing technical and financial aspects of roof gardening. Besides, mass media are playing important role on small scale agricultural practices in homesteads of the country. Until now technical aspect of roof gardening are not well known to the public. However, in USA, UK and other developed countries roof gardening is profoundly developed (www.miller-roofing.com).

Roof gardening is an art and science of growing plants on the fallow spaces within, surrounding or adjacent to the residence, most often referred to as a garden. Other conventional areas of roof gardening include atrium, balcony and window boxes. Plants are grown for a variety of utilitarian and non-utilitarian purposes. Roof gardening differs with farming in terms of scale i.e. gardening can be a hobby or an income supplement, but farming is a full-time commercial activity involving more land and quite different practices (www.campusprogram.com/reference/en/wikipedia/gardening.html). This study has been conducted to (i) present an overview of roof gardening in Dhaka city of Bangladesh along with its cultural aspects, and (ii) make a financial analysis of roof gardening.

## MATERIALS AND METHODS

This is a maiden attempt in doing such research in Bangladesh perspectives. Hence, there is a lack of previous research and background information. This research is based on information and materials collected through physical observation and interview with target groups. Efforts were made to estimate the total residential and other functional building communicating directly to DCC office. Information on roof gardening like, size, composition, cost, out turn, etc. was gathered through individual household survey. While surveying Dhaka city is subdivided into five residential zones viz., 1. Mohammadpur, 2. Mirpur, 3. Tejgaon, 4. Gulshan and 5. Old Dhaka. Using a semi structured questionnaire, survey was conducted selecting 100 households randomly from each zone; thus a total of five hundreds households were surveyed for this study.

## RESULTS AND DISCUSSION

**Roof gardens in Dhaka city.** Estimated number of housing plots in DCC is about 186,000 (plot size 4.5-7.5 decimals) out of which 80% plots (i.e., about 148,800 plots) are already used for housing (DCC, 2004). Among the houses, more than 85% are residential buildings and 15% are institutional buildings (private and public). The residential buildings are mostly in private possession and few residential buildings are government official staff quarters. The survey shows that out of 500 households, on an average only 12% of the houses are bestowed with gardens either in roofs or in balconies; majority found in expensive residential areas (e.g. in Gulshan area 25% houses with garden). The summarized result of the survey on roof gardening is shown in Table I.

**Purpose of roof gardening.** Roof gardening is a leisure time activity that involves minimal off farm physical labor. The plants contributes in reducing thermal temperature to its immediate surroundings, intercepts or act as a screen for dust reservoir, abate noise pollution, reduce reflection, etc. Olembo and Rham (1987) opined that the urban areas characterized by concrete and associated materials accumulate heat with high reflectance. Trees have a positive effect in ameliorating environmental conditions (Zabala, 1990). Vegetative cover plays an active role as a vehicle for reducing atmospheric carbon and there by mitigating its build up (Sedjo, 1989; Pant, 1994). Wenger (1984) reported that the glare from the sun through the window can be controlled with pot plants. Thus along with aesthetic and economic potential of roof gardening, environmental significance is also noteworthy. Result of investigation on purpose of roof gardening is shown in Table II.

The result shows that major purposes of roof gardening are passing leisure time (100%), creating aesthetic values (100%), contributing in environmental amelioration (45%) and financial gain being a very minor concern (4% only).

**Cultural aspects of roof gardening.** Roof gardening is not an easy going activities like conventional gardening as it's success largely depend on suitable species selection, appropriate containers, proper cultural methods and sufficient supervision and control. It is found that the roof gardening materials (e.g. seeds, seedlings, vegetative parts, containers, soils, fertilizers etc.) are usually procured from abroad by the commercial nurseries. The survey reveals that 95% roof gardeners use materials procured from abroad. The users aware that the species should be of bushy, shade tolerant, ornamental and high yielding nature. It is found that for roof gardening in DCC, 83% earthen containers, 5% cemented bed, 4% drums, 5% brass made pots and 3% others are in use. The amount of fertilizer and pesticides to be applied depend on the nature of species and soil mixture (Zabala, 1990). Bienz (1980) opined that suitable growing medium must be prepared ensuring sufficient water and mineral elements. It is found from the study that the practitioners mostly prefer to use the seedlings (65%) for roof gardening followed by propagated materials (25%) and direct seed sowing (10%).

