IV. RESULTS AND DISCUSSION

The findings pertaining to the study on **"Adaptive Reuse and Refurbishment of Buildings as Prospects for Sustainability"** are analyzed and discussed under the following headings:

A. Architect's / Interior Designer's Portfolio

B. Scenario of Refurbished Buildings for Adaptive Reuse

C. Outcomes of the Case Study

Refurbishment and adaptive reuse, though was in practice, has attracted attention as a major commitment to participate as responsible citizens in the environmental sustainability drive only in recent years. Focussed planning and a sincere effort to practice the ***9R's (Restore, Reduce, Renew, Recover, Recycle, Reuse, Rethink, Replenish, and Replace)*** in this context is gaining popularity and the resolution has roped in architects/interior designers in the wake. How far has this been successful through this micro level study enclosing a small region is depicted in this Chapter.

A. Architect's / Interior Designer's Portfolio

This section is a documentation of the experiences of architects/interior designers who had accepted refurbishment projects. Collection of data recorded about the architect's and interior designer's portfolio are discussed under the following headings:

1. ***Profile of the Establishments***
2. ***Details on Refurbishment Projects***
3. ***Procedural Formalities in Refurbishment Projects***
4. ***Refurbishment Vs New Construction Projects***
5. ***Green Technology Aspects Practiced***
6. ***Procurement of Clientele***

1. Profile of the Establishments

Details on this score are discussed under the following headings:

1.1. Year of Establishment

1.2. Profile of the Buildings

1.3. Initial Investment and Annual Turnover

1.4. CAD Softwares used for Designing

1.1. Year of Establishment: Table 2 and Figure 5 show the year of establishment of Architecture and Interior Design firms selected for the study.

Table 2: Year of Establishment of the Firms

Year of establishment	Percent responding (n-30)
1981-1990	17
1991-2000	36
2001-2010	30
2011- till date	17

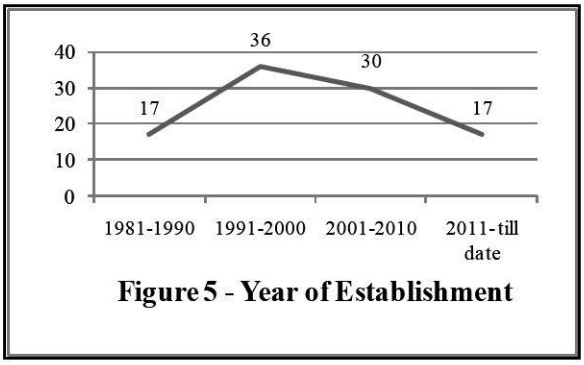


Figure 5 - Year of Establishment

Firms established between the years 1991-2000 showed maximum representation (36%), followed by almost 30 per cent who had established between 2001 and 2010. The oldest and the recently established firms (1981-1990 and 2011- till date) made up 17 per cent each respectively.

1.2. Profile of the Buildings: Owned and rented buildings featured equally (50% each). The type of ownership spread across three basic types. The details of the building and type of ownership of the selected firms in the City are shown in Table 3.

Table 3: Profile of the Buildings housing Architecture and Interior Design Firms

Particulars		Percent responding			
Type of building (n=30)	Ownership type	Built up area in sq.ft.			
		<1000	1001-2000	2001-3000	4001-5000
Owned (n=15)	Sole proprietor (n=10)	10	10	40	40
	Partnership (n=5)	60	40		
Rented (n=15)	Sole proprietor (n=9)	67	33		
	Partnership (n=3)	33	67		
	Corporate (n=3)		67	33	

Sole proprietorship firms represented maximum in owned and rented buildings (67% and 60% respectively) followed by partnership firms. Twenty per cent of the rented buildings were occupied by corporate firms that made up a minimum of 10 per cent of the entire sample. They preferred to operate in rented buildings with a built up area between 1001 and 3000 sq.ft. Sole proprietorship firms preferred to own and operate in buildings with larger built up areas (2001-5000 sq.ft). Firms operating on rental basis preferred to stay on the lower end of the scale (upto 2000 sq.ft.).

1.3. Initial Investment and Annual Turnover: Tables 4 (Figure 6) and 5 reveal the initial investment and annual turnover reported by the selected firms.

Table 4: Initial Investment Incurred

Particulars	Percent responding			
Ownership type (n=30)	Initial investment (₹ in Lakhs)			
	<5	5-10	10-15	>15
Sole proprietor (n=19)	32	37	10	21
Partnership (n=8)	63	25	12	-
Corporate (n=3)	-	67	33	-

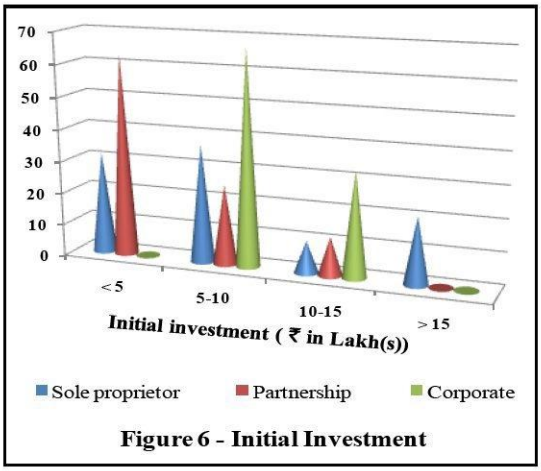


Figure 6 - Initial Investment

Maximum sole proprietorship and corporate firms had incurred initial investment upto ₹10 lakhs. Sole proprietorship firms predominated followed by partnership firms. Investment potential extended from ₹1 lakh - 15 lakhs. Probably because sole proprietors featured more, the samples showed spread of expenditure across the entire band depicted in the Table (upto ₹15 lakhs and more). Evidently, nature of the firm, experience in the field and success stories spoke of their magnificence and henceforth their investment potential. While corporates preferred the mid range (₹ 5-15 lakhs), 63 per cent among partnership firms had invested only below ₹ five lakhs. An indispensable quality among entrepreneurs is risk bearing capacity. The single owner firms had proved this. Higher the investment potential, longer their standing in the market and the goodwill earned.

Table 5: Annual Turnover of the Firms

Particulars	Percent responding				
Ownership type (n=30)	Annual turnover (in Lakh(s) of ₹)				
	1-25	25-50	50-75	75-100	>100
Sole proprietor (n=19)	58	16	-	10	16
Partnership (n=8)	26	50	12	12	-
Corporate (n=3)	-	67	-	-	33

Yearly turnover of ₹25 – 30 lakhs featured more among partnership and corporate firms while sole proprietorship firms showed turnover below ₹25 lakhs. However all the firms were operating quite profitably.

