

**A STUDY ON TERRACE GARDENING IN
BENGALURU CITY**

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MBAL 6022

**DEPARTMENT OF AGRICULTURAL MARKETING,
COOPERATION AND BUSINESS MANAGEMENT,
UNIVERSITY OF AGRICULTURAL SCIENCES,
BENGALURU-560 065**

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CO-OPERATION AND BUSINESS MANAGEMENT
UNIVERSITY OF AGRICULTURAL SCIENCES,
GKVK, BENGALURU – 560 065**

CERTIFICATE

This is to certify that the Project Report entitled “A STUDY ON TERRACE GARDENING IN BENGALURU CITY” submitted by Mr. B.A. REDDY PRASAD, ID No. MBAL 6022, in partial fulfilment of the requirements for the degree of MASTER OF BUSINESS ADMINISTRATION (AGRIBUSINESS MANAGEMENT) to the University of Agricultural Sciences, Bengaluru is a bonafide record of research work done by him during the period of his study in this University, under my guidance and supervision and the project work has not previously formed the basis of the award of any degree, diploma, associateship, fellowship or other similar titles.

Bengaluru,
December, 2018


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ACKNOWLEDGEMENT

This Project Report is the end of my journey in obtaining my MBA (ABM) degree. I have not travelled in a vacuum in this journey. A journey is easier when you travel together. Interdependence is certainly more valuable than independence. At this moment of accomplishment, I consider it my pleasure to glance path I travelled during the days of hard work and perseverance. This Project Report is the result of two years of work, whereby I have been accompanied, supported and guided by many people. At the end of my Project Report, it is a pleasant task to express my thanks to all those who contributed in many ways to the success of this study. This Project Report has been kept on track and has been through completion with the support and encouragement of numerous people including my well-wishers and my friends because of whom my post-graduate has been one that I will cherish forever. It is my turn to express deepest sense of gratitude to all of those who directly and indirectly made this Project Report possible and an unforgettable experience for me. Tough it will not be enough to express my gratitude in words to all those people who helped me, I would still like to give my many, many thanks to all these people.

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Ending is inevitable for any kind of work through acknowledging is endless. I end by saying thanks to all those whom I am unable to recall here and also those whom I might have left unknowingly.

Any omission in this brief acknowledgement does not mean indeed.

Place: Bengaluru

Date: December, 2018

(B.A. Reddy Prasad)

A STUDY ON TERRACE GARDENING IN BENGALURU CITY

B.A. REDDY PRASAD

ABSTRACT

Terrace gardening existed since the days of Babylon. Today it has a new meaning in India and other parts of the world. Due to the urbanization, there is a big threat to sustainability. One of the measures to maintain sustainability would be to maintain a terrace garden. The present study was conducted in Bengaluru city. The objectives of the study were to document the different types of terrace gardens, to analyze the various stakeholders involved in terrace gardening, to examine the socio-economic profile of the terrace gardeners, to analyze the establishment and maintenance cost of terrace gardens and to document a selected case study on terrace gardening. Primary data was collected from 60 terrace garden practitioners randomly by personal interview method. The data was analyzed using measures of central tendency, garrett's ranking technique and stakeholder mapping. It was found that the integrated type of terrace gardens was practiced by a majority of (56.66 per cent) respondents. A majority of the practitioners (35.00 per cent) had less than two years of experience in terrace gardening. A major portion of respondents had own house (85 per cent). Insect pest and diseases were the major constraints faced by the practitioners. The installation cost per pot of nutritional terrace garden was Rs. 200 while it was Rs. 280 for ornamental terrace garden. Looking into the constraints, the government should take remedial measures to promote terrace gardening.

December, 2018

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K.H. NAGARAJ
Major Advisor

ಬೆಂಗಳೂರು ನಗರದಲ್ಲಿ ತಾರಸಿ ತೋಟಗಾರಿಕೆ ಬಗ್ಗೆ ಅಧ್ಯಯನ

ಪ್ರಬಂಧ ಸಾರ

ಬಿ.ಎ. ರೆಡ್ಡಿ ಪ್ರಸಾದ್

ತಾರಸಿ ತೋಟ ಬ್ಯಾಬಿಲೋನ್ ಕಾಲದಿಂದಲೂ ಅಸ್ತಿತ್ವದಲ್ಲಿದೆ. ಆದರೆ, ಇಂದು ತಾರಸಿ ತೋಟ, ಭಾರತ ಹಾಗೂ ಪ್ರಪಂಚದ ಇತರೆ ಭಾಗಗಳಲ್ಲಿ ಹೊಸ ಅರ್ಥವನ್ನು ಹೊಂದಿದೆ. ನಗರೀಕರಣದಿಂದಾಗಿ, ನಾಗರಿಕರ ಸುಸ್ಥಿರ ಜೀವನ ದೊಡ್ಡ ಅಪಾಯದಲ್ಲಿದೆ. ಅಂತಹ ಸುಸ್ಥಿರ ಜೀವನ ಕಾಪಾಡಿಕೊಳ್ಳುವ ಕ್ರಮಗಳಲ್ಲಿ ತಾರಸಿ ತೋಟ ಬಹುಮುಖ್ಯ ಪಾತ್ರ ವಹಿಸುತ್ತದೆ. ಪ್ರಸ್ತುತ ಅಧ್ಯಯನವನ್ನು ಬೆಂಗಳೂರು ನಗರದಲ್ಲಿ ಹಮ್ಮಿಕೊಳ್ಳಲಾಯಿತು. ಈ ಅಧ್ಯಯನದ ಮೂಲ ಉದ್ದೇಶಗಳೆಂದರೆ, ವಿವಿಧ ಬಗೆಯ ತಾರಸಿ ತೋಟಗಳನ್ನು ದಾಖಲಿಸುವುದು, ತಾರಸಿ ತೋಟಗಾರಿಕೆಯಲ್ಲಿ ತೊಡಗಿರುವ ವಿವಿಧ ಪಾಲುದಾರರನ್ನು ವಿಶ್ಲೇಷಿಸುವುದು, ತಾರಸಿ ತೋಟಗಾರರ ಸಾಮಾಜಿಕ-ಆರ್ಥಿಕ ಚಿತ್ರಣವನ್ನು ಪರಿಶೀಲಿಸುವುದು, ತಾರಸಿ ತೋಟದ ಸ್ಥಾಪನೆ ಹಾಗೂ ನಿರ್ವಹಣೆ ವೆಚ್ಚವನ್ನು ವಿಶ್ಲೇಷಿಸುವುದು ಹಾಗೂ ತಾರಸಿ ತೋಟದ ಬಗ್ಗೆ ಆಯ್ದ ಒಂದು ಪ್ರಕರಣ ದಾಖಲಿಸುವುದು. ಪ್ರಾಥಮಿಕ ಮಾಹಿತಿಯನ್ನು ೬೦ ತಾರಸಿ ತೋಟಗಾರರಿಂದ ನೇರ ಸಂದರ್ಶನದ ಮೂಲಕ ಸಂಗ್ರಹಿಸಲಾಗಿದೆ. ಈ ಅಧ್ಯಯನವನ್ನು ಸೆಂಟ್ರಲ್ ಟೆಂಡೆನ್ಸಿ, ಗ್ಯಾರೆಟ್ಸ್ ರ್ಯಾಕಿಂಗ್ ಟೆಕ್ನಿಕ್ ಮತ್ತು ಸ್ಪೇಕ್ ಹೋಲ್ಡರ್ ಮ್ಯಾಪಿಂಗ್ ನಂತಹ ಅಳತೆಗಳನ್ನು ಬಳಸಿಕೊಂಡು ಮಾಹಿತಿಯನ್ನು ವಿಶ್ಲೇಷಿಸಲಾಗಿದೆ. ವಿಶ್ಲೇಷನೆಯ ಆಧಾರದ ಮೇಲೆ, ಬೆಂಗಳೂರಿನಲ್ಲಿ ಅನುಸರಿಸಲಾಗಿರುವ ತಾರಸಿ ತೋಟಗಳಲ್ಲಿ ಅತ್ಯಧಿಕವಾಗಿ (೫೬.೬೬ %) ಸಮಗ್ರ ತಾರಸಿ ತೋಟಗಳು ಕಂಡುಬಂದಿವೆ. ತಾರಸಿ ತೋಟದ ನಿರ್ವಹಣೆಯಲ್ಲಿ ಪ್ರವೃತ್ತಿಹೊಂದಲು ಕನಿಷ್ಠ ಎರಡು ವರ್ಷ ಅಗತ್ಯವೆಂದು ಅಧಿಕ ಸಂಖ್ಯೆಯಲ್ಲಿ (೩೫.೦೦ %) ಅಭಿಪ್ರಾಯ ಪಟ್ಟಿದ್ದಾರೆ. ತಾರಸಿ ತೋಟ ನಿರ್ವಹಿಸುತ್ತಿರುವವರಲ್ಲಿ ಹೆಚ್ಚಿನ ಸಂಖ್ಯೆಯಲ್ಲಿ (೮೫.೦೦ %) ಸ್ವಂತ ಮನೆ ಹೊಂದಿರುತ್ತಾರೆ. ತಾರಸಿ ತೋಟದಲ್ಲಿ ಕಂಡುಬರುತ್ತಿರುವ ಪ್ರಮುಖ ನಿರ್ಬಂಧಗಳೆಂದರೆ, ಕೀಟ ಹಾಗೂ ಸಸ್ಯರೋಗಗಳಾಗಿರುತ್ತವೆ. ಪೌಷ್ಟಿಕ ತಾರಸಿ ತೋಟ ಸ್ಥಾಪನೆಗೆ ಸರಾಸರಿ ಪ್ರತೀ ಕುಂಡಕ್ಕೆ ಸರಾಸರಿ ರೂ. ೨೦೦/- ಹಾಗೂ ಅಲಂಕಾರಿಕ ತಾರಸಿ ತೋಟ ಸ್ಥಾಪನೆಗೆ ಸರಾಸರಿ ರೂ. ೨೮೦/- ವೆಚ್ಚ ತಗಲಿರುತ್ತದೆ. ನಿರ್ಬಂಧಗಳ ಗಂಭೀರತೆಯನ್ನು ಆಲಿಸುತ್ತ, ಸರ್ಕಾರವು ತಾರಸಿ ತೋಟದ ಉತ್ತೇಜನಗೆ ಹೆಚ್ಚಿನ ಕ್ರಮಗಳನ್ನು ತೆಗೆದುಕೊಂಡು ಬೆಂಬಲಿಸುವುದು ಅತ್ಯಗತ್ಯ.

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ಕೃಷಿ ಮಾರಾಟ, ಸಹಕಾರ ಮತ್ತು ವ್ಯವಹಾರ
ನಿರ್ವಹಣೆ ವಿಭಾಗ,
ಕೃಷಿ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಜಿ.ಕೆ.ವಿ.ಕೆ.,
ಬೆಂಗಳೂರು - ೬೫

ಕೆ. ಹೆಚ್. ನಾಗರಾಜ್
(ಪ್ರಮುಖ ಸಲಹೆಗಾರರು)

A STUDY ON TERRACE GARDENING IN BENGALURU CITY

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INTRODUCTION

Terrace garden or roof garden is any garden on the roof top. Besides decorative benefit, roof plantings may provide fresh horticultural produce, temperature control, hydrological benefits, architectural enhancement, habitats or corridor for birds, and recreational opportunities.

