

## **CHAPTER– V**

### **SUMMARY, CONCLUSION AND RECOMMENDATIONS**

Tremendous rate of real estate development across the globe is imposing immense pressure on the environment and its natural resources. Construction industry is growing rapidly all over the world. Buildings have major environmental impacts over their entire life cycle which ranges from their designing, construction, operation, maintenance, renovation and deconstruction. Resources such as ground cover, forests, water, and energy are depleted to give way to buildings. Humans face a range of negative impacts linked to the way buildings are designed, built, and maintained.

Vegetation and tree cover give way to urban areas with large expanses of pavements, buildings, and other structures, thus eliminating cooling provided by the vegetation. Urban heat island impact gives rise to increased temperatures. As the developmental path charted, it is important to keep eyes on the environmental damage. It is extremely important to pause and carry out some necessary course of action for benefit of mother earth and for future generations.

The world is now slowly realizing the importance of environmental conservation. In the later part of the twentieth century 'Go Green' philosophy has been developed. Building construction sector is no exception to this. The construction industry also has shown considerable awareness towards preserving the ecological balance through various green practices. Awareness is being translated into practices and eco-friendly real estate projects, products and services are emerging faster than ever.

Mounting concern for the environmental impact of real estate has necessitated the formulation of sustainable solutions. Sustainability has become increasingly important in the building industry in recent years. A movement has emerged in the building construction industry in more efficient

and sustainable manner by reducing energy, water and resource use. This concern has led to the development of “Green Buildings”. A Green building is one whose construction and lifetime of operation assure the healthiest possible environment while representing the most efficient and least disruptive use of land, water, energy and resources. The Greenness of the building is assessed on the five broad areas viz. Sustainable site, Water efficiency, Energy efficiency, Material and resources and Indoor environmental quality.

In terms of appearance or use, there is no difference between Green Building and the conventional ones. The major differences are that Green buildings have improved indoor environment and they offer operational savings. Green buildings can have tremendous benefits, both tangible and intangible. The immediate and most tangible benefit is the reduction in water and operating energy costs right from day one, during the entire lifecycle of the building. Green buildings are designed to save energy costs by reducing the energy consumption. Solar energy and wind energy are intermittent sources of energy, so these sources have to be combined with other sources of energy or storage devices. Energy efficiency in buildings can be achieved by adopting strategies like using low energy materials, insulation for walls, roofs, roof garden, glass carpet for roof, glass technology.

Green buildings can reduce energy consumption through energy efficient lighting, air conditioning systems motors, pumps etc. Green buildings encourage use of water in a self-sustainable manner through reducing, recycling and reusing strategies. There are number of indirect sources of pollution such as vehicle pollution from the transport of building products and the manufacturing of building products. There are also direct source of pollutants such as HVAC refrigerants and the toxic emissions from the finishes. All these lead to global warming, ozone layer depletion and air pollution. The Green Buildings encourage the use of alternate fuels for transportation and captive power generation. Green Buildings also emphasise waste reduction. Construction wastes and demolition debris are the main wastes produced during the construction process, and these wastes degrade the quality of the environment. Green Buildings ensure waste reduction by the

reuse and minimisation of construction wastes and debris and diverting them to recycling units, the use of existing building structure and reclaimed building materials, the increased use of recycled content in construction materials and designing the structure to which produce less scrap. Green Buildings also encourage using recycled and reused materials and discourages the use of virgin wood, thereby addressing environmental impacts associated with extraction and processing of virgin materials.

The intangible benefits of green buildings include enhanced lighting, health and wellbeing of the occupants, safety benefits and conservation of scarce natural resources. It ensures maximum daylighting and cross ventilation and recognises measures to minimize indoor air pollutants. Green buildings can have a more significant impact on their occupant's health and productivity through improving indoor environment quality (IEQ). This can be achieved by using less toxic interiors, low-emitting adhesives, paints, carpets and composite wood, illuminating 75-90% of the space with natural light and thermal comfort due to local control over air conditioning and better ventilation.