To comprehend if the initial investment had any effect on the annual turnover correlation analysis was done. The 'r' value was found to be +0.41. Pearson's r is positive (+) which means that an increase or decrease in the initial investment will cause an increase or decrease in the annual turnover respectively. Since r = 0.41, $r^2 = 0.168$, which means that only 16 per cent of the total variation in annual turnover can be explained by the linear relationship between initial investment and annual turnover. The other 84 per cent of the total variation in annual turnover remains unexplained.

1.4. CAD Softwares used for Designing: Designing process in various firms differed from the use of manual techniques to Computer Aided Design to using both. More than three-fourth (77%) of the surveyed sample used only computer aided design while the others (23%) used both manual and CAD for designing purposes, which makes it clear that CAD was used either way and by all. Table 6 illustrates the commonly used CAD softwares.

Table 6: CAD softwares used for designing

Particulars			Percent responding (n-30)*
Software used in CAD		Developers	
	AutoCAD	Autodesk	90
	3D Studio Max	Autodesk Media and Entertainment	30
	Sketch up	Trimble Navigation	23
	Autodesk Revit	Autodesk	13
	ArchiCAD	Graphisoft	7
	Adobe Photoshop	Adobe Systems	7

* Multiple Response

AutoCAD was the most popular software amongst all professionals and was used by a maximum (90%) of the surveyed sample followed by 3D Studio Max (30%) and Sketch up (23%). These are evidences for the changing trend among clients/customers and the architects exemplifying a participatory method. Ease in drafting plans, utilizing state-of-the-art technology and options for modifying plans to suit client preferences were attributes cited for adopting the technology.

2. Details on Refurbishment Projects

.Details on this score are discussed under the following headings:

2.1. Refurbishment Projects Completed

2.2. Client Satisfaction

2.3. Nature of Refurbishments Sought

2.4. Reasons for Refurbishments

> Designing for adaptive reuse requires designing for the recovery of the majority of the building's components i.e. exterior walls, roofs, foundations, decking, exterior skin, frames and so on. It also requires designing for recovery of the majority of the interior non-structural elements i.e. interior walls, doors, floor coverings, ceiling systems and so on. In short, designing buildings for adaptive reuse should ideally expose the building's structure to minor changes while undergoing major refurbishment.

2.1. Refurbishment Projects Completed: Though earlier, refurbishment was done only by small contractors or masons, the study proved that these projects have come to the lime light, mainly because both the clients and the architects have started comprehending the worth of such old structures. This tendency has opened up opportunities for many other service contractors. Table 7 presents the number of refurbishment projects completed by the selected professionals.

Table 7: Number of Refurbishment Projects Completed

No. of Projects	Percent responding (n-30)
5-9	60
10-14	23
15-19	7
20-24	7
25-30	3

While 60 per cent had completed 5-9 projects, 10 per cent had 20-30 projects. These facts highlight the popularity of the firms and the confidence the public had in the ability of the architects and interior designers, the chosen sample, in executing the same. It is also an indication on how the trend has rooted deep in the selected locale.

2.2. Client Satisfaction: Satisfaction of clients is the primary motto and satisfied clients are an asset to every establishment. While all the samples took up both new construction and refurbishment projects two-thirds of the sample (63%) stated that it was very

challenging to satisfy clients who demanded refurbishment. Thirty seven per cent felt it was the clients of new construction projects who were difficult to please.

2.3. Nature of Refurbishments Sought: Latham's (2000) definition posited that adaptive reuse 'retains as much of the original as possible, upgrading performance to modern standards and changing user requirements'. In tune with this, after acquiring the building, in order to make its reuse rewarding and profitable, refurbishment works are carried on in various stages. The various levels of refurbishment sought by clients are given in the Table 8 and Figure 7.

Table 8: Nature of Refurbishments sought

Particulars	Percent responding (n-30)*
Minor/cosmetic	27
Services	50
Structural	23
Major	23
Complete	7

* Multiple Response

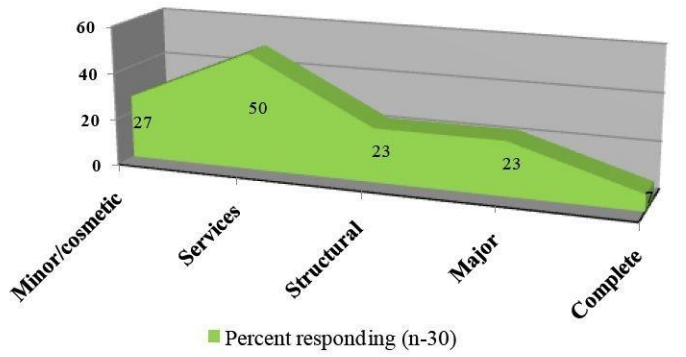


Figure 7 - Nature of Refurbishments sought

Architects and interior designers stated that 50 per cent of the clients approached them when they had to change or upgrade services like replacement of heating, ventilation and air-conditioning plant along with its pipe work, ducting, terminal units, controls and insulation. Minor or cosmetic refurbishments were next in line of demand which included tasks like improving lighting, replacing floor coverings, exterior painting and repair plus minor changes to the fittings. It is evident therefore that a building over a period of time requires attending to some flaws and consequent changes periodically. The findings have proved that a building always is a component requiring sustained maintenance expenditure, because they are prone to different types of obsolescence.

2.4. Reasons for Refurbishments: Whilst some elements in occupied buildings are not changeable, such as location, other aspects can be readily upgraded to improve working and organisational conditions as well as to maximise asset/rental income value. A point to be remembered also is that refurbishment is significantly less time-consuming than

demolition and rebuilding, perhaps taking only two thirds of the time. The reasons for refurbishment stated by clients are given in the ensuing Table.

Table 9: Reasons for Refurbishments sought after by Clients

Reasons for refurbishments	Percent responding (n-30)*
Improve building aesthetics	67
Need to upgrade services	47
Increase the usable floor area	43
Changes in use	30
Comply to change in regulations	10
Spaces are not feasible to vastu	7