Bengaluru is the 2nd fastest growing city and 3rd most populous city in India with the population of 12 million approximately. The city once had a prestige of calling as garden city has now turned into a concrete jungle due to urbanization. However there is a possibility of making the city green and bring back to its original form. One such attempt is Terrace gardening.

OBJECTIVE

To document the different types of terrace gardens practiced in Bengaluru.

METHODOLOGY

Study area:

This study was carried out in Bengaluru city of Karnataka state, since there is a growing awareness about the benefits from Terrace Gardening.

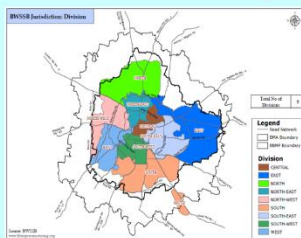


Fig. 1: Map of Bengaluru city

Source of data:

The primary data was collected from 68 respondents covering four taluks of Bengaluru city, such as Bengaluru North, Bengaluru south, Bengaluru East and Anekal where Terrace gardening is practiced.

Analytical Tools and Techniques:

The data was analyzed through descriptive statistics such as frequency and percentage.

RESULTS

Table 1: Types of Terrace Gardens Present in various taluks of Bengaluru City

Sl. No	Types of Terrace Gardens	Taluks				Total
		Bengaluru North	Bengaluru East	Bengaluru South	Anekal	
1	Ornamental and aromatic	3 (30%)	2 (20%)	4 (40%)	1 (10%)	10 (14.7)
2	Nutrition	10 (41.7%)	6 (25%)	2 (8.3%)	6 (25%)	24 (35.3%)
3	Ornamental and Nutrition	11 (35.35%)	9 (26.47%)	7 (20.5%)	7 (20.5%)	34 (50%)
	Total	24 (35.3 %)	17 (25.0 %)	13 (19.2 %)	14 (20.5 %)	68 (100%)

Table 2: Experience of Terrace gardening by the practitioners

Sl. No.	Years	Number of Respondents	Percent
1.	< 1	11	16.1
2.	> 1 - 2	17	25.0
3.	> 2 - 3	14	20.8
4.	> 3 - 4	8	11.7
5.	> 4 - 5	0	0.0
6.	> 5 - 6	6	8.8
7.	> 6 - 7	0	0.0
8.	> 7 - 8	0	0.0
9.	> 8 - 9	3	4.4
10.	> 9 - 10	3	4.4
11.	> 10	6	8.8
	Total	68	100

DISCUSSION

➤ More number of terrace gardens were found in Bengaluru North taluk (35.5%) and there were least number of terrace gardens in Anekal taluk which might be due to less population density comparatively.

➤ Many practitioners have very little experience of less than 4 years in terrace gardening activity.

➤ The study revealed that more number of practitioners prefer to own ornamental and nutritional (50%) terrace gardens than any other types.

GRAPHS AND PHOTOGRAPHS

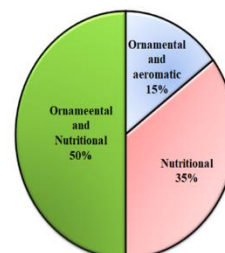


Fig. 2: Types of Terrace Gardens practiced in Bengaluru

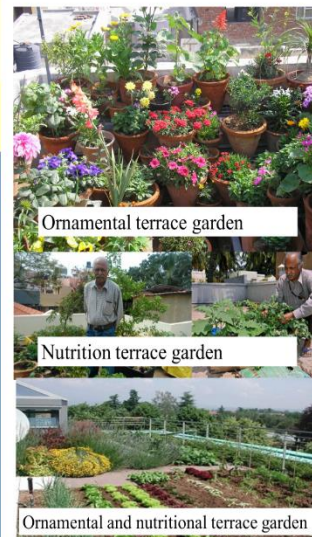


Fig. 3: Types of Terrace Gardens

SUMMARY

Bengalurians are aware of hazardous and pesticide contaminated fruits and vegetables available in the market. More than 75 per cent of area in Bengaluru city is covered with concrete. Residents depend on their terrace to grow vegetables and fruits. More importance was given to Ornamental and nutrition gardens.

ADVISORY COMMITTEE

Chairperson: Dr. K. H. Nagaraj
Members: Dr. B. M. Shashidhara
Dr. C. P. Gracy
Dr. S. Ganesamoorthy

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I INTRODUCTION

With the pressure on land and its cost in urban areas, there is hardly any space to have a garden. If anyone wants to grow vegetables domestically, there are other avenues now that need to be looked at. A terrace above the house provides an ideal space to fulfill the purpose. Terrace gardening not only provides some space back to agriculture, but also helps the house holder to obtain sustainably, the chemical free fresh vegetables, fruits and flowers.

1.1 History

The first known historical reference to a roof garden above grade is for the stone temples in the region of Mesopotamia (Werthmann, 2007). Civilizations in Mesopotamia built roof gardens thousands of years ago on the landings of Ziggurats, or stepped pyramids. The plantings of trees and shrubs softened the climb, provided shade and relief from the heat (Dunnett and Kingsbury, 2008).

The Hanging Gardens of Babylon built by the Persians around the 500 B.C. (Weiler and Barth, 2009) is the next known successor of the roof gardens. The roof gardens along with visual delight cooled the hot landscapes and provided greenery. In the Middle Ages and Renaissance, there were additional demands from the roof gardens and that was to meet the demands of Christian ecclesiastical architecture and wealthy families of the era. Palazzo Piccolomini, Pienza, Italy and the Cloister garden at Mont-Saint-Michel at France are classic examples of roof gardens that remain today (Osmundson, 1999). In Russia, under the czarist rule, roof gardens were considered as a luxury by the nobility. Catherine II of Russia (1729-96) commissioned the famous roof garden on the Winter Palace in Saint Petersburg.

1.2 Importance of terrace garden

Due to the urbanization and growing population, there is a big threat to sustainability. There are many ways and means of maintaining this sustainability to some extent by the citizens. One of the measures would be to possess a terrace garden in order to utilize the available open space in a productive way. A terrace garden may serve many purposes, but one important purpose would be for those who have a passion for gardening. Apart from that, it has many other benefits like ecological benefits, water conservation, energy conservation, decorative enhancement and

attraction to birds and insects. Terrace gardens also contribute towards the health betterment of the occupants of the building. There are many people who are passionate of gardening but often are disappointed, as they may not be fortunate enough to have open spaces for the same.

Passion is important as a strong motivation to have a terrace garden, because it is not easy to establish and maintain a terrace garden as the one on the ground. There are many obstacles like the quality of construction, proper water-proofing of the terrace, strength of the building to withstand additional weight, the available watering facility, the drainage facility and proper maintenance of the garden. Hence it calls for some investments and expenditure as well.

Terrace gardens give pleasure to city dwellers and provide an opportunity for enhancing creativity as well psychological benefits. In addition, they change the visual appearance of the building, screening from neighbors, conceal unwanted pipeline and unappealing scenery.

Terrace and balcony gardens are highly popular in urban middle and upper class families in Bengaluru and were found as a sort of leisure activity for some people. Suspicion about the quality of vegetables available in urban markets and recycling of household waste is one of the most other reasons for terrace gardening.

1.3 General types of terrace gardens.

Terrace gardens are basically classified based on the components present on the terrace and it's utility.

1.3.1 Based on the components present, they are mainly classified as

- a) Green roof and
- b) Container terrace garden

a) Green roof

A green roof or living roof is a roof of the building that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane. It may also include additional layers such as a root barrier, drainage cells and irrigation systems.

There are two main types of green roofs that may be utilized for rooftop agriculture which includes extensive and intensive green roofs. Descriptions and characteristics of these two types of green roofs are described as follows.

i) Extensive Green Roof

As the name implies, an extensive green roof is usually installed entirely on the rooftop. Extensive green roofs are not typically installed for recreational purposes or in efforts to grow food crops but are designed with the goals of improving building performance and can be installed on rooftops with slopes of up to 45 degrees. Growing medium (e.g. cocopeat) usually ranges from 2 to 5 inches deep and plant heights usually range from 2 to 6 inches. When saturated, weights typically ranged from 10 to 50 pounds per square foot. Plants that are suitable for extensive green roofs includes succulents, grasses, and mosses. If utilized for growing food, an extensive green roof is best suited only for growing herbs and low root vegetables such as leafy greens.

ii) Intensive Green Roof

Compared to the extensive green roof, the intensive green roof type has deeper growing substrates and can grow a wide variety of vegetable crops. This type of green roof is installed on larger, flat rooftops. Soil depths usually range from 8 to 12 inches deep and can be as deep as 18 inches. Soil depths depend on the structural capacity of the building. When saturated, weights of this type of green roof range from 80 to 120 pounds per square foot.

b) Container terrace garden

Container terrace gardening or pot terrace gardening is the practice of growing plants, including edible plants, exclusively in containers on the terrace instead of planting them in the ground. A container in gardening is a small, enclosed and usually portable object used for growing plants. It may take the form of a pot, box, tub, basket, tin, barrel or hanging basket.

1.3.2 Based on the utility, terrace gardens are classified as

a) Nutrition Garden

It is also called as organic terrace garden or Kitchen terrace garden. A number of vegetables and fruits are grown on the terrace which plays an important role in supplying nutrition to the family.

b) Ornamental garden

Ornamental terrace garden use plants that are designed more for aesthetic pleasure appearance. They include flowering plants, cacti and succulents, ferns etc.

c) Medicinal herb garden

The herbs are grown in a container on the terrace for medicinal, culinary and fragrance purpose, such as basil, multivitamin, mint, lemon grass, stevia etc.,

d) Water garden

Also known as aquatic gardens are a type of man-made water feature whose primary purpose is to house display. The primary focus is on plants but they will sometimes also house ornamental fish.

1.4 Role of terrace garden in improving environment

1.4.1 Improving the Air Quality

Plants act as oxygen manufacturing chambers and reduce environmental pollution. Presence of greenery around always able to absorb dust and other airborne toxins and during rainy seasons, they wash them away into the drains. Hence the plants act as natural filters of dust and other toxins. Therefore plants clean the air in around the building.

1.4.2 Improving Occupants' Health

The organic yields obtained from one's own garden are free of chemical fertilizers and pesticides, if garden is maintained accordingly. The special herbs, vegetables and fruits which have medicinal values can also be grown and consumed to improve the occupant's health and hence improve their productivity.

1.4.3 Improves Ecological Balance

Terrace gardens contribute towards ecological balance by providing shelters for other inhabitants in nature like birds, earthworms and butterflies.

1.4.4 Easy Recycling of the Wet Waste

The wet waste generated in the kitchen can be easily recycled by applying it in to the terrace garden after composting. This way, cost of additional manure required for the terrace garden can be saved. This helps in garbage disposal in a productive way.