There are some barriers in way of adopting green buildings. One of the barriers is the additional cost incurred in its construction and difficulty in getting positive returns on this extra investment of the builders and developers if their green building projects are not sold. Another barrier is the lack of technical capacity for the planning, design and construction of green buildings. There is already a skills deficit in the sector, with only few employees having adequate training and a smaller number of engineers going into construction than previously. Similarly, there is a shortage of contractors and a lack of technical training capacity. Lack of availability of funds, space and materials needed in the construction of green buildings are also the major barriers. Procuring green certification is difficult, lengthy and expensive process which is a great barrier. Lack of interest on the part of all the stakeholders are important barrier to progress of green building. One of the main barriers encountered in encouraging green building practices is lack of awareness of the benefits amongst the users of building. The common

perception is that green construction is prohibitively expensive. The public are more concerned about the costs than the sustainability aspects, and seem less aware of longer term savings. Green buildings and green appliances are viewed as a luxury market. The affordable housing sector is completely estranged from the concept. However, there is growing awareness of the benefits of green building and demand is growing slowly, especially in commercial spaces. There is a need for large-scale awareness and capacity-building programmes.

Voluntary green building rating systems have become a popular tool to encourage the construction sector to adopt sustainable practices. In India, the two main rating systems are the Green Rating Integrated Habitat Assessment (GRIHA), developed by TERI and the Ministry of New and Renewable Energy, and Leadership in Energy and Environment Design (LEED), operated by the Indian Green Building Council (IGBC). GRIHA uses a set of 34 criteria to assess buildings and incorporates all the relevant building codes and standards, including the ECBC, and has been adopted by the government Central Public Works Department.

### **Justification**

Due to the fact that the construction industry is traditionally a large user of natural resources, the necessity to design buildings with a low environmental impact is increasing. An environment friendly building is one that does not adversely affect the larger environment and the health of its users. The sheer number of existing housing units as well as the potential impact of future growth directly speaks to the need of an integrated green building approach to housing. The environment of existing residential building can create a sizeable impact on the global environment and health of the users.

Green building is accepted worldwide in the recent past, but there is still a vast community that either is unaware of sustainable design concept, indifferent to its cause, or unconvinced of its advantages. It is heartening to know that the concept of Green Buildings is not widely being adopted in the

Indian real estate industry. However, efforts are not enough and a greater push is required to make real estate environment sustainable. To convince owners, builders, and designers and other stakeholders about the benefits of sustainable design, it is necessary to make them understand the numerous advantages of green building concept.

Vadodara city has witnessed a remarkable growth in the construction of residential units. During the later part of the twentieth century and during the early year's twenty first century. At that time all the builders might not have paid much attention to its influence on the residents and environment. Now, that builders are also becoming conscious of environmental impact of constructions made by them, they incorporate several aspects so as to make the buildings environment friendly. Now the upcoming buildings are made "green" but the existing building can also be improved to make them environment friendly. There is a need to find out the extent to which the residential units constructed by the builders are "Green"- meaning environment friendly. Based on findings suggestions can be given to make them "Green". The extent of greenness of the existing residential buildings means that the building has to address a set of criteria such as site location, energy efficiency, water efficiency, sustainable material selection and indoor environmental quality.

It is also essential to find out the awareness of consumers, that is, the owners of the houses regarding the concept of green building as educated and aware consumer regarding the various aspects of green building is sure to influence many of the people around as well as their children who are going to build their own houses in future.

Aware consumer clientele can also influence the property market by pitching demand for green credentials of the buildings. Improved environmental performance of the buildings constructed by the builders can also add to their reputation and they can get returns of their investments in green buildings. However, it is necessary to find out the opinion of builders regarding green buildings and the barriers faced by them in adopting green building design

and construction. The opinion of the builders regarding the green building is sure to influence the projects they undertake for construction.

A study was, hence, planned encompassing various aspects in relation to Green Building. Some of the houses constructed by selected builders of Vadodara city were considered for assessing the extent to which they are green (eco-friendly). It was considered important to study the opinion of the builders regarding green buildings and the reasons as well barriers they have for Green building concepts / features. It was also thought important to find the knowledge of the home owners whose houses were assessed.

The researcher did not find any study focusing on awareness of homeowners of existing (non-green buildings) regarding green buildings and also the assessment of it for the extent of its greenness. Opinion of the builders also needs to be assessed in Indian context.