* Multiple response

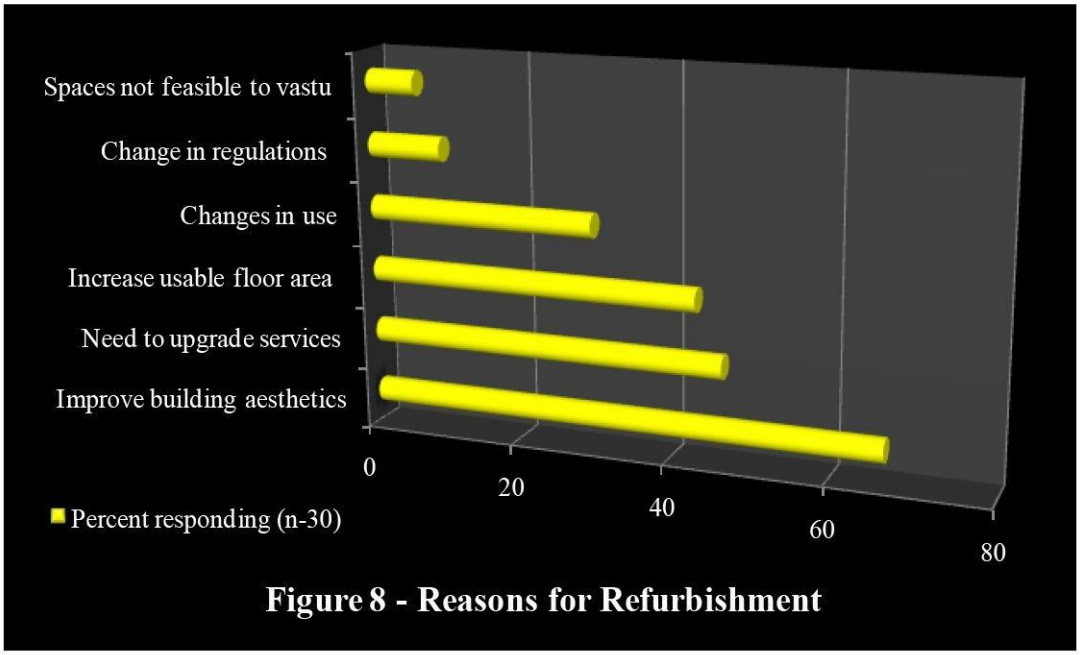


Figure 8 - Reasons for Refurbishment

Improving building aesthetics, need to upgrade services and expanding usable floor area were the major reasons sought by clients, which architects diligently executed in their projects. While a good 30 per cent of the clients had proposed change in use of the building, 10 per cent requested to make changes to abide by regulations. However, architects and interior designers had well defined reasons for accepting the projects.

Nevertheless, a good 87 per cent of them agreed that refurbishment projects required professional/technical acumen and skilled workers who could execute the project – a challenge for architects which also paved the way for technical expertise in employment and subcontracting/outsourcing options.

3. Procedural Formalities in Refurbishment Projects

This aspect of the study is analyzed under the following headings:

3.1. Assessing Conditions of Existing Buildings

3.2. Criteria Considered for Change of Systems

3.3. Difficulties Faced during Project Execution

3.1. Assessing Conditions of Existing Buildings: There are six sequential stages as given in Table 10 that are required to be followed depending upon the scale of refurbishment. Extent to which they were followed is depicted in the Table 10.

Table 10: Sequence followed in Assessing Conditions of Existing Buildings

Assessment Criteria	Percent responding (n-30)*
Checking the subsoil and foundation condition	50
Assessing the reinforcement corrosion of all exposed external concrete surfaces	57
Reviewing the condition of concrete to avoid long term problems	60
Evaluating the structural problems to inspect any signs of distress due to overloading or movements	57
Inspecting the structural capacity if it is suspected that the structure lacks strength to take on loads that are to be increased significantly	53
Checking the structural stability of very old buildings for robustness	53

* Multiple response

All the samples followed a clear cut sequence of processes in assessing the condition of the existing buildings. They were apparently related to structural strength and stability whose requirements varied depending on the type of building, adaptive reuse and refurbishment. A maximum of 60 per cent reviewed the condition of the concrete to check if any dead weight could be added during refurbishment. Fifty seven per cent each of the sample assessed the reinforcements of external concrete surfaces and evaluated structural problems respectively. The study proved that not all samples considered all the criteria while assessing structures for refurbishment.

3.2. Criteria Considered for Change of Systems: Building energy services include all the energy consumption associated with a building-such as space heating and space cooling, ventilation fans (interior supply and exhaust, parking garages), lighting (interior

and exterior), refrigeration, water heating, elevators, and escalators, as well as operation of electric and electronic equipment (Liu et al., 2010). These service systems require continuous maintenance and sometimes change. The criteria considered for the change are given in Table 11 and Figure 9.

Table 11: Change of Systems during Refurbishment

Criteria considered	Percent responding (n-30)*
Client demands for another specific system	60
Required upgradation	40
Lot of wear and tear	37
Dilapidated completely	37
No more required	20

* Multiple response

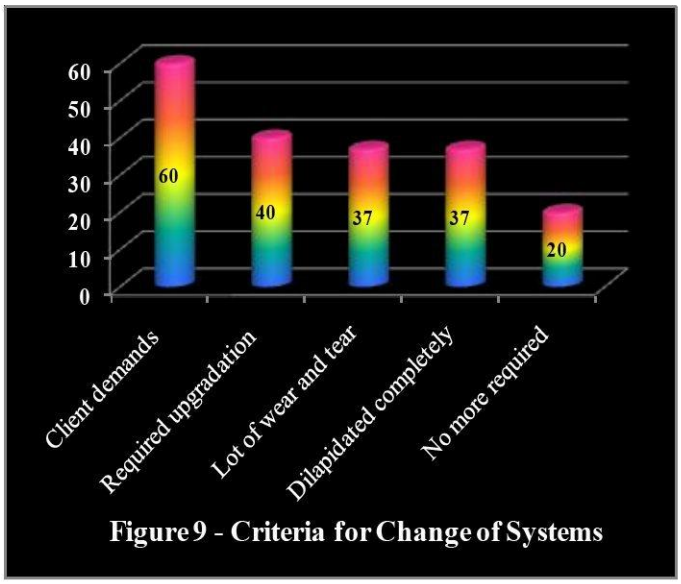


Figure 9 - Criteria for Change of Systems

Client specificity followed by upgradation was the major criteria considered for changing existing systems during refurbishment. Conditions of dilapidation and having undergone major wear and tear had forced the clients to go for change of such systems. A meager 20 per cent had requested change as they found literally no functional requirement for these.