1.5 Need for the study

The Terrace Gardening is emerging as an important business venture under different formats in Bengaluru city due to presence of large number of urban middle and upper class families who thrive to have a garden on terrace due to space constraint on the ground. These families spend a good deal of money on establishment and maintenance of terrace garden. These families also look for variety of designs with lot of plant species and hardscape elements. As a result, there is a good demand for business ventures that are providing different types of services to terrace garden business. However, so far the studies related to terrace gardening in Bengaluru city is rather scanty. So far few systematic efforts have been made to document different types of terrace gardens in India. More importantly, no attempt has been made to examine the establishment and maintenance costs of terrace gardens till date.

Keeping these issues in mind, the present study is undertaken with an attempt to examine, explore and analyze various dimensions of terrace gardeners in Bengaluru city. The outcome of the study would be helpful for terrace gardeners to realize the various players in the chain, how they are interconnected, their management roles etc. In the milieu, the present study is carried out with the following objectives.

1.6 Objectives of the study

1. To document the different types of terrace gardens practiced in Bengaluru city
2. To analyze the various stakeholders involved in terrace gardening
3. To examine the socio-economic profile of terrace gardeners
4. To analyze the establishment and maintenance cost of terrace gardens and
5. To document the selected case study on terrace gardening in Bengaluru city

1.7 Hypotheses of the study

Based on the objectives, the following hypotheses were framed

1. There are plenty of terrace garden types available in Bengaluru city
2. The stakeholders are very few due to unorganized and fragmented business

1.8 Limitations of the study

1. The study is conducted based on both primary and secondary data. The primary data was collected from the terrace gardeners. Few players were reluctant to give the accurate data about the company. The data was however cross-checked when biased was found.
2. The study is restricted only to the Bengaluru city and the findings are not applicable to others areas of India.
3. Due to time constraint, all terrace gardens are not covered. However, emphasis has been given on important terrace gardens which could be representative for all terrace gardens in the city.

1.9 Presentation of the study

The study is presented in six chapters as detailed below.

Chapter I: It outlines a general background of terrace gardening and listed a series of research objectives. In the following chapters, these issues will be discussed in greater depth.

Chapter II: It outlines the relevant concepts. The literature review will help to set up a theoretical framework for terrace gardening concepts.

Chapter III: It explains the research methods, features of the study area and analytical tools used in the analysis. It provides an explanation about why and how these methods are used in this study.

Chapter IV: It provides the results and discussion of the study. This chapter seeks to find out the answers for the objective and also hypotheses.

Chapter V: Summary and conclusion of the research study is presented in this chapter

Chapter VI: It provides the references for the further clarifications.

II REVIEW OF LITERATURE

In this chapter the literature related to concepts that are closely connected to terrace garden management both in practice and research are reviewed. With respect to management practices followed in terrace gardening business, the studies conducted are scarce. However, number of studies have been conducted in documenting the urban green spaces within a city and its impact on Bio-diversity. The reviews relevant to the present study are presented under the following subheadings.

- 2.1 Different types of terrace gardens practiced
- 2.2 Various stakeholders involved in terrace gardening
- 2.3 Socio-economic profile of terrace gardeners
- 2.4 Establishment and maintenance of terrace gardens
- 2.5 Case studies on terrace gardening

2.1 Different types of terrace gardens practiced

Islam and Khandaker (2014) studied about the purpose of rooftops by rooftop gardeners in Dhaka city of Bangladesh. Various purposes like drying clothes, playing area, entertaining guests and as a relaxing place were considered. The results revealed that most of the respondents used the rooftops for drying and playing purposes. Other than these purposes, most of the rooftops were found to have ornamental gardens followed by fruit gardens and vegetable garden.

Zagorski *et al.* (2004) studied the types of garden and their choice of garden type according to the gardener's attitude. The study discriminated four types of gardens found in city of Tasmania, Australia namely, the species-poor shrub garden; the local native garden; the woodland garden and the gardenesque. The study differentiated that, respondents with who valued functional gardens and the hard work in creating a garden, largely produced gardenesque outcome. A strongly conservationist group of gardeners had native and woodland or shrub gardens. A group of gardeners who valued romance and privacy largely had woodland gardens. A small group of gardeners who liked gardens to create themselves and preferred to minimize the act of gardening tend to have the shrub garden outcome.

Buehler and Junge (2016) studied global trends and current status of commercial urban rooftop farming. The aim of the study was to analyse current practices in commercial urban rooftop farming. The analysis showed that commercial URFs can be grouped into two main types: Firstly, hydroponic systems in greenhouses where mostly leafy greens, tomatoes, and herbs are grown; secondly, soil-based open-air farms that grow a large variety of vegetables. Among which hydroponics was often seen as the key technology for commercial urban food production.

2.2 Various stakeholders involved in terrace gardening

Mengual *et al.* (2015) studied differing stakeholder perceptions of urban rooftop farming in Mediterranean cities. The study differentiates the idea that when urban agriculture is integrated into buildings then it is called urban rooftop agriculture. It sought to understand how those perceptions shape the development of new urban agriculture practices and projects. The methodology used in semi-structured interviews with 25 core stakeholders. The results revealed that Urban Agriculture is largely perceived as a social activity rather than a food production initiative, because the planning of urban gardens in Barcelona was traditionally done to achieve leisure and other social goals. However, several stakeholders highlighted the potential to increase urban fertility through URF by occupying currently unused space. As a result, the positive valuation of urban rooftop farming depends on the conceptualization of urban agriculture as a social or food production activity.

Pramodita (2013) used stakeholder mapping technique in developing a Family Firm Typology. This objective of the study is to develop a basis for distinguishing family firms from other organizational forms, and among various types of family firms. It used the well-established overlapping three-circle model (a developed model of stake holder mapping), each circle representing family membership, ownership, and managerial roles of internal family firm stakeholders. The results of the study were positive after conducting various tests. The study thus developed a typology which could help understand the types of governance mechanisms which will enhance the performance of different types of firms.

Gohary *et al.* (2006) conducted the study on stakeholder management for Public Private Partnership (PPP) initiatives. This study involves usage of Stake holder Involvement (SI) programme which can study stakeholders of multi disciplines. This study presented a semantic model and taxonomy that represents the key concepts underlying stakeholder involvement in PPP infrastructure projects. The recommendations provided by the system can act as a 'short-list' of potential tools to the inexperienced.

Walker *et al.* (2008) studied the influence, stakeholder mapping and visualization of stakeholder management in construction industry. This study described about the development of tools and methodologies useful for the people undertaking stakeholder management activities. It suggested that visual representation of complex problems with visualization tools reduce the chances of project failure and enhance success through having clearer pictures of stakeholder influence patterns.

Mark (2008) analysed the stakeholder participation in environmental management. This paper gave literature support on the development of participatory approaches in different disciplinary and geographical contexts, evidence for normative and pragmatic benefits of participation in environmental activities. It gave evidence that stakeholder participation can enhance the quality of environmental decisions by considering more comprehensive information inputs. This study also identified eight features of best practice participation from a Grounded Theory Analysis of the literature. The reviews concluded by emphasizing the future needs of research in environmental management.

Newcombe and Robert (2010) studied the stakeholders of construction industry using stake holder mapping technique. The study suggests that stakeholder mapping applied to large construction projects could explain the importance to project managers of conducting the analysis of the power, predictability and interest of key project stakeholders.

2.3 Socio-economic profile of terrace gardeners

Islam (2014) surveyed the common fruits and vegetable varieties found among the rooftop gardens in city of Dhaka, Bangladesh. The results showed that there were 60 varieties of fruits and vegetables commonly grown in the rooftops. However, the types and mix were chosen in the city depending upon individual household food preferences, availability of seeds types that can be grown on the rooftop, climate and availability of soils. While studying about the problems faced by rooftop gardeners, it was found that Burglary problems were so prominent followed by attack of the gardens by insects, birds and monkeys.

Islam (2014) studied about the Rooftop Gardening as a Strategy of Urban Agriculture for Food Security: The Case of Dhaka City, Bangladesh and found that the water access is becoming a serious problem in Dhaka. However, most of the respondents stated that water is not a problem for those who can pay for it. Those who own buildings can also afford water. In 98per cent cases they have access to water on the roofs, and there are already water pipes installed on the roofs for other purposes (such as cloth washing etc.).

Yuhong *et al* (2012) studied the effect of land use on potential sky gardens varies greatly by districts. Buildings with 10 to 20 floors have higher potential roof gardens in most districts. Building area is the main determinant of potential roof garden, and population density of potential podium gardens. Three scenarios of realization, namely minimum (20 per cent), medium (50 per cent) and maximum (80 per cent), are adapted to project sky garden provision in individual districts.

2.4 Establishment and maintenance of terrace gardens

Yinghui and Kishnani (2010) studied about the concept of building integrated agriculture and cost benefit of utilising rooftops for sustainable food crop cultivation in Singapore. The objective of the study was to examine the viability of rooftop farming in urban centres in Asia. The findings of the study suggested that Singapore's public housing estates are suitable for rooftop farming. It was also found that if such schemes would come in place, there would be 700 per cent increase in domestic vegetable production, satisfying domestic demand by 35.5 per cent in Singapore. Also, the rooftop gardens would reduce the Singapore's carbon footprint by 9,052 tonnes of emissions annually.

Wong *et al.*(2002) studied the life cycle cost analysis of rooftop gardens in Singapore. The objectives of the study were to highlight the economic benefits of green roofs that can offset the initial costs, to examine the initial cost implications of having a green roof as compared to a conventional flat roof, to compute and compare the life cycle costs of roof gardens and average flat roofs and to incorporate economic benefits by incorporating energy costs into life cycle costs. The study has observed that life cycle costs of extensive green roofs with or without consideration for energy costs were lower than that of exposed flat roofs, despite its higher initial costs. However, for accessible rooftops, even life cycle (energy) costs of intensive system are not less than the normal build-up flat roof.

Orsini *et al.* (2014) explored the production capacity of rooftop gardens in urban agriculture. The study was conducted in city of Bologna, Italy. The study exposed the fact that the potential of rooftops in the study area could provide more than 12,000 tonnes of vegetable per year which could satisfy 77 per cent of inhabitant's requirements.

Whittinghill and Rowe (2011) studied the role of green roof technology in urban agriculture. The study indicates that though the urban agriculture on rooftops has the potential to alleviate like economic development, job creation and food security. It can be limited by factors like lack of formalized land use rights and health hazards related to food contamination. The other roles of urban agriculture on rooftops were facilitation in the formation of formal space and water use agreements and enabling redistribution of ground-level resources among urban farmers. The study suggests that before green roof can be incorporated into urban agriculture on a larger scale, installation costs must be reduced, roof weight limitations should be assessed and appropriate management practices should be developed which will ensure that the benefits of green roofs, such as energy savings and storm water management.

Taylor *et al.* (2012) studied about constraints faced by the tribal farmers in dairy farming in Udaipur district with a sample of 80 households. In this study, Garrett's ranking has been used as a tool to analyze the constraints. The results revealed that major constraints faced by tribal farmers were non-availability of green fodder throughout the year, inadequate knowledge about scientific feeding of dairy animals, repeated breeding of animals, lack of pedigree bulls for natural services, low milk productivity of animals and lack of scientific housing etc.