### **Statement of Problem**

The present research aims to assess selected houses of Vadodara City with regards to the extent they are “Green” and also the knowledge of the house owners regarding various aspects of “Green building”. It also aims to find out the opinion of builders of Vadodara City about Green building and the reasons and barriers in adopting Green building features in their construction.

Thus the present study has the following specific objectives

### **Objectives of the study**

1. To ascertain the background information about selected home owners of Vadodara city.
2. To assess the extent of knowledge of selected home owners regarding various aspects of Green Building.
3. To assess the extent of Greenness of the selected existing houses.

4. To find out the opinion of the selected builders of Vadodara City regarding the concept of Green Building.
5. To find out the extent of influence of reasons for adopting the Green Building design and construction by the builders of Vadodara City.
6. To find out the extent of barriers faced by the builders of Vadodara city in adopting Green Building design and construction.
7. To prepare an educational package on various aspects of Green Building for various stakeholders and to test the efficacy of it.

### **Delimitation**

The study was limited to

- 220 owners of the house residing in different residential areas of Vadodara city.
- the home owners who had constructed or purchased their houses (tenement/ bungalow) between 2005-2013.
- the Key decision maker who was willing to answer the questionnaire at the time of data collection.

### **Hypotheses**

1. There exists a relationship between the opinion of builders regarding green building concept and their selected personal and situational variables.
2. There exists a relationship between the extent of influence of reasons in adopting Green Building design and construction and selected personal and situational variables of the builders.
3. There exists a relationship between the extent of barriers faced by the builders in adopting green building design and construction and their selected personal and situational variables.
4. There is an interrelationship between the extent of influence of reasons in adopting green building design and features of builders and extent of barriers faced in adopting green building design and construction and opinion of builders regarding green building concept.

5. The extent of knowledge of the home owners regarding various aspects of Green Building varies with their selected Personal, Family and Situational variables.
6. The extent of greenness of the selected house varies with the selected Personal, Family and Situational variables of the home owners.
7. There exists a relationship between the extent of greenness of the selected houses and extent of influence of reasons in adopting Green Building design and construction of the builders, barrier faced by the builders in adopting Green Building design and construction and opinion of builders regarding Green Building concept.
8. There exists a relationship between the knowledge of home owners and the extent of greenness of the selected houses.
9. There exists a difference in the extent of knowledge of the home owners regarding Green buildings before and after the exposure to the educational programme on Green buildings

## **Methodology**

The study was descriptive and experimental in nature. There were two units of inquiry – one was the builders and the other was the Home Owners of the residential units built by the same builders.

**Builders:** A questionnaire was developed by the researcher as a tool for data collection from the builders. Apart from background information of the builders the tool contained three summated rating scales viz. (i) Opinion of builders regarding Green Buildings, (ii) Extent of influence of reasons in adopting Green building design and construction, and (iii) Extent of barriers faced in adopting Green building design and construction. The Opinion of builders regarding Green Buildings scale had 5 point continuum for the responses ‘Strongly agree’, ‘Agree’, ‘Neutral’, ‘Disagree’ and ‘Strongly disagree’ which were scored 5 through 1 respectively for the positive statements and for the negative statements the scoring was reversed. Higher scores reflected favourable opinion of builders towards green buildings. The reasons were categorized as ‘Economic’ ‘Environmental’ and ‘Other’ reasons. The respondents were required to state the extent to which they were influenced



by the listed reasons with a response structure of 'To great extent', 'To some extent' and 'To least extent'. Scores of 3 through 1 were ascribed respectively to these responses. The barriers were classified as 'Lack of technical knowledge', 'Availability of funds, space and materials', 'Green certification process', 'Lack of expected returns' and 'Lack of interest'. The responses were 'Major barriers', 'Minor barriers' and 'Not a barrier' where the scores ascribed were from 3 through 1 respectively to these responses. High scores reflected high extent of barriers faced by the builders in adopting green building design in their construction projects undertaken.

A list of builder's was obtained from Confederation of Real Estate Developers' Association of India (CREDAI). Out of 300 member builders of Vadodara City, seventy five were selected through systematic random sampling method.