3.3. Difficulties Faced during Project Execution: Table 12 and Figure 10 describe the data.

Table 12: Difficulties Faced during Project Execution

Particulars	Percent responding (n-30)*
Frequent inputs or demands from the client	60
Budget constraints	57
Dearth of skilled technicians and workers	53
Time constraints	40
Incompetent labourers	33
Poor structural strength of buildings	30
Unavailability of systems demanded by the client	23
Non availability of old drawings	13

* Multiple response

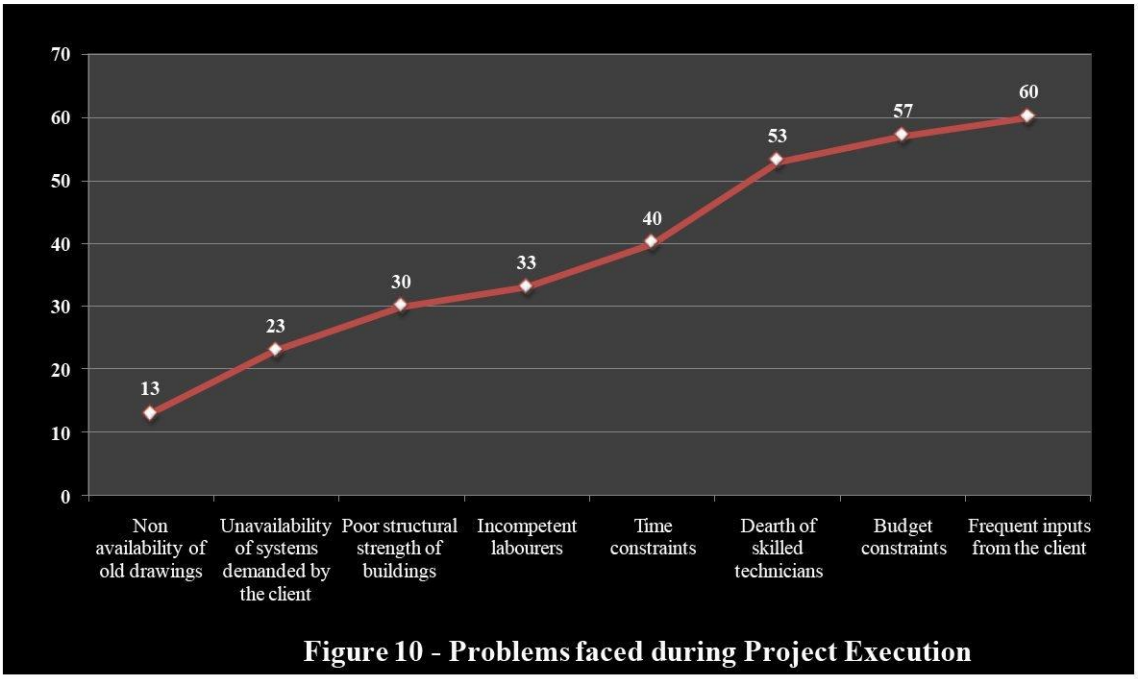


Figure 10 - Problems faced during Project Execution

Nature of difficulties extended from practical ones like loss of previous drawings/documents to difficulties related to those of human behaviour, for e.g. a nagging client. Maximum sample (60%) stated that frequent inputs from clients during the execution of the project disturbed the flow and schedule of the work. Almost 57 per cent of the sample faced budget constraints and 40 per cent felt that they were always pressed for time as the clients demanded projects to be completed in minimal time. Fifty three per cent were stressed due to dearth of skilled technicians and workers who could meticulously execute directions.

4. Refurbishment Vs New Construction Projects

To feel and compare the pulse of both the clients and the implementation on consideration of procedural aspects for refurbishment and new construction, queries were added. This enabled finding out the client behaviour and the implementation flexibility when going in for refurbishment. This aspect of the study is analyzed under the following headings:

4.1. Procedural Aspects Considered

4.2. Criteria for Material Selection

4.1. Procedural Aspects Considered: Table 13 and the adjoining Figures (11-15) present the data for this part of the study.

Table 13: Procedural Aspects Considered

Procedural Aspects	Percent responding (n-30)	
	Refurbishment	New construction
Charging criterion (Figure 11)		
Total contract	50	44
Consultant fee	13	33
%of total cost/labor cost	37	23
Consideration of Vastu and Fengshui concepts (Figure 12)		
Vastu	83	83
Fengshui	7	7
None	10	10
Client's view on plans /ideas/schemes (Figure 13)		
Firm on their ideas and plans	30	70
Flexible with their ideas	40	20
Give the professional a freehand	30	10
Clients outlook on investment/expenses (Figure 14)		
To be completed within the budget	57	60
Allow a small percentage of increase	36	33
Give the architect or designer a freehand	7	7
Source of materials (Figure 15)		
Local	70	77
Out station	7	0
Both	23	23

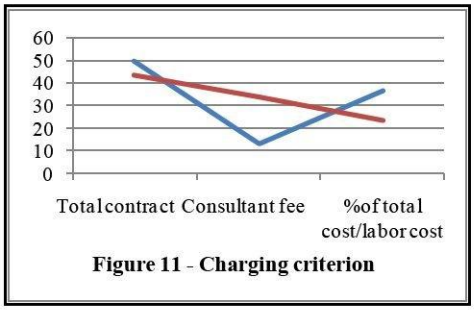


Figure 11 - Charging criterion

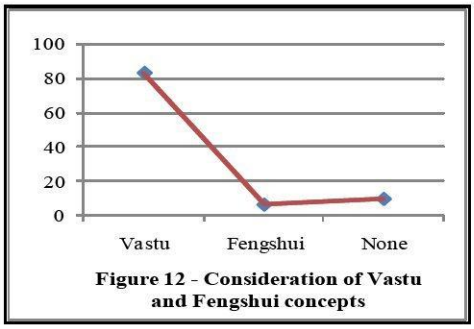


Figure 12 - Consideration of Vastu and Fengshui concepts

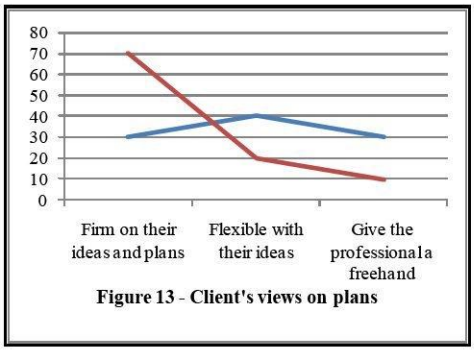


Figure 13 - Client's views on plans

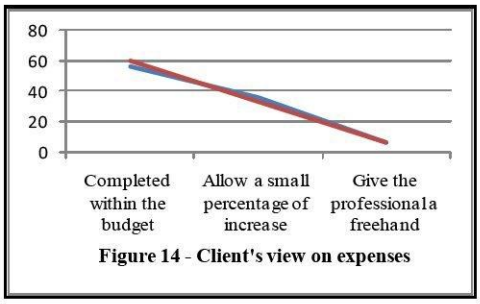


Figure 14 - Client's view on expenses

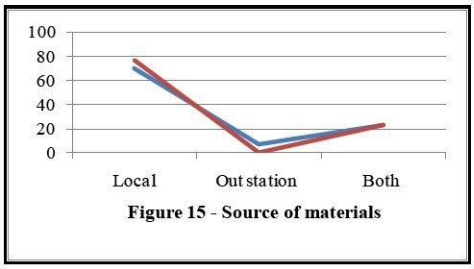


Figure 15 - Source of materials

Refurbishment **New construction**

Majority preferred to take up total contract. For new construction they offered consultancy services (33%) and/or charged on total cost or for labor. The concept was the reverse for those who had accepted refurbishment.