Nurmi *et al.* (2013) studied about the green roof cost-benefit analysis. Green roofs are roofs that are partially (or almost completely) covered with vegetation. Between the roofing membrane and the vegetation there may be several technical layers. In this report they discussed the benefits and costs of lightweight self-sustaining vegetated roofs that do not require structural modifications from the building. The costs and benefits have been analysed in Helsinki, Finland.

Rao (2016) studied the benefits of the terrace gardens and reported as waste recycling, ecological benefits, energy conservation, water conservation, decorative enhancement of buildings, occupant's health improvement and attracting birds and insects are the major benefits of terrace garden. The case study highlighted the benefits of terrace garden and its significant role in sustainability and environment.

Islam (2014) indicated that all the owners enjoyed gardening. About 68 per cent of the residents spend 50 to 80 Canadian dollars per annum. Many of them have plans to initiate food gardening (65 per cent) in the future. Only less than five per cent of house owners are willing to allow tenants to RTG. They also do not want to increase rent to allow their tenants to RTG as they might lose the tenant if rent is increased.

Blair *et al.* (1991) assessed the yield of 151 garden plots and calculated the economic value, based on retail produce prices. Garden sites yielded an average of USD 160 worth of produce. Gardeners ate six out of 14 vegetable types significantly more frequently, while milk products, citrus, sweet foods and drinks were consumed less frequently. Except for citrus, the reduced gardener consumption remained significant when other key variables were controlled. Gardening was positively associated with community involvement and life satisfaction.

2.5 Case studies on terrace gardening in Bengaluru city

Jörg *et al.* (2012) documented a case study on The Podium Roof Garden which is an award winning design, the product of several talented architectural and landscape architectural firms. The complexity and intricacies of the design are apparent when viewing any of the pre-production renderings. Style and individuality are the hallmarks of any design firm; however, during the course of any project certain design and economic factors must be taken into consideration. The Podium Roof Garden provides an excellent case study of the psychology of green roof expectations and their economic costs.

Rohini Srivastava(2011), in her study on landscaping reported that the landscape roofs offer many benefits, starting with the additional building insulation, lower requirements for air conditioning and energy, mitigate the heat island effect, reduce the total area of impervious dark surfaces in city. With emergence of Delhi as a major urban center of India, green roofs can become a part of the local building practices to improve the urban way of life.

Carter and Keeler (2008), in this study collected data from an experimental green roof plot to develop benefit cost analysis (BCA) for the life cycle of extensive (thin layer) green roof systems in an urban watershed. The net present value (NPV) of this type of green roof currently ranges from 10 per cent to 14 per cent more expensive than its conventional counterpart. A reduction of 20 per cent in green roof construction cost would make the social NPV of the practice less than traditional roof NPV. Considering the positive social benefits and relatively novel nature of the practice, incentives encouraging the use of this practice in highly urbanized watersheds were strongly recommended.

III METHODOLOGY

A detailed description of research design is discussed in this chapter. The information on economic features, flora and fauna wealth, supportive green policies by governing bodies of the study area is provided. The details in this chapter are presented under following sub-headings:

- 3.1 Description of study area
 - 3.1.1 Demography and economy
 - 3.1.2 Geography and environment
 - 3.1.3 Flora and fauna
- 3.2 Sampling procedure
- 3.3 Nature and source of data
- 3.4 Analytical tools and techniques employed
 - 3.4.1 Descriptive statistics
 - 3.4.2 Garrett's ranking technique
 - 3.4.3 Stakeholder Mapping

3.1 Description of the study area

Bengaluru is one of the fastest growing cities in India with a population approaching nine million (Ramachandra *et al.*, 2009) and is branded as 'Silicon Valley of India' for heralding and spearheading the growth of Information Technology (IT) based industries in the country. With the advent and growth of IT industry, as well as numerous industries in other sectors and the onset of economic liberalisation since the early 1990s, Bengaluru has taken lead in service-based industries fuelling substantial growth of the city both economically and spatially. Bengaluru has become a cosmopolitan city attracting people and business alike, within and across nations.

3.1.1 Demography and economy

Bengaluru is the principal administrative, cultural, commercial, industrial, and knowledge capital of Karnataka. The Bruhat Bengaluru Mahanagara Palike (BBMP) is the agency responsible for the governance of the Greater Bengaluru Metropolitan area. Within the city boundary, 198 administrative sub-divisions or wards are

established. Greater Bengaluru with an area of 741 sq. km has agglomerated the defence, and biotechnology based industries (Nagendra *et al.*, 2012). In addition, numerous services, trade and banking activities mark the city's economic landscape.

An important feature of the economic activities of Bengaluru is the huge concentration of Small and Medium Enterprises (SMEs) in diversified sectors across the city. Bengaluru has more than 20 industrial estates/areas comprising large, medium and small enterprises. A majority of the SMEs function as ancillaries and subcontractors to large enterprises in the field of engineering and electronics industries, among others. The industrial estates sprung up mostly in the periphery of the erstwhile city and gradually as the city grew became part of its sprawl. The proliferation of SMEs in residential and commercial areas, in addition to the industrial areas, has added to the chaos and congestion in the city. Bengaluru's 523 billion (US\$ 8.2 billion) economy makes it one of the major economic centers in India, with the value of the city's exports totaling 432 billion (US\$ 6.8 billion) in 2011–12 (Sudhira *et al.*, 2007).

Bengaluru's tree lined streets, numerous parks and abundant greenery have led to it being called the 'Garden City' of India. It has also been identified as the country's 'Silicon Valley' and it is one of the technological innovation hubs with a Technological Achievement Index (TAI) is 134 according to the Human Development Report (United Nations Development Programme, 2001). However, with all the hype about growth in IT and IT based industries, Bengaluru also houses numerous other leading commercial and educational institutions and industries like textiles, aviation, space, biotechnology, etc. As an immediate consequence of this growth in the last decade, apart from creating a ripple effect in the local economy, there has also been greater pressure on infrastructure and resources like water supply, energy, public transportation, land, etc. The local body and other parasternal agencies responsible for delivery of basic services are facing stiff challenges in catering to the demand.

3.1.2 Geography and environment

Bengaluru is located at 12.97°N, 77.56°E and covers an area of 2190 sq. km., almost equidistant from both eastern and western coast of the South Indian peninsula, and is situated at an altitude of 920 m above mean sea level. The mean annual total rainfall is about 880 mm with about 60 rainy days a year over the last decade. The summer temperature ranges from 18°C to 38°C, while the winter temperature ranges from 12°C to 25°C. Thus, Bengaluru enjoys a salubrious climate all-round the year. Bengaluru is located over ridges delineating four watersheds, viz. Hebbal, Koramangala, Challaghatta and Vrishabhavathi watersheds. The undulating terrain in the region has facilitated creation of a large number of tanks providing for the traditional uses of irrigation, drinking, fishing and washing. Their creation is mainly attributed to the vision of Kempegowda and of the Wadiyar dynasty. This led to Bengaluru having hundreds of such water bodies through the centuries.

3.1.3 Flora and fauna

The city has a welcoming climate, and was once well known for having a large number of open spaces including two historic parks, botanical gardens, and a number of wetlands and water bodies as well as a protected tiger reserve at its periphery (Sudhira *et al.*, 2007). With the city's unprecedented growth, the large number of public open spaces diminished over the years. Much of the loss in green cover is due to the rapid change in land use. As the city grew over space and time, inner areas got more crowded and congested. Initiatives to ease congestion on road networks have led to axing numerous road-side trees. Many lakes have been converted into residential layouts, bus stands, play grounds, stadiums etc. The built-up area in the metropolitan area was 16 per cent of total in 2000 and is currently estimated to be around 23–24 per cent. The rest of the area is occupied by either agriculture lands, quarries or other vacant lands. In the aspect of nurturing flora and fauna, the situation in Bengaluru is quite complex. With prominent green spaces like Lalbagh and Cubbon Park almost at the city center and a few water bodies, such as Ulsoor, Sankey, Lalbagh, Yediyur and Madiwala, scattered across city's landscape,

the remaining green spaces in the periphery harbour a great number of species. In a compilation of fauna present in and around Bengaluru within a radius of 40 km from city centre about 40 species of mammals, more than 340 species of birds, 38 species of reptiles, 16 species of amphibians, 41 species of fishes and 160 species of butterflies have been recorded. A new 'ant' species, *Dilobocondyla bangalorica*, was discovered in Bengaluru recently (Varghese, 2006). In another study, Sudha and Ravidranath (2000) have investigated the floral assemblage in different land-use categories and the changes in vegetation over Bengaluru City. Around 164 species were identified in different residential areas, of which 149 were recorded within compounds with 87 avenue trees.

The rich diversity speaks of the volume of life still persisting in spite of rapid urban growth. In recent times, the increase in vehicular traffic has increased suspended particulate matter and other oxides of carbon, nitrogen and sulphur in the environment. Air pollution and the reduction in tree cover have induced the urban heat island effect resulting in variations in local temperature and sudden unanticipated showers during late afternoon.

Bengaluru is experiencing unprecedented urbanization and sprawl in recent decade due to concentrated developmental activities with impetus on industrialization for the economic development of the region. Land use patterns reveal the main concentration areas and can provide invaluable inputs for sustainable city planning. Out of the total Bengaluru population, 90.94 per cent (87.50 lakhs) lived in urban regions as per 2011 census.

It has been evident that the urban cover has drastically increased over decades in Bengaluru which was mere eight per cent in 1973 and has increased by seven folds to about 54.42 per cent in 2010. Vegetation cover was about 23 per cent in 2010, but it was three times more in 1973 (68.27 per cent). There were many lakes in and around Bengaluru city which accounted for 20.35 per cent in 1973 and it is less than a per cent in 2010 (Table 1.1)

Table 1.1
Percentage Land cover over the years in Bengaluru city

Years	Urban cover	Vegetation	Water cover
1973	7.97	68.27	3.41
1992	27.30	46.22	2.62
1999	35.37	45.76	2.26
2002	37.75	38.72	1.84
2006	43.23	28.83	1.57
2010	54.42	23.41	0.90

Source: geospatialworld.net

3.2 Sampling procedure and data collection

Bengaluru is purposefully selected for the study to document the terrace gardening practices prevailing in the city. On one hand, there is garden city and its rich green history; on the other hand, there are technologically intensive industries and fast growing real estate properties which are declining the green cover of the city. The citizens of Bengaluru are in between striving to bring back the green cover on the available spaces such as terrace. Other factors to consider Bengaluru as the study area is the availability of terrace gardens to document, large number of terrace garden practitioners, Organic Terrace Garden groups (OTGs) and Non-Profit organizations such as Garden City Farmers (GCF). The study particularly confines to Bengaluru urban as most practitioners are found to reside here.

Analysis of the study was done mainly based on primary data. The primary data was collected from 60 terrace garden practitioners of Bengaluru by personal interview through a pre-tested interview schedule developed for the study. The list of terrace gardeners was obtained from Garden city Farmers (GCF) organization and the respondents were selected randomly. Respondents for the study included passionate terrace gardeners, terrace garden consultants and input agencies.