**Home Owners:** A questionnaire and an observation checklist were developed by the researcher to collect data from home owners. A summated rating scale containing statement related to meaning of green building and different aspects of green building viz. site selection, water efficiency, energy efficiency, materials and indoor environment quality. The respondents were asked to state whether they "Agree", "Undecided" and "Disagree" where the scores ascribed were from 3 through 1 respectively to the positive statements. The scores were reversed in case of negative statements. The observation checklist contained items indicating the greenness of the house in various aspects of the green building such as sustainable site selection, water efficiency, energy efficiency, material and resources, indoor environment quality and innovative ideas. The responses were "Yes" which indicated the presence of those aspects in the building and "No" reflected the absence of that aspect in the building. Each sub aspects were assigned scores thereby totalling them make the score of that aspect. Higher scores indicated high extent greenness of the house. From the housing colonies developed by the selected builders, 220 existing residential units were selected which were constructed between 2005 and 2013. The selection was done through Snow ball sampling method.

Validity and Reliability of the tools was established. To test the content validity of the scales prepared were given to a panel of 11 judges from Department of Family and Community Resource Management, Faculty of Architecture, experts from other Universities (S.N.D.T. University, Mumbai), Practicing and working builders, architects and civil Engineers. The reliability of the scales was established through split-half and test-retest methods. Spearman-brown correction was applied where needed. The reliability values were found to be high for all the scales. The data were analyzed using descriptive statistics (Frequency, percentage and mean) and relational statistics i.e. 't' – test, ANOVA, Co-efficient of Correlation and Chi – square were applied according to the nature of variables.

To create awareness among the masses regarding Green buildings, an educational programme was prepared in print and audio-visual form. The respondents scoring low on knowledge scale and house owners of those houses which had low extent of greenness were exposed to educational programme in the form of Power point presentation with its explanation which was prepared to facilitate the respondents for better understanding. A booklet was also prepared consisting the same content to distribute it for their future reference. Both the media were prepared in English and Hindi language for wider applicability and acceptability. The content was developed based on the review of literature collected including the aspects such as Present environmental condition, Construction Facts, Need of Green Buildings, Definition of Green Building, Meaning of Green Buildings, Benefits of Green Buildings, Green Rating Systems, Features of Green Buildings, Going Green in Existing Buildings by following guidelines (Site selection, Water efficiency, Energy conservation, Material selection and Indoor Environmental Quality).

The content validity was established of the educational programme prepared. Pre-testing of the programme was conducted to establish the reliability which was done through the paired t-test. For this the knowledge test was administered before and after the exposure of educational. The paired t-test results reflected the high efficacy of the educational programme prepared.

## **Major Findings**

The major findings of the study are presented here.

### **1. Information regarding Builders**

The data were collected from the builders to find out their opinion regarding green buildings, extent of influence of reasons and extent of barriers faced in adopting green building design and construction.

#### **Section I: Background Information of Builders**

The mean age of the builders was 43.01 years. One half of the builders' belonged to age group of 36 to 50 years. More than one third of the builders had done diploma in civil engineering. Less than one half of the builders were working as builders since 11 to 20 years with a mean of 16.05 years. It was found that more than one half of the respondents had low extent of exposure to the sources of information on green building. Most of the builders were somewhat familiar about the concept and methods of Green Buildings. Majority of the builders had incorporated Green Building element "Indoor Environment Quality" and "Water Efficiency" in their Private projects only.

#### **Section II: Opinion of builders regarding Green Buildings**

To find out the opinion of builders regarding Green buildings, several statements on Green building aspects were framed. More than one half of the builders strongly agreed and reflected that there is a need to promote Green Building design and construction due to the deteriorating condition of Vadodara city and it also helps in balancing the negative effect of various kind of pollution. The opinion of builders regarding Green buildings was presented as 'Most Favourable', 'Somewhat Favourable' and 'Least Favourable'. It was found that less than three fourth of the builders had "Somewhat Favourable" opinion regarding Green Buildings.