India being the cradle of 'Vastu shastra', so to say, it was not surprising that more than 80 per cent of the clients had demanded to look into vastu concepts in both, be it refurbishment or new construction. Media, communication facilities and knowhow from other countries had forced a negligible proportion even to go in for 'Fengshui' concepts. Yet, the survey also brought to the limelight a good ten per cent who had faith in no such beliefs.

While 40 per cent of the clients were quite flexible and had readily accepted to acknowledge ideas of architects regarding refurbishment efforts, 30 per cent each respectively were either firm or were generous enough to give the architects a free hand to execute their ideas in refurbishment projects. New construction projects on the other hand saw that a vast proportion (70%) of clients were adamant in their viewpoints (insisting and enforcing their ideas on architects).

Only a negligible seven per cent were ready to accept hike in expenditure (irrespective of being a refurbishment or new construction project) while more than 55 per cent wanted the architects to conform to the given budget. The rest of them accommodated allowances here and there, if situations demanded so.

Indigenous products and locally available materials satisfied even the special needs for majority of refurbishment and new construction projects, while 23 per cent each resorted to materials available from both local markets and sources in other places.

Charging criteria which are basically the architect's concern showed them to differ based on refurbishment projects or new construction. Scale of refurbishment or new construction probably decided the charging criterion. Preference for investing in projects, choice of materials and consideration of vastu and fengshui in building concepts witnessed clientele behaviour to be uniform whether it was a refurbishment project or a new construction. They were found to be adamant regarding the views on plans/ideas for new construction while they accepted architect's inputs for refurbishment.

4.2. Criteria for Material Selection: Table 14 gives details on the criteria considered for material selection for projects.

Table 14: Criteria for Selecting Materials for Projects

Particulars	Percent responding (n-30)*	
Criteria considered	Refurbishment	New construction
Quality	33	53
Efficiency of the material	20	10
Appearance	17	23
Economical	27	40
Durability	33	27
Client preference	33	17
Market availability	3	3
Eco-friendliness	33	7
All aspects	40	40

* Multiple response

For 40 per cent each respectively all the criteria stated above were pointers for consideration in the selection of materials for the projects. Only quality, durability and client preference guided material choices for refurbishment projects; quality and economy in purchase outnumbered all other criteria for new construction projects.

5. Green Technology Aspects Practiced

This aspect of the study is analyzed under the following headings.

5.1. Awareness of the Concepts

5.2. Eco Friendly Techniques Used

5.1. Awareness of the Concepts: Sixty per cent of the surveyed samples were aware of the concept and consequences of the carbon footprints caused by the construction process. They suggested the use of eco friendly and green certified materials and planting more trees as possible measures to reduce carbon foot print thus caused. Yet, none of them had kept track of or calculated the carbon emissions caused during construction.

According to a report titled 'Greenomics' (2008), by the Jones Lang LaSalle Meghraj Institute , the construction industry in India is growing rapidly at a rate of 10 per cent compared with the world average of 5.2 per cent. It is observed that buildings in India consume about 20 per cent of the total electricity in the country. Hence, real estate activity in India has a significant impact on the environment and resources. This indicates that there is a real need and opportunity to develop green buildings in the country.

5.2. Eco Friendly Techniques Used: Adaptive reuse transforms underused buildings and sites into locations that are economically useful; hence, building reuse is technically

environment friendly. This effect can be two fold if, refurbishment of the structure is made eco friendly and green technology is incorporated to make the reuse sustainable.

Sixty seven per cent of the surveyed sample (architects/interior designers) assured that they used eco-friendly materials and techniques for both refurbishment and new construction projects. While 23 per cent tried to implement them in new construction projects alone, the others (10%) failed to do even that; they also stated that they did implement such techniques if specified or requested by the client. ***The alternate hypothesis set for the study is partially accepted.*** It is evident that this concept of national concern is yet to take off well in the concerned locale. Hence this part of the study is studied under the following headings.

5.2.1. Eco Friendly Methods or Techniques Used: Table 15 depicts the concerned data.

Table 15: Eco friendly methods or techniques used

Particulars	Percent responding (n-27)*
Energy saving lighting solutions	83
Low- or no-VOC paints	80
Eco friendly building materials	67
Water saving devices	47
Photovoltaic panels/solar panels	43
Recycled materials/components	33
Energy saving HVAC equipment	27

* Multiple response

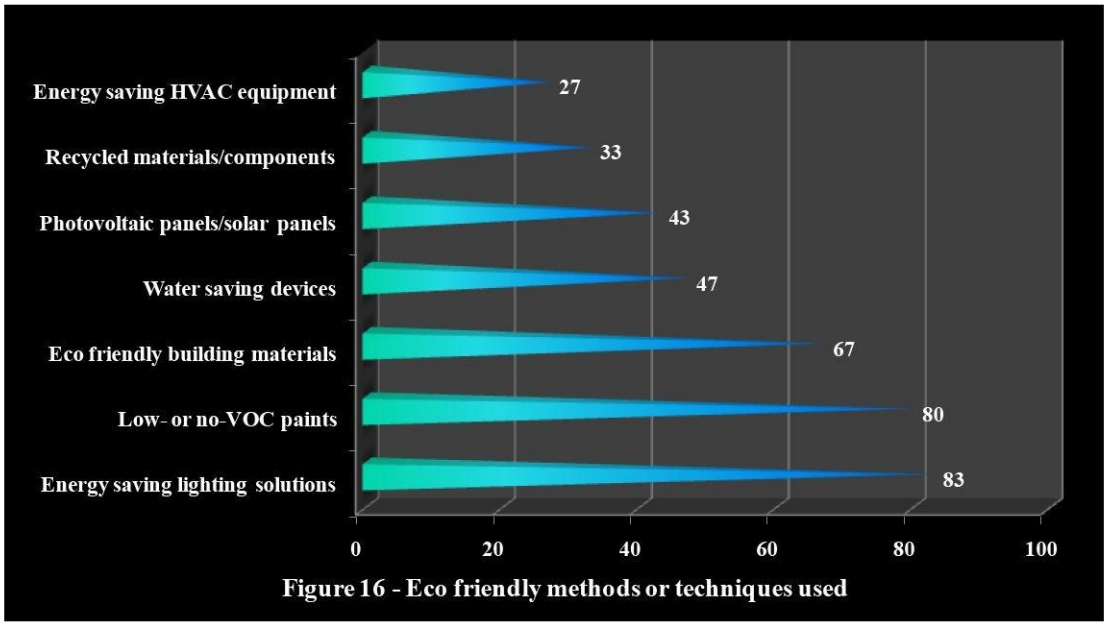


Figure 16 - Eco friendly methods or techniques used

A vast number (83%) of samples had suggested use of energy saving lighting fixtures like LEDs featuring BEE star labels. Eighty per cent used either 'low' or 'no VOC' paints. Water saving and solar powered devices were used by less than 50 per cent of the sample. Thirty three per cent managed to recycle materials and components to reuse them in the projects. Comparatively focus on saving electrical energy received priority more than adoption of alternate energy sources in daily use.