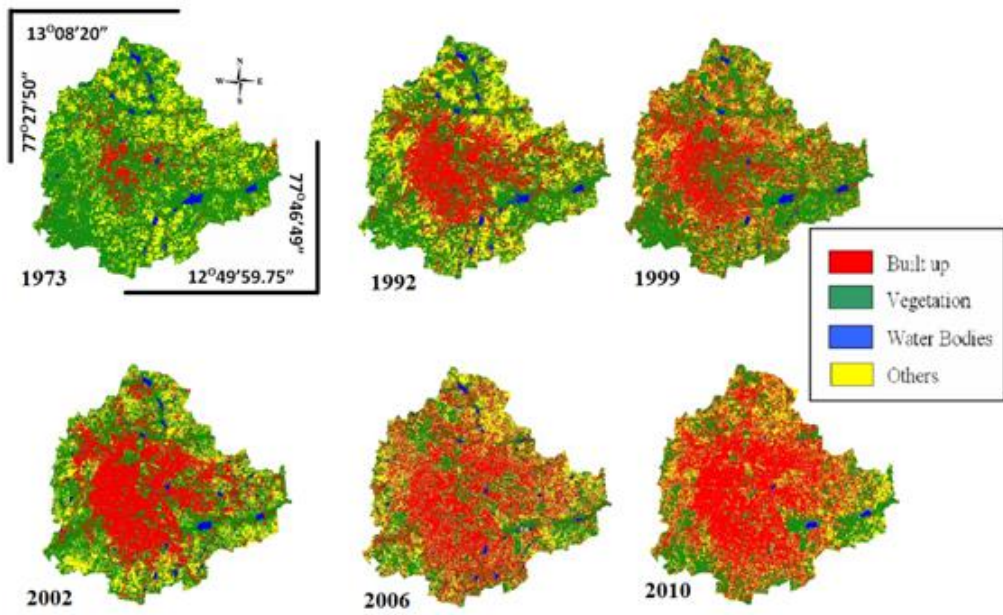
3.3 Nature and source of data

In order to examine the objectives of the study, the data collection was done mainly from primary sources. In primary data collection, terrace garden practitioners gave data pertaining to various aspects of terrace garden like types, components, economics, purpose and constraints.

3.4 Analytical tools and techniques employed

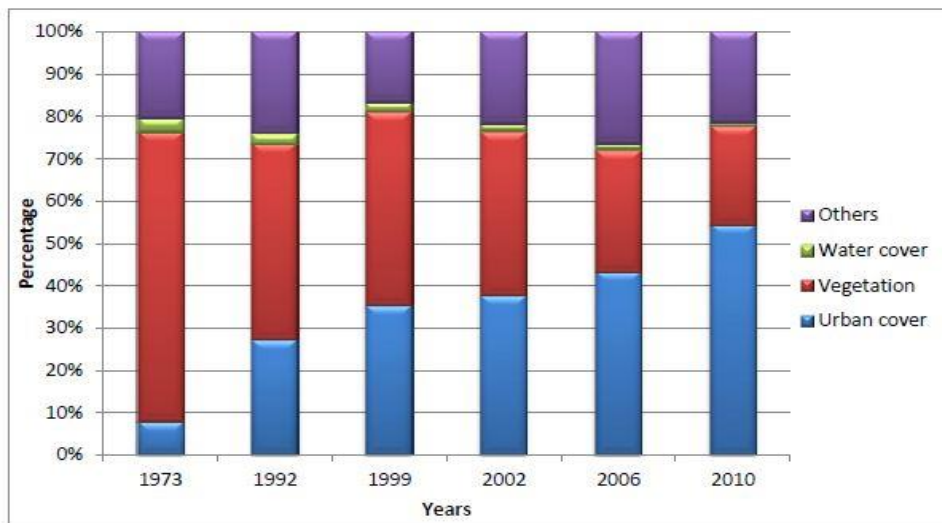
3.4.1 Descriptive statistics

The information collected from terrace gardeners were tabulated and analyzed by computing averages and percentages. This methodology is used to categorize the type of terrace gardens, roles played by stakeholders, socio-economic characters, factors drive terrace gardeners to purchase inorganic vegetables and fruits and number of hours spent by respondents per week.



Source : geospatialworld.net

Fig. 1. Land Use change in Bengaluru over the years



Source : geospatialworld.net

Fig. 2. Land use changes in Bengaluru (in Proportion)

3.4.2 Garrett's ranking technique

The study of constraints faced by the terrace garden practitioners is one of the important aspects of the present research from policy point of view. The respondents were asked to rank the constraints in terrace gardening activity and also to rank the purpose of adopting terrace garden. Later, those ranks were converted in to scores by referring to Garrett's table.

In the study, Garrett's ranking technique was used to analyze the constraints in terrace garden and purpose of adopting terrace gardening. The order of the merit given by the respondents was changed into ranks using the formula.

$$\text{Per cent position} = \frac{100(R_{ij} - 0.5)}{N_j}$$

Where, R_{ij} = Rank given for i^{th} item by j^{th} individual

N_j = Number of items ranked by j^{th} individual

The present position of each rank was converted to score by referring to tables given by Garret and Woodworth (1989). Then for each factor, the score of individual respondents were summed up and divided by the total number of respondents for whom scores for all the factors were ranked, following the decision criterion that higher the value the more important is the constraint for adopting terrace garden.

3.4.3 Stakeholder Mapping

Stakeholder mapping is a collaborative process of research, debate, and discussion that draws from multiple perspectives to determine a key list of stakeholders across the entire stakeholder spectrum. Mapping can be broken down into four phases:

1. Identifying: listing relevant groups, organizations, and people
2. Analysing: understanding stakeholder perspectives and interests
3. Mapping: visualizing relationships to objectives and other stakeholders
4. Prioritizing: ranking stakeholder relevance and identifying issues

The process of stakeholder mapping is as important as the result, and the quality of the process depends heavily on the knowledge of the people participating.

1. Identifying: The first step in the mapping process is to understand that there is no standard established list of stakeholders for any aspect. The final list of stakeholders at any situation depends on the objective of research and its impacts. Therefore, list changes as the environment around the area of research evolve. As a result, the stakeholders are not always static except the core stakeholders.
2. Analyzing: Once the list of stakeholders is identified, it is useful to do further analysis, to better understand their relevance and the perspective they offer, and to prioritize based on their relative usefulness for this engagement.
3. Mapping: Mapping stakeholders is a visual exercise and analysis tool that one can use to further determine which stakeholders are most useful to engage with. While stakeholders are evaluated by the same criteria, mapping allows seeing where stakeholders stand and helps to visualize the often complex interplay of issues and relationships.
4. Prioritizing stakeholders: The objective behind this step is to save money and time as it is not possible to engage with all stakeholders with the same level of intensity all the time. By categorizing the stakeholders, one can map them into appropriate engagement levels.

VI RESULTS AND DISCUSSION

This chapter is designed to throw light on the results of the present study keeping the research methodology in general and objectives in specific. Findings in detail are presented under the following heads:

- 4.1 Different types of terrace gardens practiced in Bengaluru city
- 4.2 Stakeholders involved in terrace gardening
- 4.3 Socio-economic characteristics of the respondents
- 4.4 Constrains faced by the terrace gardeners in installation and maintenance of terrace gardens
- 4.5 Analysis on establishment and maintenance cost of terrace garden
- 4.6 Case study on terrace gardening in Bengaluru city

4.1 Different types of terrace gardens practiced in Bengaluru city

Different types of terrace gardens found during the study were classified based on the utility and documented in Table 4.1. It is found that 56.66 per cent of the practitioners had integrated type of terrace gardens where they were growing vegetables, fruits, flowers, ornamental plants as well as medicinal plants on their terraces in different proportions according to their requirements. Further, 26.66 per cent of the respondents had exclusively nutritional terrace gardens. Ornamental gardens were exclusively found to be practiced by 11.66 per cent and merely 5 per cent of the practitioners were found to be practicing exclusively medicinal garden.

The integrated gardens were found to be practiced more comparatively, because terrace gardens were seen not just as a part of nutritional purpose but an integrated activity which serves for many purposes such as recreation, education, ambience, aesthetics etc., The practitioners apart from getting benefits out of terrace garden, they look terrace garden activity as a part of their life style in cities.

Table 4.1
Different types of terrace gardens prevailing in Bengaluru city

(n=60)

Sl. No.	Type of garden	No. of respondents	Per cent
1.	Nutrition garden	16	26.66
2.	Ornamental garden	7	11.66
3.	Medicinal garden	3	5.00
4.	Integrated garden	34	56.66
Total		60	100

4.2 Stakeholders involved in terrace gardening.

The role played by the stakeholders involved in terrace gardening are explained in Table 4.2. The sampling frame is composed of sixty respondents who own and practice terrace garden in their daily life. It is found that all the respondents are generalized as a category 'passionate terrace gardeners' (100 per cent). Few of them (36.66 per cent) who practiced terrace gardening for a longer time, went a step ahead and served as consultants for practitioners who seek advice from the experts. Some of the respondents (18.33 per cent) provided certain inputs such as containers, polybags, composting units, compost, panchagavya, seeds and saplings for free, as an exchange or for retail price to the fellow practitioners. They sent them through courier, home delivery or in the terrace garden group meetings for retail price and transportation chargers or for little margin over the investment. The main motto of stakeholders was not to achieve profit in business but to promote terrace gardening and help newbies to achieve good gardening skills since they considered terrace gardening activity as a hobby rather than business.

The stakeholder mapping was represented in the Figure 4.1. It shows that all stakeholders were passionate terrace gardeners whereas; some of them were input agents and consultants and few of them were serving as both input agents and consultants as well.

All terrace gardeners may not be experts in cultivation of crops. Even though many practitioners had lot of experience, they were enthusiastic in gaining and sharing the knowledge about terrace gardening and also to promote the same. Sources of getting information by the terrace gardeners for terrace garden maintenance are listed in Table 4.13. It is observed that all (100 per cent) the practitioners followed social media such as WhatsApp, Facebook, YouTube etc. regularly, as a source of getting information regarding terrace gardening activities.

Terrace gardeners have formed terrace garden groups in WhatsApp and Facebook based on the region they reside. They share the knowledge and clear their doubts about terrace gardening activities as and when required.

It is observed that terrace garden enthusiasts play a good role in providing information to the others as 66.67 per cent of the respondents gain information from the terrace garden enthusiasts by meeting them monthly. Terrace garden groups are conducting monthly meets during which they motivate and guide other practitioners about good terrace gardening practices.

It is found that 60 per cent of the respondents ask solutions from the consultants for their terrace garden maintenance. Whereas 41.67 per cent of the respondents obtain information through e-commerce websites which are maintained by terrace gardening companies to promote their business.

The table revealed that only few of the practitioners get information from agriculture and horticulture colleges. This might be due to the reason that they are located away from the institutions or might not be aware of their existence.

The contribution of Television, newspaper and magazines were also meagre in providing information regarding terrace gardening.