#### **Section III: Extent of Influence of Reasons in adopting Green Building design and construction**

It was thought necessary to find out the reasons that might have influenced the builders to adopt the Green building concept in their projects. It was

reflected from the findings that less than one half of the respondents had “moderate extent of influence” of “economic reasons” for adopting Green building design and construction. The “environmental reasons” influenced “to a great extent” to less than two third of the builders. The “other reasons” were influential “to somewhat extent” to less than three fourth of the builders. The computed weighted mean for each reason for adopting Green building concept revealed that “Environmental reasons” were the most influential reasons for adopting Green building concept by the builders of Vadodara city. The overall weighted mean on all the factors was 2.29 out of 1 and 3.

#### **Section IV: Extent of Barrier faced in adopting Green Building Design and Construction**

There were several barriers that builders faced in adopting Green building design and construction. It was found that majority of the builders reported lack of technical knowledge of builders, contractors, clerk and other project team to a high extent as a barrier in adopting Green building design and construction. More than three fourth of the builders faced “moderate extent” of barrier in availing funds, space and materials for constructing Green buildings. The computed weighted mean for each barrier faced by builders in adopting Green Building showed that “Technical Knowledge” and “Lack of Interest” were the categories for which the selected builders faced major barriers in adopting Green Building concept. The overall weighted mean for the entire sale was 2.27 out of 1 and 3.

#### **Information regarding Home Owners**

##### **Section I: Background Information regarding the home owners**

It was revealed that majority of the decision makers/house owners who jointly or independently took decision regarding the purchase or construction of the house were male. Majority of the respondents were husbands and a little less than one fifth were females i.e. home makers as respondents. The mean age of the respondents was 42.05 years. More than one half of the respondents belonged to the age group of 36 to 50 years. Majority of the decision makers/house owners who jointly or independently took decision regarding the purchase or construction of the house were male. Majority of the

respondents were husbands and a little less than one fifth were females i.e. home makers as respondents. Information regarding the education of the respondents highlighted that less than one half of the respondents were graduates and more than one third of the respondent were post graduate. It was found that less than three fourth of the respondents were working in service sector. The total monthly family income ranged from Rs. 28,000 to Rs. 2, 00,000 with a mean income of Rs. 88,153.64. Majority of the respondents belonged to nuclear family with a small family size consisting of two to five family members. Majority of the respondents were residing in tenement or twin duplex type houses. Less than one half of the respondents purchased or constructed their house between the year 2008 and 2010.

## **Section II: Knowledge of Home Owners regarding various aspects of Green Buildings**

The knowledge of the home owners was assessed regarding Green buildings. The knowledge scale contained statements on various aspects of Green Buildings such as Meaning of Green Buildings, Energy Efficiency, Water Efficiency, Materials and resources and Indoor Environment Quality. It was found that majority of the home owners had moderate extent of knowledge regarding 'meaning of Green building'. Less than one half of the respondents had low extent of knowledge on 'sustainable site' as one of the feature of green buildings. More than one half of the respondents had low extent of knowledge regarding 'water efficiency' and similar percentage of respondents had low extent of knowledge regarding 'energy efficiency' as a feature of green buildings. A little less than one half of the respondents had moderate extent and low extent of knowledge regarding the 'material and resources' in green buildings respectively. All of the respondents had low extent of knowledge regarding the 'indoor environment quality' in the green buildings. Less than two third of the respondents had low extent of knowledge on the entire scale of various aspects of green buildings. The weighted mean computed for each of the aspects reflected that the respondents had higher score for knowledge regarding the "meaning of Green Building". It was also found that respondents had least score on knowledge regarding "Indoor

Environment Quality”. The overall weighted mean on all the aspects was 1.76 out of the range 1 to 3.

### **Section III: Assessment of the selected houses for their extent of greenness**

The house of the respondents was analysed for the extent of greenness. It was observed that regarding the ‘sustainable site’ less than three fourth of the houses had moderate extent of greenness. On the aspect of ‘water efficiency’, more than three fourth of the houses had moderate extent of greenness. About the ‘energy efficiency’, more than one half of the houses had low extent of greenness. Regarding the ‘material and resources’ it was found that majority of the houses had moderate extent of greenness. Majority of the houses had moderate extent of greenness on ‘indoor environment quality’. Regarding ‘innovative aspects’ the low extent of greenness was found in all of the houses. The computation of weighted mean reflected that majority of the selected houses assessed had moderate extent of greenness. The weighted mean computed for each factors for assessing the existing selected buildings reflected that the scores for “Indoor Environment Quality” was found to be the highest amongst all the aspects. The aspect of “Innovative Ideas” scored the lowest. The overall weighted mean on all the factors was 0.326 on the range of 0 to 1.