5.2.2. Outlook of Clients about Green Technology: Thirty seven per cent of the samples revealed that clients insisted on implementing green technology in the design and construction process. Though only by a small number, it is a positive start for being aware of eco friendly and green techniques among customers or users of buildings.

5.2.3. Reasons for Clients to Include Green Technology: Table 16 presents the data.

Table 16: Incorporation of Green Technology

Reasons stated	Percent responding (n-30)*
Convinced by the architect or interior designer	60
Aware of the cost effectiveness in the long run	57
Support the use of eco friendly materials	47
Reading and awareness programmes	30
Friends or relatives had used it	27

* Multiple response

Maximum sample (60%) stated that clients were convinced by the architect or interior designer to implement green technology in their projects. The reason next in line was that the clients were aware of the cost effectiveness in the long run. Forty seven per cent stated that clients patronized the concept and had insisted on its incorporation.

5.2.4. Constraints to Include Green Technology: Table 17 explains the same.

Table 17: Constraints to adopt Eco Friendly Techniques

Constraints to adopt eco friendly techniques	Percent responding (n-30)*
High initial investment	77
Unsure of the durability	50
Unfamiliar with the concept of green technology	43
Rooted to the conventional methods	40
Unfamiliar with the functioning	30
Specific materials/devices unavailable in eco friendly options	20
Negative reviews	13

* Multiple response

Despite awareness of green techniques among clients and architects it was found that such ideas always came with a constraint. Among the group studied 77 per cent claimed that clients hesitate to adopt green techniques due to its high initial investment and 50 per cent stated that clients were unsure of its durability. Unfamiliar concept and functioning and preference of conventional methods seemed to be the other common reasons stated by the clients.

6. Procurement of Clientele

The data on this aspect is presented in Table 18.

Table 18: Procurement of Clientele

Points of honour	Percent responding (n-30)*
Impressed by previous projects	80
Recommendation from clients	60
Media and marketing	20

* Multiple response

Eighty per cent of the sample stated that they had acquired new clients as a result of the success of their previous projects. While 60 per cent obtained clients through recommendation from old clients, only a minimum number (20%) procured clients sequel to advertising and marketing techniques used. Among the 20 per cent who used media and marketing techniques to obtain clients 50 per cent invested in trade fairs and exhibitions to market themselves and the others relied on advertisements on social networking sites (30%) and telecom services like Justdial (20%).

This section of the study showcased architect's and interior designer's perspective on the concept of refurbishment, adaptive reuse and green technology. It has been a narrative of their personal experiences for having taken up the projects.

The ensuing section reflects the feelings of the users of adaptive reuse buildings – refurbished structures.

B. Scenario of Refurbished Buildings for Adaptive Reuse

A genuine interest among the consuming public is of great importance for projects like refurbishment and adaptive reuse to gain momentum. They have to commit themselves for a national and personal cause in the march towards environmental

conservation and sustainability because the effort warrants greatest measure of adaptation and sacrifice from the consumer's side. Hence, the findings pertaining to this part of the study are discussed under the following headings:

1. Nature and Scale of Occupancy

2. Refurbishment Facilitating Adaptive Reuse

3. Green Technology Aspects Incorporated

4. Efforts on Modernisation and Value Addition

5. Issues and Drawbacks of Reusing Existing Buildings

1. Nature and Scale of Occupancy

One fifth of the sample firms were either owned or on lease respectively, but three-fifths were happily functioning in rented premises. Among the total sample, 60 per cent were partnership firms followed by 33 per cent which were run by sole proprietors. Table 19 and Figure 17 show the relationship between the types of building, type of ownership and the built up area of each establishment.

Table 19: Nature and scale of occupancy

Particulars		Percent responding					
Type of Building (n = 30)	Type of Organisation	Built up area in 1000 square feet					
		1-3	3-5	5-7	7-9	9-11	11-13
Owned (n = 6)	Sole proprietor (n = 4)	75	25				
	Partnership (n = 2)	50			50		
Rented (n = 18)	Sole proprietor (n = 4)	25	50	25			
	Partnership (n = 12)	59	33				8
	Corporate (n = 1)			100			
	Government (n = 1)	100					
On lease (n = 6)	Sole proprietor (n = 2)		100				
	Partnership (n = 4)		75			25	