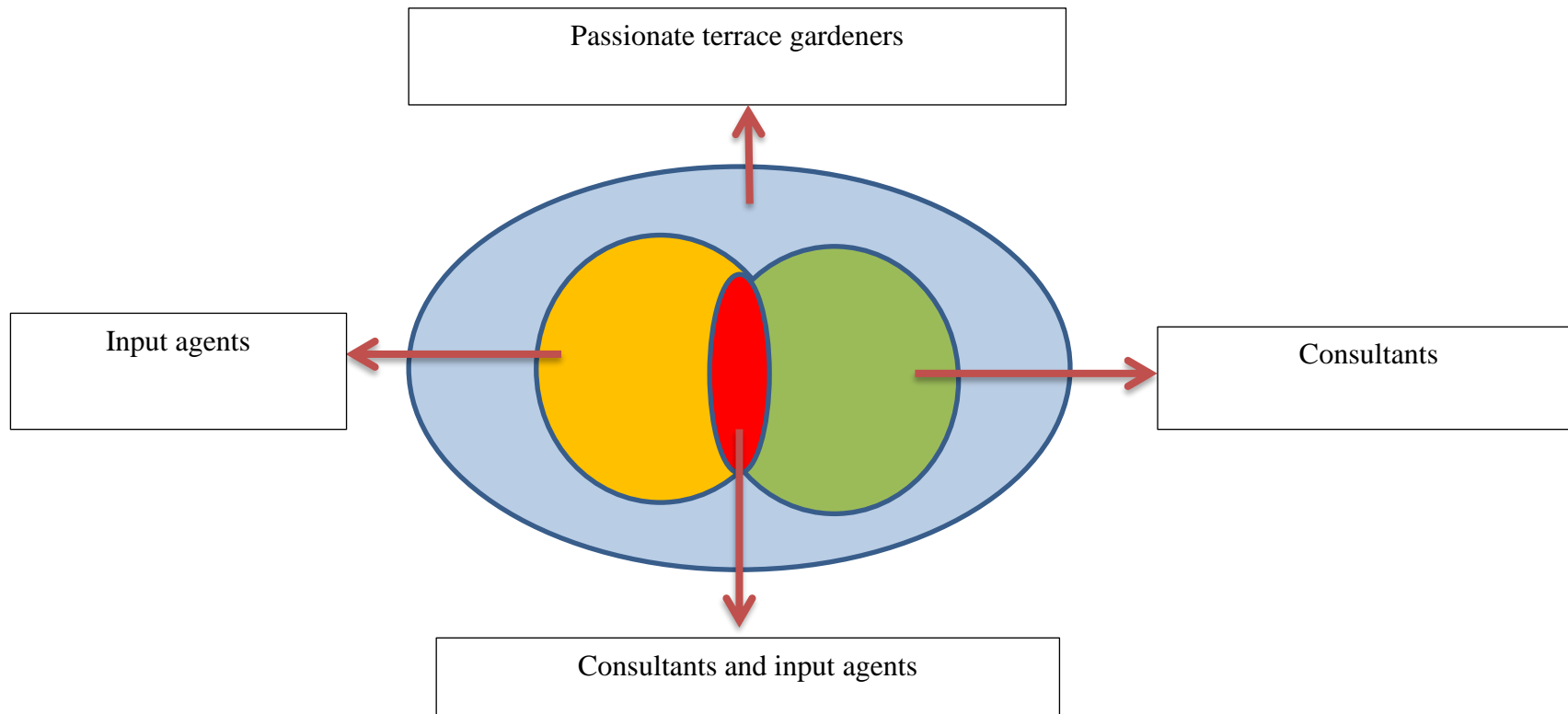


Fig: 3
Distribution of stakeholders in terrace gardening based on their roles

Table 4.2
Role played by the stakeholders in terrace gardening.

(n=60)

Sl. No.	Role of the stakeholder	No. of respondents	Per cent
1.	Passionate terrace gardener	60	100
2.	Consultant	22	36.66
3.	Input agents	11	18.33

Table 4.3
Sources of getting information by the terrace gardeners for terrace garden maintenance

(n=60)

Sl. No	Particulars	Frequency of contact					No. Of respondents	Per cent
		Daily	Fortnightly	Monthly	Once in two months			
1.	Consultants	0	2	31	3	36	60.00	
2.	Input agencies	0	0	7	12	19	31.67	
3.	Agri/Horti colleges	0	0	0	3	3	0.50	
4.	Enthusiasts	0	0	40	0	40	66.67	
5.	T.V, Newspaper, Magazine	2	2	0	0	4	0.60	
6.	e-commerce website	0	25	0	0	25	41.67	
7.	Social media	60	0	0	0	60	100.00	

4.3 Socio-economic characteristics of the respondents practicing terrace garden in Bengaluru city

The socio-economic characteristics of the respondents are classified in to personal characteristics and general characteristics which is illustrated below.

4.3.1 Personal characteristics of the respondents practicing terrace gardening

The personal characteristics of the respondents are presented in the Table 4.4. The details of socio-economic classification like age, gender and family size were highlighted.

Among the practitioners, majority of the respondents were female (61.67 per cent) and male were comparatively less (38.33 per cent). Even though majority of respondents were female, during the personal interview it is revealed that they don't differentiate among the family members with respect to gender in maintaining terrace garden, as terrace gardening is a family oriented activity rather than individual activity. Therefore, it can be concluded that, terrace garden becomes successful only when there is co-ordination among the family members.

The table indicated that 36.67 per cent of the practitioners belonged to the age group of 30 to 40 years, 28.33 per cent belonged to the age group of 40 to 50 years and 16.67 per cent belonged to age group of 20 to 30 years as well as 50 to 60 years. Majority of practitioners were in the working age group and are health conscious. Through personal interview it is revealed that terrace gardening activity provided them relaxation and brought down the stress level after working long hours in the offices. Due to the increased awareness about hazardous chemical contaminated fruits and vegetables available in the market, there is a shift in consumption to safe organic food that keep themselves and their family fit and healthy. From the Table 4.4, it is observed that 1.67 per cent of the practitioners belonged to the age group of more than 60 years. This shows that even senior citizens liked to practice terrace gardening to get some physical exercise through this activity as well as to obtain home grown organic food.

With respect to family size, 68.33 per cent of practitioners possessed three to four members in the family and 18.33 per cent possessed five to six members in the family. This indicates that a majority of the families were small in size; this is mainly due to migration to Bengaluru for education and employment as their primary purposes. The study shows that a majority of the respondents belonged to the nuclear

families (81.66 per cent) with one to four members of family size and rarely there were joint families (18.33 per cent) with five to six members in the family. This may be due to migration of part of the family from villages to cities in search of employment and business and then settled in Bengaluru city as the city is called as silicon city and a hub of opportunities to the employment and business.

4.3.2 General characteristics of the respondents practicing terrace gardening

The general characteristics of the respondents are presented below. The details of socio-economic classification like experience, area dedicated for terrace gardening, source of irrigation and other dimensions were highlighted.

Experience of practitioners in terrace gardening is presented in the Table 4.5. Among the practitioners, 35 per cent of the respondents had two years or less than two years of experience in terrace gardening. This is followed by 25 per cent of the practitioners with experience of more than two to four years and 18.33 per cent of the practitioners with experience of more than four to six years.

A great majority of the practitioners had less than six years of experience in terrace gardening (78.33 per cent). Even though terrace gardening is an age old concept; it has been gaining its importance in recent years and people are gaining awareness about the benefits of practicing it. Hence, they are showing more enthusiasm to have garden on their terraces. The another reason to have more terrace gardens in the recent years is, due to rapid urbanization, the prices of the land is shooting up and space to have kitchen garden around the home is shrinking as that land is utilized mainly to construct buildings. Hence terrace is the feasible place to have a garden. The recent technologies in terrace water proofing are making practitioners not to worry about the roof leakage to have terrace garden.

During the study, it was observed that the practitioners had devoted 85.7 per cent of their terrace space for terrace gardening activity. Out of it, 28.33 per cent who had terrace garden space of 400-600 square feet, followed by 18.33 per cent who had the terrace garden space of 600 square feet to 800 square feet and 15 per cent practitioners dedicated the terrace garden space of 800 square feet to 1000 square feet which is demonstrated as an evidence in the Table 4.6. The possible reason for this type of area dedication for terrace gardening depends on the area available for the said purpose and also the factor of ownership of the building.

Table 4. 4**Personal characteristics of the respondents practicing terrace gardening****(n=60)**

Sl. No.	Particulars	Number of respondents	Per cent
1.	Gender		
a)	Male	23	38.33
b)	Female	37	61.67
Total		60	100
2.	Age (Years)		
a)	Up to 20	0	0.00
b)	More than 20 to 30	10	16.67
c)	More than 30 to 40	22	36.67
d)	More than 40 to 50	17	28.33
e)	More than 50 to 60	10	16.67
f)	Above 60	1	1.67
Total		60	100
3.	Family size		
a)	1 to 2	8	13.33
b)	3 to 4	41	68.33
c)	5 to 6	11	18.33
Total		60	100

A cursory look at the Table 4.7 indicates the type of the ownership of terrace garden by the practitioners. 85 per cent of the practitioners had their own house when compared to 15 per cent of practitioners practicing on rented house. The people practicing terrace gardening on rented houses were less because of lack of support from the owners to allow terrace gardening activity as they think that due to terrace gardening the roof may get damage and cause water leakage apart from the heavy load which may cause damage to the structural integrity of the building. The owners of the rented house think that they might face problems while removing components of terrace garden at the time of renting to the other tenants.

The Practitioners were utilizing water from different sources such as bore well, BWSSP, rain water harvesting method and recycled water for terrace gardening activity which is documented in Table 4.8.

The data in table revealed that 43.33 per cent of the practitioners were using bore well water as a source of terrace gardening followed by 28.33 per cent for whom rain water harvesting system and recycled water was the source of irrigation. 21.67 per cent of practitioners were using BWSSP as well as recycled water as a source of water for their terrace gardening activity. Most of the houses did not have rain water harvesting systems and hence a great majority of the respondents depended on bore well as the source of irrigation.

Infrastructure facilities owned by the terrace gardener decide the type of terrace garden he is practicing. The data in Table 4.9 shows the infrastructure facilities owned by terrace gardeners in the city. It was found that all the respondents (100 per cent) were maintaining terrace gardens through pots. Some novel concepts like green roofs are famous only in abroad which is a new concept in Bengaluru city. Hence, none of the green roofs got documented in the study. There were 50 per cent of the practitioners having seating arrangements on their terrace gardens. Hardscapes such as Buddha statue, fountains, gazebo, fire pits etc. were owned by 15 per cent of the practitioners and 23.33 per cent practitioners had shade net on their terrace either partially or fully covered. It is also found that 41.67 per cent practitioners had water

Table 4.5
Experience of practitioners in terrace gardening

(n=60)

Sl. No.	Experience (Years)	Number of respondents	Per cent
1.	Less than 2	21	35.00
2.	More than 2 to 4	15	25.00
3.	More than 4 to 6	11	18.33
4.	More than 6 to 8	9	15.00
5.	More than 8 to 10	3	5.00
6.	More than 10	1	1.67
Total		60	100

Table 4.6
Area dedicated for terrace gardening by the respondents

(n=60)

Sl. No	Area (sq.ft)	No. of respondents	Per cent
1.	Less than 200	1	1.67
2.	More than 200 to 400	4	6.67
3.	More than 400 to 600	17	28.33
4.	More than 600 to 800	11	18.33
5.	More than 800 to 1000	9	15.00
6.	More than 1000 to 1200	6	10.00
7.	More than 1200 to 1400	4	6.67
8.	More than 1400 to 1600	3	5.00
9.	More than 1600 to 1800	4	6.67
10.	More than 1800 to 2000	1	1.67
Total		60	100

Table 4.7
Type of ownership of terrace gardens by the practitioners

(n=60)

Particulars	Own		Rented	
	No./Area	Per cent	No./Area	Per cent
Ownership	51	85	9	15
Average years of experience	4.4	-	3.66	-
Average area dedicated (sqft)	770	85.7	772	85.8

garden components to grow water plants like water lily and some had incorporated ornamental fish in those containers. Vertical garden stands were commonly found among 28.33 per cent practitioners to grow more plants in a less place. Respondents who had better outside contacts obtained advice from experts and adopted greenhouse concepts and water garden concepts.