### **Testing of Hypotheses**

To analyse relationship between selected variables t-test, Co efficient of Correlation, Chi square and Analysis of Variance were computed.

- A significant relationship was found between private projects undertaken by the builders and extent of influence of reasons in adopting Green building design and construction.
- A positive relationship was found between opinion of builders regarding Green building concept and sources of information on Green buildings.
- A significant relationship was found between extent of influence of reasons for adopting green building design and construction and opinion of builders regarding green building concept.

- A significant relationship was found between the opinion of builders regarding green building concept and extent of greenness of the selected houses.
- A positive relationship was found between the extent of knowledge of the home owners regarding various aspects of Green Building and their age.
- The results showed a significant variation in the extent of knowledge of the home owners on various aspects of Green Building with their educational level.
- A positive relationship was found between extent of knowledge of the home owners regarding Green Buildings and extent of greenness of the selected houses.
- The respondents significantly differed in their knowledge level regarding green buildings before and after the exposure to the educational programme on Green buildings.

### **3. Educational Programme**

Those home owners who scored moderate and low on the knowledge regarding green buildings scale as well as those who scored low on the extent of greenness on the existing houses were exposed to the educational programme. The home owners were gathered and the power point presentation was shown to them and then immediately after that they were asked to fill the same knowledge scale. This was done to test the efficacy of the educational programme prepared and to test the change in knowledge level of the respondents regarding “Green Buildings”. The paired t-test results revealed the net gain in the knowledge of the home owners regarding Green buildings which shows the efficacy of the educational programme prepared for the purpose.

### **Conclusions**

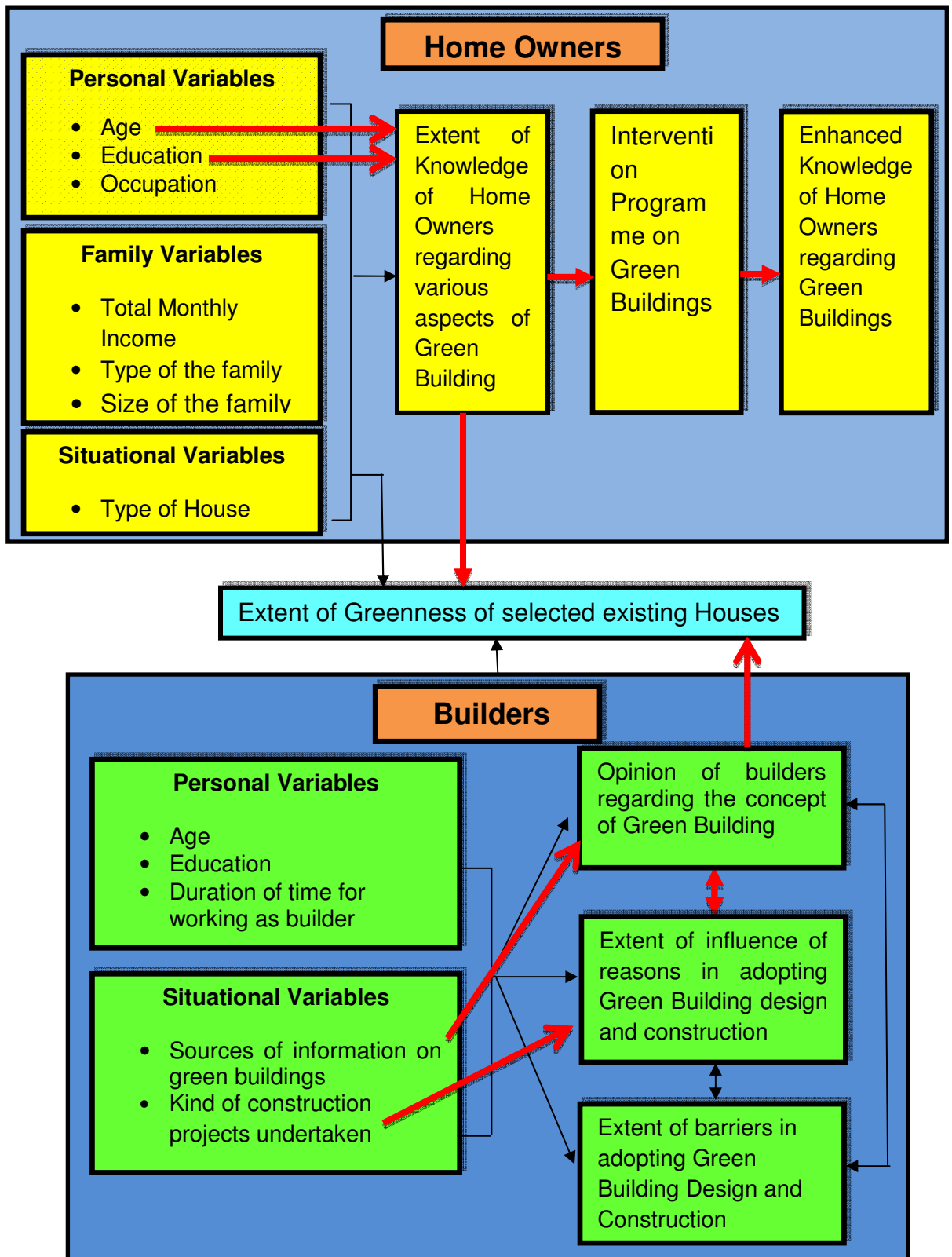
The study on “Assessment of selected houses and knowledge of the owners regarding Green buildings” was conducted on selected Builders who had constructed the houses were considered as sample for the assessment for