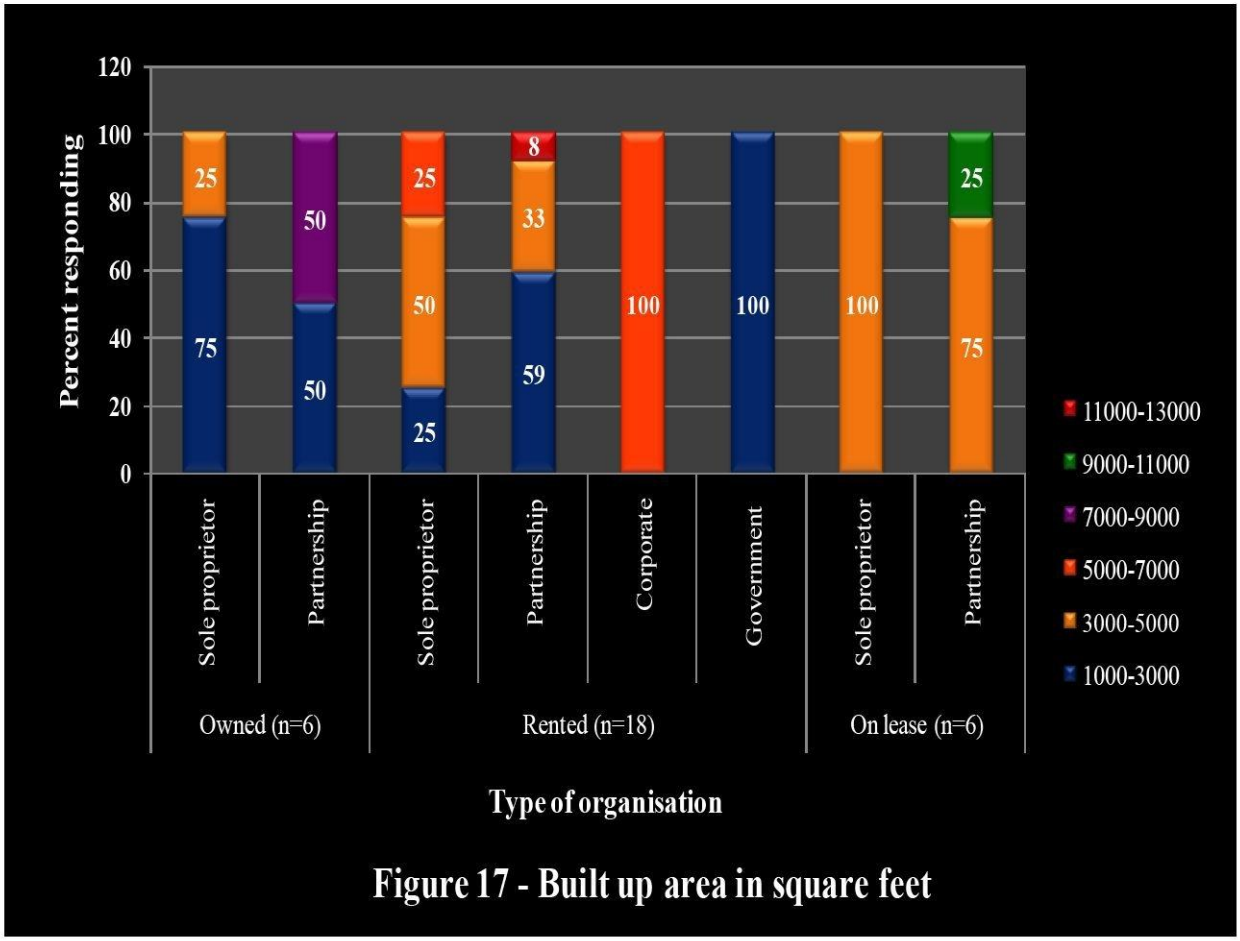


Figure 17 - Built up area in square feet

Owned buildings were preferred by a majority of sole proprietors, while partnership firms preferred rented or leased buildings respectively. Corporate and government organisations preferred only rented spaces. The study brought to light the modern trend among entrepreneurs to show preference to refurbished spaces which enabled customization and adaptive reuse. Partnership firms that used buildings that were leased and rented had better potentials for expansion as these were the ones that had ventured in buildings of built up areas of more than 9000 sq.ft. and even upto 13,000 sq.ft. This advantage was restricted in firms that operated in owned buildings. Sole proprietorship stole the show in this group. Unfortunately, this group lacked multiple investors and risk bearers that featured in partnership firms. Hence maximum representation was in buildings with built up area from between 1000 - 3000 sq.ft followed by 3000 - 5000 sq.ft.

2. Refurbishment Facilitating Adaptive Reuse

There are various definitions of the term adaptation and in fact, it typically refers to 'change of use', maximum 'retention' of the original structure and fabric of a building as well as extending the 'useful life' of a property (Mansfield, 2002) and these were the main reasons stated by owners for refurbishment to enable the reuse of the building. Sincere sentiments to join hands in the national/global campaign to reduce carbon footprints (as given in the Box - Greenomics) was evidently one of the major reasons for adopting this measure. Based on these points, this part of the study was framed, the findings of which are discussed under:

- ***2.1. General Legal Specifications for Buildings***
- ***2.2. Adopting Buildings for Adaptive Reuse***
- ***2.3. Refurbishment Process***
- ***2.4. Refurbishment of Various Parts of the Building***
- ***2.5. Expenditure Incurred for Refurbishment***

Greenomics

According to a report titled 'Greenomics' (2008), by the Jones Lang LaSalle Meghraj Institute, real estate development uses about 40 per cent of the total energy and about 20 per cent of India's total electricity. The Preservation Green Lab of the National Trust for Historic Preservation concludes that it can take between 10 and 80 years for a new, energy-efficient building to overcome, through more efficient operations, the negative energy and climate change impacts caused in the construction process. According to the National Trust for Historic Preservation, it takes about 65 years for an energy-efficient new building to save the amount of energy lost in demolishing an existing building hence retrofitting and reusing buildings may offer environmental and monetary savings over demolishing structures and rebuilding them.

The range of environmental savings from building reuse is found to vary widely, based on building type, location, and assumed level of energy efficiency. Savings from reuse was estimated to be between 4 and 46 per cent over new construction when comparing buildings with the same energy performance level. Qureshi (2008) states that the construction of a newbuild home gives off 50 tonnes of CO_2, the refurbishment process of an existing one emits just 15 tonnes of CO_2 thereby making an initial saving of 35 tonnes of carbon dioxide (CO_2) per property as reaffirmed by the Building and Social Housing Foundation (BSHF, 2008).

2.1. General Legal Specifications for Buildings: A maximum of 97 per cent of the sample maintained the setback provisions. All the samples acknowledged that the zoning ordinances permitted their respective type of operations. Twenty per cent of the sample had improvised the strength and safety of the structure of the building by reinforcing load bearing components with concrete and adding I-beams wherever necessary.

2.2. Adopting Buildings for Adaptive Reuse: The discussions on the findings of this part of the study are presented on the following lines.

2.2.1. Purpose of Refurbishment

2.2.2. Motivation to Refurbish

2.2.3. Choice of Buildings for Adaptive Reuse

2.2.4. Age of the Building Refurbished for Reuse

2.2.1. Purpose of Refurbishment: Table 20 gives details on the purpose and type of conversion. The various conversion prospects identified among the surveyed sample are illustrated in Exhibit 5.

Table 20: Purpose of refurbishment

Conversion type			Percent responding (n-30)
From	To	Specification	
Residence (n = 28)	Showrooms (n = 9)	Tile	11
		Kitchen and bathroom	3
		Textile	7
		Furniture	3
		Wedding card	3
		Jewellery	3
	Eateries (n = 10)	Restaurants	27
		Cafés	7
	Offices (n = 3)	Government	3
		Private	7
	Healthcare (n = 3)	Hospitals	7
		Clinic	3
	Services (n = 3)	Play school	3
		Salons	7
Office (n = 1)	Eateries (n = 1)	Restaurant	3
Theatre (n = 1)	Eateries (n = 1)	Restaurant	3

Exhibit 5: Conversion Prospects Identified

Conversion		New purpose		Percent responding (n-30)
Residential to Commercial (n=28)	Residence to Showrooms			32
	Residence to Eateries			35
	Residence to Offices			11
	Residence to Healthcare			11
	Residence to Services			11
Office to Eateries (n=1)				100
Theatre to Eateries (n=1)				100

The sample comprised of many genre of enterprise like showrooms, eateries, offices, healthcare and services. Among the total sample studied conversion was mostly preferred for use as eateries (40%) followed by showrooms (30%). Conversions in terms of refurbishment was predominantly found feasible with residences as they offered multiple options to convert them to showrooms, eateries, offices, healthcare and services.