**Financial analysis.** The analysis is done in order to have an insight whether roof gardening can be considered as a supplementary economic activity in urban society. With a view to know the types of people and their socio-economic status involved in roof gardening, the interviewees were categorized into three major groups depending on annual income (Table III).

It is found that a large portion of the roof gardener belongs to middle class category having their own houses (75%). Lower class is less interested in roof gardening activities because they lack of own residence and even if they possess, most of them are not pucca building i.e. not suitable for roof gardening.

**Capital investment (fixed cost).** The capital needed for

**Table I. Summary of survey on roof gardening in DCC**

| Name of the Zones | House surveyed (No.) | House without garden (No.) | Houses with roof garden | | | House having garden (%) |
|---|---|---|---|---|---|---|
| | | | In roof (No.) | In balcony (No.) | Total (No.) | |
| Mohammadpur | 100 | 88 | 4 | 8 | 12 | 12 |
| Mirpur | 100 | 92 | 4 | 4 | 8 | 8 |
| Tejgaon | 100 | 90 | 3 | 7 | 10 | 10 |
| Gulshan | 100 | 75 | 9 | 16 | 25 | 25 |
| Old Dhaka | 100 | 95 | 2 | 3 | 5 | 5 |
| Total | 500 | 440 | 22 | 38 | 60 | 12 |

Source: Household survey, 2004

**Table II. Purpose of roof gardening**

| Purpose of raising roof garden | Respondents agreement(%) |
|---|---|
| Leisure Time | 100 |
| Psychological Health | 20 |
| Aesthetic Value | 100 |
| Environmental amelioration | 45 |
| Luxury | 15 |
| Financial gain | 4 |

Source: Household survey, 2004

**Table III. Distribution of roof gardeners with respect to income**

| Social class | Annual income range(Tk.) | Percentage (%) |
|---|---|---|
| Lower class | 36000-84000 | 15% |
| Middle class | 85000-180000 | 75% |
| Higher class | >180000 | 10% |

Source: Household survey, 2004

roof gardening is not as much as heavy industry or as other business. However, initial investment varies from garden to garden depending on the size, gardener's taste, species etc. The fixed costs for roof gardening includes the cost of cemented planting base preparation or procuring container, seedlings or vegetative parts, planting tools (e.g. hoes, spades, sprinkles) etc. Table IV shows the fixed costs required for roof gardening.

**Variable cost.** Variable costs for roof gardening are the cost for weeding, hoeing, watering, manuring, insecticide, replanting etc. The study identifies the following variable cost needed for roof gardening (Table V).

**Opportunity cost.** When gardeners spend the gardening time for another job and get some wages then this wage is the opportunity cost of roof gardening. Generally the urban dwellers work in garden either in morning or evening which is their leisure time. Moreover, they enjoy while gardening. Therefore, for roof gardening, the opportunity cost seems to be zero.

**Time value.** The return from the gardening starts within three months after investment because of using grafted plants. If money is deposited into bank then returns (interest) comes yearly and when compounding the roof gardening return annually it seems that roof gardening is more profitable. When intangible benefits (e.g. recreation and other non-parametric values) are considered it will be much higher.

**Return and profit.** Generally very few people consider roof gardening commercially to get profit. The return varies due to size and number of species. This analysis is done on the basis of average production and current price derived from current financial market (Table VI).