the extent of 'Greenness'. Builders had a mean age of 43 years and were graduate and were in the field of construction since 11 to 20 years with the mean of 16 years. Majority of them had somewhat favourable opinion regarding Green buildings. About one half of the builders had high extent of influence of reasons for adopting Green building concepts in their construction. The 'Environmental' reasons were more influential than other reasons. About two third of builders faced high extent of barriers in adopting Green building concept in their construction projects. A positive relationship was found between the extent of influence of reasons for adopting Green building concepts in their construction and their opinion regarding Green buildings. This indicates that more the influence of reasons more favourable opinion regarding Green buildings. A positive relationship between opinion of the builders regarding Green buildings and the extent of 'Greenness' of the houses assessed indicated that more favourable the opinion, more was the extent of 'Greenness' of the existing houses.

The study conducted on the selected home owners of the Vadodara city having mean age of 42 years, graduates staying in tenement/duplex revealed that majority of them had low extent of knowledge regarding Green buildings. The 'Greenness' of their houses reflected that they were Green to a moderate extent. The age and education of the home owners was found to be influencing their knowledge regarding Green buildings. The knowledge of the home owners influenced the extent to which the buildings were assessed as 'Green'. Thus, the extent of 'Greenness' of the houses were affected by the knowledge of the home owners and the opinion of the builders regarding Green buildings. The extent of Greenness of the existing selected houses was found to be influenced by the knowledge of the home owners and opinion of the builders regarding Green buildings. This reflects the need to make home owners and builders aware about the upcoming concept of 'Green buildings'. Hence, an educational programme consisting of power point presentation and a written material in booklet form was found to be effective as it enhanced the knowledge of the selected home owners on Green buildings. There was a significant gain in the knowledge of the house owners regarding Green buildings after the exposure to the educational programme prepared. This indicated the need to conduct such programmes more widely.



**Figure 39: Revised Conceptual Framework on the basis of findings of the study**



**Note: Black Lines - Proposed hypothetical relationship between the selected variables**

**Red Lines – Proved relationship between the selected variables found through statistical analysis in the present study**

## **Implications of the Study**

The findings of the study brought out number of implications for the field of Family and Community Resource Management, Educational Institutions, Government and Non-government organizations, LEED and GRIHA, Architects, Interior Designers and Builders, and the Home owners.