The purpose of adopting terrace gardens based on the ranking given by the practitioners is mentioned in the table 4.10.

The first preference as a purpose of adopting terrace gardens by the majority of the respondents was nutritional security to the family, followed by ambience, hobby and health condition of the family, contribution to the society and inspired by workshops and events as they were ranked accordingly. Whereas, very few were practicing terrace gardening for income purpose as it is ranked last. The purpose of adopting terrace garden differed among the respondents based on their requirement, education, available space and passion for terrace gardening.

Table 4.8
Source of irrigation utilized for terrace gardening

(n=60)

Sl. No.	Source of water	Number of respondents	Per cent
1.	Bore well	26	43.33
2.	Bengaluru Water Supply and Sewage Board	4	6.67
3.	Bengaluru Water Supply and Sewage Board & Rain Water Harvesting	13	21.67
4.	Rain Water Harvesting & Recycled Water	17	28.33
Total		60	100

Table 4.9
Infrastructure facilities owned by the terrace garden practitioners

(n=60)

Sl. No	Components	No. of respondents	Per cent
1.	Pots	60	100.00
2.	Seating arrangements	30	50.00
3.	Hardscape	9	15.00
4.	Green house	0	0.00
5.	Shade net house	14	23.33
6.	Water garden components	25	41.67
7.	Vertical garden stand	17	28.33

Table 4.10
Purpose of adopting terrace gardens by the terrace gardeners

(n=60)

Sl. No	Purpose	Mean Garrets score	Garrett's rank
1.	Nutritional	72.85	I
2.	Ambience	64.45	II
3.	Hobby	63.26	III
4.	Health condition of the family	59.14	IV
5.	Contribution to the society	43.98	V
6.	Workshops and events	36.06	VI
7.	For income	26.17	VII

4.4 Constrains faced by the terrace gardeners in installation and maintenance of terrace gardens

Practitioners may face many constraints while installing and maintaining terrace garden. The practitioners ranked the constraints as perceived by them are depicted in Table 4.11. It is revealed that practitioners face maximum problem due to insect pest infestation as it was ranked first, followed by plant diseases, non-insect pests such as rodents, monkeys, cats, birds. This was followed by lack of space available on the terrace for expansion and to grow all the plants as they wish are some of the constraints faced by practitioners as they ranked accordingly. Leaking of the roof due to terrace gardening, lack of time, non-availability of inputs such as compost, organic fertilisers and lack of guidance from the experts are the least among the constraints faced by the practitioners. It is a misconception that terrace gardening leads to leaking of roof, and that it was noticed that only improper water proofing leads to leaking of the roof and not due to terrace gardening activity. The constraints as perceived by the practitioners were expressed based on the felt need towards terrace gardening and in a way to improve upon the gardening.

Most of the practitioners maintain organic terrace gardens but still they have to depend on inorganic fruits and vegetables due to several factors that drive them to purchase inorganic fruits and vegetables (Table 4.12). It is evident from the table that 61.7 per cent of the respondents believed that lack of space to cultivate the crops on terrace is the main factor forcing them to purchase inorganic vegetables and fruits to meet the nutritional requirement. The space is limited as well as it is difficult to cultivate all the crops on the terrace due to climatic conditions and the available depth of the soil which will not support the growth of some plants. 61.7 per cent of the respondents felt that they cannot dedicate more time in doing terrace gardening since many of them are from working class. 51.7 per cent of the respondents believed that inorganic fruits and vegetables were cheap and affordable. Whereas 28.3 per cent claimed that the organic stores to purchase vegetables and fruits were far away and not reachable by them.

It is obvious for the practitioners to spare some time to the terrace gardening activity for its proper maintenance. The total number of hours spent by the practitioners for terrace gardening activity in a week is presented in Table 4.13. The results showed that 51.7 per cent dedicate one hour every day and in total seven hours in a week for terrace gardening activity. Whereas 20 per cent of the gardening practitioners expressed that they dedicate two hours a day and as a result they would spend 14 hours a week for terrace gardening activity. Since the nutrition terrace garden requires more attention, hence it draws practitioners to spend more time every day, whereas ornamental gardens need not require more attention hence, it draws less attention. However, depending on the occupancy and the spare time available, different practitioners spent 4 - 20 hours a week for terrace gardening.

Table 4. 11
Constraints faced by the terrace gardeners in installation and maintenance
of terrace gardens

(n=60)

Sl. No	Constraints	Mean Garrett's score	Garrett's rank
1.	Insect pest infestation	369.75	I
2.	Disease problems	350.50	II
3.	Rodents, monkeys, cats, birds etc...	337.33	III
4.	Lack of sufficient space on terrace for expansion	285.67	IV
5.	Lack of knowledge in handling plants	279.00	V
6.	Irrigation - water problem	248.25	VI
7.	Climatic conditions	238.67	VII
8.	Lack of co-ordination from other family members	178.00	VIII
9.	Roof leakage problem	176.67	IX
10.	Lack of time	176.33	X
11.	Non-availability of inputs	142.83	XI
12.	Lack of guidance from the experts	119.50	XII

Table 4.12
Factors drive terrace gardeners to purchase inorganic vegetables and fruits

(n=60)

Sl. No.	Factors	No. of respondents	Per cent
1.	Cheap and affordable	31	51.7
2.	Lack of space to cultivate all crops on terrace garden	37	61.7
3.	Organic stores are not reachable	17	28.3
4.	To save time	37	61.7

Table 4. 13
Time spent by respondents in terrace gardening activity

(n=60)

Sl. No	Time spent (Hours/week)	No. Of respondents	Per cent
1.	4	6	10.0
2.	7	31	51.7
3.	8	1	1.7
4.	9	7	11.7
5.	14	12	20.0
6.	15	1	1.7
7.	16	1	1.7
8.	20	1	1.7

4.5 Analysis on establishment and maintenance cost of terrace garden

It is observed that all the terrace gardens were customized. There was no particular standard cost of installation and maintenance of terrace gardens on any basis like per square feet area or per pot. Therefore an attempt has been made by generalizing the cost of installation and maintenance of terrace garden based on “per pot” as well as “per square feet” area by collecting the data from the terrace garden installation and maintenance companies. All these costs are basic which may vary according to the choices and preferences of those willing to adopt terrace gardens.

Terrace gardens of the practitioners were majorly classified into nutritional and ornamental, wherein both the cases, people spent money on installation and maintenance. Both categories had common spending on pots, compost, filler material, plant material, staking and irrigation equipment.

Nutritional garden has exceptional spending on seeds, fertilizers and pesticides for maintenance of vegetables and fruit plants. Similarly, ornamental garden has exceptional spending on plants. Ornamental gardens usually consist of aesthetic plants which are costlier than nutritional plants. In nutritional garden on an average, each pot with all other gardening components costed around Rs.200 exclusive of maintenance cost as depicted in Table 4.14. In ornamental garden on an average each pot with all other gardening components costed around Rs.280 exclusive of maintenance cost as depicted in table 4.15. There are some people who would become self-sufficient in gardening (Table 4.16). They tend to produce their inputs after certain time of experience in practicing terrace garden, though initial cost is nearer to the other two types mentioned above. In a long run self-sufficient gardeners would not spend money on recurring costs involved in maintenance of their garden.

Table 4.14
Cost of installation and maintenance of nutrition terrace garden

(n=16)

Sl. No	Particulars	Cost in Rs.			
		< 500 (Sq.ft)	500-1000 (Sq.ft)	1000-1500 (Sq.ft)	1500-2000 (Sq.ft)
1.	Number of pots	52	98	156	190
2.	Pots	5062	10491	15010	18763
3.	Compost	1667	3333	4990	6238
4.	Filler material	303	388	502	628
5.	Fertilizer	520	492	409	511
6.	Pesticide	321	296	310	388
7.	Seedlings/plants	1109	2041	2998	3748
8.	Seeds	102	202	280	350
9.	Irrigation	221	511	2980	3725
10.	Staking	106	493	450	563
11.	Maintenance/month	1000	1500	2580	3225
Total		10411	19747	30509	38136

Table 4.15
Cost of installation and maintenance of ornamental terrace garden

(n=7)

Sl. No	Particulars	Cost in Rs.			
		< 500 (Sq.ft)	500-1000 (Sq.ft)	1000-1500 (Sq.ft)	1500-2000 (Sq.ft)
1.	Number of pots	46	83	122	155
2.	Pots	5010	9018	16909	16909
3.	Compost	1667	3001	5626	5626
4.	Filler material	301	542	1016	1016
5.	Fertilizer	56	101	189	189
6.	Pesticide	33	59	111	111
7.	Seedlings/plants	5020	9036	16943	16943
8.	Seeds	59	106	199	199
9.	Irrigation	320	576	1080	1080
10.	Staking	107	193	361	361
11.	Maintenance/month	500	900	1000	1000
Total		13073	23531	34947	43434

Table 4.16**Cost of installation and maintenance of self-sufficient terrace garden****(n=37)**

Sl. No	Particulars	Cost in Rs.			
		< 500 (Sq.ft)	500-1000 (Sq.ft)	1000-1500 (Sq.ft)	1500-2000 (Sq.ft)
1.	Number of pots	47	126	165	217
2.	Pots	5231	6173	14074	19161
3.	Compost	1667	1967	2892	3557
4.	Filler mat	288	340	500	614
5.	Fertilizer	393	464	682	838
6.	Pesticide	329	388	571	702
7.	Seedlings/plants	994	1173	1724	2121
8.	Seeds	98	116	170	209
9.	Irrigation	280	1330	5486	10597
10.	Staking	113	1033	1906	5241
11.	Maintenance/month	0	0	0	0
Total		9393	19733	28005	43040

Case study of a Journalist turned passionate terrace gardener - Prathima Adiga

Profile of Mrs. Adiga

Name	: Prathima Adiga
Address	: #220, 28th cross, 2 nd block, 2nd floor, Rajajinagar, Bengaluru
Age	: 46
Education	: B.Com
Family size	: Five Members



Mrs Prathima Adiga is a 46 years old journalist living in Rajajinagar, Bengaluru. Mrs. Adiga could stand as a representative among the sample because of her enthusiasm and dedication she showed towards practicing and promoting terrace garden. She dedicated almost all of her terrace for gardening (700 Sq ft) and converted it into a small vegetable farm and a beautiful leisure station for her family. She is blessed with a family that encourages and supports her passion in terrace gardening. Her husband is a civil engineer in profession and she has a son studying in a higher primary school. At her house she takes care of her mother-in-law and father-in-law. Her family members enjoyed spending time in terrace gardening and dedicate time whenever they get leisure.