It is found that on an average 20,083 Taka year$^{-1}$ (Taka is Bangladesh currency; 1 US$ = 60 Taka, hereafter as Tk.) is derived from each roof garden against an average yearly cost of Tk. 6,720 (Table V) excluding fixed cost. So yearly neat profit from roof gardening is Tk.13, 363 (i.e. 20,083 - 6,720) which is financially attractive as a small scale venture as no active labor is required. From Table IV, it is seen that the average fixed cost for roof gardening is Tk. 9, 440. If this amount of money is borrowed from the bank at current lending rate (i.e. 8%), then interest becomes

**Table IV. Fixed cost for roof gardening**

| Garden size (sq.m) | Social class | Frequency | Investment range (Tk.) | Class average(Tk.) | Mean investment(Tk.) |
|---|---|---|---|---|---|
| 75-150 | Lower class | 75 | 265,000 | 3,533.33 | 9,440 |
| 151-280 | Middle class | 375 | 3,375,000 | 9,000.00 | |
| >280 | Higher class | 50 | 1,080,000 | 21,600.00 | |

Source: Household survey, 2004

**Table V. Variable costs for roof gardening**

| Types of cost | Garden size (sq.m) | Cost (Tk.year$^{-1}$) | Class average(Tk.year$^{-1}$) | Total Average cost (Tk.year$^{-1}$) |
|---|---|---|---|---|
| Watering | 75-150 | 720 | | |
| | 151-280 | 840 | 1,020 | |
| | >280 | 1,500 | | |
| Use of fertilizer | 75-150 | 1,500 | | |
| & insecticide | 151-280 | 2,040 | 2,100 | 6,720 |
| | >280 | 2,760 | | |
| Seed collection, planting & maintenance | 75-150 | 2,820 | | |
| | 151-280 | 3,600 | 3,600 | |
| | >280 | 4,380 | | |

Source: Household survey, 2004

**Table VI. Financial return scenario in roof gardening**

| Types of products | Garden size (sq.m) | Social class | Return | | | |
|---|---|---|---|---|---|---|
| | | | return range (Tk.year$^{-1}$) | Mean of the range (Tk.year$^{-1}$) | Class mean (Tk.year$^{-1}$) | Mean total return (Tk.year$^{-1}$) |
| | 75-150 | Lower | 1,200-16,000 | 10,000 | | |
| Flowers | 151-280 | Middle | 1,200-20,000 | 8,300 | 6,933 | |
| | >280 | Higher | 1,200-4,800 | 2,500 | | |
| | 75-150 | Lower | 1,200-24,000 | 8,200 | 5,550 | |
| Fruits | 151-280 | Middle | 1,200-12,000 | 4,850 | | |
| | >280 | Higher | 1,200-7,200 | 3,600 | | 20,083 |
| | 75-150 | Lower | 1,200-20,000 | 6,300 | 5,567 | |
| Vegetables | 151-280 | Middle | 1,200-18,000 | 6,700 | | |
| | >280 | Higher | 1,200-7,000 | 3,700 | | |
| Cuttings & others | 75-150 | Lower | 1,200-6,000 | 2,100 | 2,033 | |
| | 151-280 | Middle | 1,200-5,000 | 2,000 | | |
| | >280 | Higher | 1,200-3,500 | 2,000 | | |

Source: Household survey, 2004

Tk.755.20. That means it is much more profitable to invest this amount in roof gardening rather than to save the same amount into bank. On the other hand, lower and middle class members of the society can borrow this amount from the bank to invest in roof gardening for savings even after paying interest. The analysis clarified that return from roof gardening not only covers the variable cost but also cover the fixed cost within a year. In calculating neat profit of roof gardening, rent of roof space is ignored. Generally roof has no commercial utilities. However, recently poultry farm is seen to establish in roof.

**Conclusion and Recommendation.** Roof garden plays an important role in the mental well being of the gardener as well as in amelioration of the physical environment. Result of the study shows that roof gardening has also a promising potential as a small scale business that can accelerate additional family income. Nevertheless, it may generate some employment facilities through its backward and forward linkages. Finally, based on the findings following recommendations are made:

a) Technical know-how and financial attractiveness of roof gardening require further dissemination through proper motivation.

b) Establishment of new training and research institutes on roof gardening and horticulture may help to mass scale practice.

c). Necessary policy measures on roof gardening by relevant government and non-government organizations may facilitate its institutional development.

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