### **For Educational Institutions**

The educational institutions such as field of Family and Community Resource Management, Architecture, Interior Designing, Civil Engineering, and Environmental Studies can make efforts creating awareness regarding Green buildings through the following:

1. The curriculum of Family and Community Resource Management deals with the management of various resources in its curriculum at each level. Environment education is part of the core curriculum of the field offered at both undergraduate and post graduate level. Other courses such as Building Material and Housing, Residential and commercial Space Designing, Landscaping and Gardening are among the thrust areas of the field of field. Hence, Green building as a topic can be incorporated the curriculum of the field of Family and Community Resource Management and other relevant courses.
2. The disciplines have with extension programme as an integral part of the curriculums. By conducting such programmes the awareness can be created among the masses as the present investigation undertaken reflected the need for enhancing the knowledge of various stakeholders. The educational media prepared in this research can be used for various target groups.
3. Educational institutions can carry out more researches to identify the problems of the builders and the home owners in adopting Green building design and construction. The suggestions for the solutions can be provided through researches.

4. Seminars, training programmes and workshops can be conducted on Green buildings to bring the all the stakeholders together on the same platform where the awareness can be created and technical suggestions can be given.
5. It was found that the existing buildings of the home owners were green to a moderate extent. This reflected the need to create awareness among the stakeholders about the ideas and methods of converting their existing building more environment friendly. Here the fields such as civil engineering, architecture and interior designing can play their role by suggesting the technical changes that can be brought in the existing houses to make them 'Green'.
6. Educational institutions can develop the skills required to build green practices into commercial and residential activities, for example through vocational education and training for those working in the real estate sector.

### **For Government**

1. Government should make efforts in formulation strategies and policies which mandate builders to adopt features of green building in the construction projects.
2. It was expressed by the builders that they faced barrier in availability of funds, space and materials required for Green buildings, therefore the government can take some measures in overcoming this barrier.
3. Government must give subsidy to the builders for buying Green building materials and in implementing features of Green building in their construction projects, as, Builders opined that construction of Green building proves to be costlier than ordinary buildings.

4. Government can give incentives as a motivator for the builders and buyers for choosing Green building options in their construction projects easily and freely.
5. The attention of the government can be drawn towards the deteriorating condition of the environment due to the construction of the non-environment friendly buildings. Strict control must be implemented over such practices which have negative impact on the environment.
6. The government can also play a significant role in creating awareness among the purchasers about the need, importance and benefits of Green buildings.

### **For Non-Government Organization**

The Non-Governmental organizations working for environment protection can organize awareness camps, street plays or by using folk media for various stakeholders of Vadodara city for creating awareness regarding Green buildings and their benefits.

### **For LEED and GRIHA**

LEED and GRIHA should step forward and in collaboration with the educational institutions for creating awareness among the potential existing home owners as well as students who are the future home owners. They can also take up projects on converting the existing residential buildings into green buildings along with new construction as majority of the houses assessed in the present study were Green only to a moderate extent.

### **For Architects, Interior Designers and Builders**

The findings of the present research would act as a feedback to the Architects, Interior Designers and builders to realize the need of constructing a Green building and promote in Vadodara city.

## **For Home Owners**

The home owners who were the sample of the present study were given feedback regarding the extent to which their houses were assessed as “Green”. They were informed about it and hence were invited to participate in the educational programme. They were highly motivated to implement many of the measures to make their houses more environment friendly.

## **Recommendations for Future Studies**

1. An investigation in other cities can be carried out to find out the knowledge of the home owners, assess their houses for the extent of greenness.
2. Study of similar nature can be carried out to find out the barriers faced by the builders and their opinion regarding Green buildings of other cities.
3. A longitudinal comparative experimental study can be undertaken between people residing in Green buildings and conventional buildings to measure the productivity and health of the home owners.
4. Study of similar nature can be conducted for commercial buildings.
5. A study can be conducted to find out the incentives and policies framed by the government for promoting Green buildings and its awareness among the masses.
6. A study can be conducted to find out the opinion of builders and public towards various building assessment methods (Rating systems).
7. Case studies can be conducted to assess the performance of Green Building constructed in a city.
8. A study can be undertaken to find out the financial and environmental benefits of Green buildings.
9. A similar kind of comparative study can be undertaken between the different cities of Gujarat state and other states of India.