Mrs. Adiga derives many benefits out of her terrace gardening. Major benefit was having fresh, chemical free, tasty fruits and vegetables as well as flowers for pooja purpose. She incorporated many hardscape components and designed her terrace garden which is more aesthetic and one can relax after a long working hours. She learned lot of 'Do it yourself' techniques to modify and update her garden to look more aesthetic and cut down the unnecessary maintenance costs. She used terrace garden to educate others who are interested in terrace gardening. As revealed by her, some of the indirect benefits she is realizing are reducing carbon footprints, regulating the temperature of the roof, utilizing home generated kitchen waste in the best possible way.

After analyzing the health status of her family, she got to know that a sound health can be achieved through good food habits. There was hardly any space to have kitchen garden on the ground. Later she realized that having terrace garden is a very good option to grow required vegetables and few fruits. Hence she started cultivating crops on terrace. Since she was born and brought up in Bengaluru city, she hardly has knowledge about cultivation of crops, that too on terrace using pots is not an easy task. Still she developed confidence and kept a step forward. She faced lot of constraints in the beginning like pest and diseases. But she never took her step back. She accepted it has a challenge and consulted many experts, tried to solve them. It took two years for her to get expertise in terrace gardening. Now she not only cultivate terrace garden for home consumption but also to teach newbies.

Mrs. Adiga has integrated type of terrace garden where she grows vegetables, fruits and flowers in pots. Wherever she finds fruits and vegetables of rare variety, she will collect and plant it in her garden, she said. In spite of having huge terrace garden with lots of individual pots, she said she hardly spends 1000 rupees towards the maintenance of the terrace garden. She developed the garden over the period of time and became self-sufficient by producing her own compost, fertilizers. She uses recycled paint buckets as pots which reduced her initial cost dramatically. The major source of irrigation is bore well water. She converts all her home waste into compost mainly through kamba (compost making device).

She owns facilities like rain water harvesting, composting unit, liquid fertilizers, MS fabricated stands, terrace gardening kit etc. She sees such investments as a seed for goodness of her family and also the society. Mrs. Adiga harvests a bumper yield of about 250-280 kgs of vegetables, fruits and flowers from her small terrace of about 700 sqft per year. This shows her expertise in growing crops on terrace.

She started terrace gardening in the year 2015-16. Initially she grown easy cultivable crops like leafy vegetables, tomatoes and chilies in a small place of 400 sqft out of 800 sqft she spent 10,000 rupees as initial cost. In the year she hardly got 55 – 60 kgs of vegetables. In the year 2016-17 she extended her terrace garden to 600 sqft with the paint buckets brought for free by her husband and started growing flowers, fruits and some tough growing vegetables such as brinjal, capsicum, Cole crops etc.,



Fig 4 : Self-sufficient terrace garden of Mrs. Prathima Adiga



Fig 5 : Liquid organic fertilizers prepared by Mrs. Adiga



Fig 6 : Kamba (Compost making device)

along with the greens and regular vegetables and got yield of 190 – 200 Kgs. In the year 2017-18 she extended her terrace garden to 700 sqft and utilized her whole terrace into a full pledged terrace garden. She started growing cucurbits sweet potatoes, ginger, turmeric etc., In this year along with the regular crops, she started experimenting nonnative crops like strawberries, broccoli etc., and got yield of 250 – 280 kgs with the expertise she got over the years. The major portion of the entire produce was utilized for home consumption purpose and excess was shared with the neighbors.

Mrs. Adiga is not only a passionate terrace gardener but also acts as a consultant by sharing knowledge and inputs to other terrace gardeners. “Gaining knowledge is the first step for wisdom, sharing knowledge is the first step for humanity. To stand on these words, Mrs. Adiga didn’t stop at just learning. Having three years of experience, She found ways to extend her knowledge both offline and online. Through offline she guided and inspired around 450 people to install terrace gardening and now they are successfully practicing terrace garden. Through online she inspired numerous with the help of social media such as facebook and whatsapp. She became an active member of some of the facebook and whatsapp organic terrace garden groups (OTG’s) in Bengaluru such as Kamba group (Bengaluru west zone), Uttarahalli Terrace Garden group (UTG), Southeikai group (Bengaluru south zone) and R R Nagar organic terrace garden group. She produced compost and liquid fertilizers by herself at her home and sells to her fellow OTG members.

Mrs. Prathima Adiga stands for the words, “Be the change you want to see in the world”. She is a passionate terrace gardener, indeed! She continues to inspire others also.

V SUMMARY AND CONCLUSION

Terrace gardening existed since the days of Babylon, today it has a new meaning in India and other parts of the world. Since various developments are taking place, we started losing our agricultural lands. With the buildings on land and its cost in urban areas, there is scarcely any space for a garden. So if vegetables were to be grown domestically the only way is terrace which gives the ideal space.

The Terrace Gardening is emerging as an important business venture under different formats in Bengaluru city due to presence of large number of urban middle and upper class families who thrive to have a garden on terrace due to space constraint on the ground. These families spend a good deal of money on establishment and maintenance of terrace garden. These families also look for variety of designs with lot of plant species and hardscape elements. As a result, there is a good demand for business ventures that are providing different types of services to terrace garden business.

Terrace gardening is an alternative agricultural approach to farming system that is more responsive to natural cycles and biological interaction. The reason for focusing on urban agriculture is that terrace gardens have potential for application in cities and must be seen as a permanent element of urban system because ecological imbalances created due to abuse and overuse of environmental services in the city has left a very thin line between natural and man-made disasters.

There is immense scope of terrace gardening in urban context as they enhance food security and availability of healthy food. The food produced in terrace garden is much safer than the food we get in the market as there is less or no pesticide, insecticide and fertilizers are added. Terrace gardens help in supporting and conservation of urban biodiversity by providing safer environment and habitat to insects, bees, butterflies and birds. Therefore, they play a key role in biodiversity conservation of urban species. Hence, there is huge potential for the promotion of terrace gardens in urban areas in general and Bengaluru in particular. However, no systematic study has been conducted to document different types of terrace gardens being practiced in Bangalore city. There is no data related to cost of maintenance of terrace gardens and the constraints faced by the practitioners. In this milieu, the present study is undertaken with the following objectives.

Objectives of the study:

1. To document the different types of terrace gardens practiced in Bengaluru
2. To analyze the various stakeholders involved in terrace gardening
3. To examine the socio-economic profile of terrace gardeners
4. To analyze the establishment and maintenance cost of terrace gardens
5. To document the selected case study on terrace gardening in Bengaluru city

Methodology:

Bengaluru is purposefully selected for the study to document the terrace gardening practices prevailing in the city. On one hand, there is a garden city and its rich green history; on the other hand, there are technologically intensive industries, fast growing real estate properties which are declining the green cover of the city. The citizens of Bengaluru are in between striving to bring back the green cover on the available spaces such as terrace. Other factors to consider Bengaluru as study area are the availability of terrace gardens to document, large number of terrace garden practitioners, Organic Terrace Garden groups (OTGs) and Non-Profit organizations such as Garden City Farmers (GCF). The study particularly confines to Bengaluru urban as most of the practitioners are found to reside here.

Analysis of the study was done mainly based on primary data. The primary data was collected from 60 terrace garden practitioners of Bengaluru by personal interview through a pre-tested schedule. The list of terrace gardening practitioners was obtained from Garden City Farmers (GCF) and the respondents were selected randomly.

The respondents for the study included Passionate terrace gardeners, Terrace garden consultants and Input agencies. In addition, secondary data was collected regarding land cover of the city. The secondary data was also collected from the various sources.

Major findings

1. A great majority of terrace gardens types found was integrated type (56.66 per cent) compared to nutrition (26.66 per cent), ornamental (11.66 per cent) and medicinal (5.00 per cent) types.
2. Cent per cent of the respondents were passionate terrace gardeners followed by consultants (36.66 per cent) and input agents (18.33 per cent).

3. All terrace gardeners rely on social media such as Whatsapp and facebook to get information and to clear doubts about gardening everyday
4. A great majority of the practitioners were female (61.67 per cent). Majority of the respondent's age has fallen under the range of 30 to 40 years (36.67 per cent). There were more number of families (68.33 per cent) had family size of three to four members.
5. A majority of the practitioners (35.00 per cent) had less than two years of experience in terrace gardening followed by those who had experience in between two to three years (25.00 per cent). Whereas those who had experience more than 10 years are very less (1.67 %)
6. A majority of the practitioners (28.33 per cent) dedicated 400 to 600 sqft of area for terrace gardening activity and found that on an average the practitioners devoted 85.7 per cent of their total terrace space for terrace gardening activity.
7. A major portion of respondents practicing terrace gardening had own house (85 per cent) compared to rented house.
8. Bore well water was the major source of irrigation As a source of irrigation, majority of the practitioners were using bore well water (43.33per cent) for the terrace gardening activity
9. Cent per cent of the practitioners were practicing terrace gardening through pots in comparison with green roofs.
10. The first priority of having terrace garden is for nutritional security followed by ambience, hobby and the last is for income generation
11. Insect pest and disease problem were the major constraints faced by the terrace gardening practitioners followed by lack of sufficient space on terrace for expansion and the last ranked was lack of guidance from the experts.
12. The major factor that drives terrace gardeners to purchase inorganic vegetables and fruits is lack of time and lack of space on the terrace to cultivate all varieties required for diet
13. Majority of the practitioners (51.7per cent) spend one hour daily for terrace gardening activity everyday followed by two hours per day (20.0 per cent)
14. Nutritional terrace garden costs around Rs 180 whereas Ornamental terrace garden costs Rs 230 for the installation "per pot" exclusive of maintenance charges

Conclusion

Terrace garden has immense scope in the urban areas and should be made available throughout the country through the state agriculture and horticulture departments. Policies should be made to establish terrace gardens mandatory in urban cities considering food security, increase in green cover and biodiversity conservation. Since there is meager research is being conducted on urban farming and terrace gardening in the Agriculture and Horticulture colleges in the country, there is a need to focus more on terrace gardening research and promotion to fight the climate change. Urban terrace gardens will revolutionize and helps to increase the health of the city dwellers. Transforming our roofs is a practical and comparatively easy way to mitigate climate change. It is also the most effective if not the only way to adapt to a warming climate. By restoring vegetation to our cities, we not only reduce carbon foot prints and adapt to climate change but we can also reconnect with nature, increase our food security and provide habitat for wildlife especially insects.

Though the terrace gardening business has huge opportunity for the commercial firms to play, the success of it in the city is mainly due to NGO's like Garden City Farmers (GCF) and Organic Terrace Garden Groups (OTG's). Organic Terrace Gardeners are achieving self-sufficiency by preparing and sharing the inputs and reducing the recurring maintenance costs through the help of OTG's and social media. Hence the Government should encourage the concerned institutions to promote terrace gardening in Bengaluru city. The study has found out several constraints faced by the terrace gardeners. Efforts should be made by department of Horticulture to solve the problems by providing technical consultancy and ensure supply and services to the needy.

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