Out of the residences converted into other forms, eateries predominated (35%), with showrooms closely following in line (32%). Prospects for conversion to offices, healthcare and services were visualized by 11 per cent each respectively. These are ample evidences to project the upcoming trend in the market.

At the outset, refurbishment to entertain other purposes was meted out not only by residences (which featured as a giant's share) but also by offices and theatres. **Obsolescence with a redundancy felt for the 'meant purpose' can be attributed as reasons** as obsolescence is sometimes classified according to items of outmoded design and functionality, items with structural design unable to meet current code requirements, and factors arising outside the asset, such as changes in user demand.

2.2.2. Motivation to Refurbish: Table 21 presents the concerned data.

Table 21: Motivation to refurbish over new construction

Particulars	Percent responding (n-30)							
Reasons stated	Type of ownership and building							
	Owned (n=6)		Rented (n=18)				On lease (n=6)	
	S*	P*	S*	P*	C*	G*	S*	P*
Helps save money	50	17					17	17
Helps save time	50	17	6	11			17	33
Lower operation costs - low rent			22	39	6	6		17
Convenient to setup workspaces	33			6				33
Liking for old style architecture				6			17	17
Spaciousness of old buildings				17			17	
Easier to get approval		17						
Design demands old structures				6				17

* Multiple response; S-Sole proprietor, P-Partnership, C-Corporate, G-Government organisation

Reasons stated by sole proprietors for using existing buildings that were owned or on lease were on common goals like saving time and money. Partnership firms, whether rented or leased analyzed it in different dimensions like lower operation costs (due to low

rent), convenience to set up workspaces, fitness of purpose, satisfaction of spaciousness and fitness of design to buildings. Corporate and government offices thought only about saving on operation costs. It was evident that type of ownership and building had a say in the decision for choosing an existing building. Prospects for early occupation, refurbishment demands, spatial conveniences, structural modification and lesser regulatory demands emerged as motivators for refurbishment of an old building.

2.2.3. Choice of Buildings for Adaptive Reuse: Table 22 gives the pertinent data.

Table 22: Choice of buildings for adaptive reuse

Choice of buildings	Percent responding (n-30)							
Criteria considered	Type of ownership and building							
	Owned (n=6)		Rented (n=18)				On lease(n=6)	
	S*	P*	S*	P*	C*	G*	S*	P*
Locality	67	17	22	56			17	17
Available at a good price			6	11				17
Available when needed				17			17	17
Parking space		17		11	6			
Character of the building	33			17				
Spaciousness			6	6	6			
Vintage architectural charm				6				17
Stand alone structure				6				17
Tender fulfilled						6		

*Multiple response

Owners had to be humble with whatever they had, hence they had fewer options. Multiple factors had urged especially the partnership groups to go in for adaptive reuse starting from availability, to tackling operational obstacles.

Locality, availability when needed and character of the building stole the show. Though an existing building may require refurbishment for potential use, those on rental basis was much preferred. Changing trends and fashions which are short lived never featured. Yet, an earnest desire to retain the vintage charm and architectural elements and to be on a premise that proved a ***'stand alone structure'*** attracting prospective business had added the much needed spices to motivate the samples to go in for refurbishment of an existing building and reuse the same for a redefined purpose.

2.2.4. Age of the Building Refurbished for Reuse: Table 23 presents the concerned data.

Table 23: Age of building Vs Year of adaptive reuse

Length of Service	Percent responding (n-30)			
Age in years	Year of adaptive reuse			
	1991 -1995	2001 -2005	2006 -2010	2011 -2015
1-10				3
11-20			10	
21-30		7	3	18
31-40	3	3	18	10
41-50				10
51-60		3	3	3
61-70				3
91-100			3	

Though spurt in demand for adaptive reuse (or use of old buildings) became popular only from the start of the new millennium and there has been a gradual increase in the trend ever since, it was noted that maximum buildings (34%) that were adapted were 31-40 years old followed by 28 per cent that were 21-30 years old. Preference for those buildings exhibiting 21 – 70 long years of standing was quite visible. Though the trend had set in comparatively well before 2K, it had witnessed a soaring takeoff only in the last fifteen years with a maximum of 47 per cent to have been commissioned for the present purpose in the last five years. It is no wonder that three per cent of the sample preferred to occupy buildings which were earmarked for their architectural and heritage value - real value for money and a prestige issue.

2.3. Refurbishment Process: The various attributes contributing to the selected refurbishment projects are discussed in detail in the following segment.

2.3.1. Reasons Identified for Refurbishment

2.3.2. Time taken for Conversion

2.3.3. Personnel Responsible for the Projects

2.3.4. Design Compatibility to Specifications Preferred

2.3.5. Level of Refurbishment Affording Adaptive Reuse

2.3.1. Reasons Identified for Refurbishment: Reasons identified for refurbishment are stated in Table 24.

Table 24: Reasons identified for refurbishment

Particulars			Percent responding (n-30)*				
Conversion type			Reasons for refurbishment				
From	To	Specification	Improve building aesthetics	Increase usable floor area	Change in regulation	Change in use	Need to upgrade services
Residence (n = 28)	Showrooms (n = 9)	Tile (n=3)	67	67		100	
		Kitchen and bathroom (n=1)	100	100		100	
		Textile (n=2)	100	50		100	
		Furniture (n=1)	100	100		100	
		Wedding card (n=1)	100	100		100	
		Jewellery (n=1)	100	100		100	
	Eateries (n = 10)	Restaurants (n=8)	100	63	25	100	
		Cafés (n=2)	100			100	
	Offices (n = 3)	Government (n=1)				100	
		Private (n=2)	100	50		100	
	Health care (n = 3)	Hospitals (n=2)	50	50		100	100
		Clinic (n=1)				100	
	Services (n = 3)	Play school (n=1)	100			100	
		Salons (n=2)	100	100		100	
Office (n = 1)	Eateries (n = 1)	Restaurant (n=1)	100			100	
Theatre (n = 1)	Eateries (n = 1)	Restaurant (n=1)	100			100	

* Multiple response

Conversion of residences for business purposes predominated. Showrooms of various merchandise (tile, kitchen and bathroom, textile, furniture, wedding card and jewellery), eateries, offices, healthcare and other services were found to have exploited the resourcefulness of the old residences for adaptive reuse. On the other hand former offices and theatres were preferred for conversion into eateries of a larger scale. **Evidently former edifices meant for a specific use have assumed significance with the trends in adaptive reuse. Moreover they were found to lend well for refurbishment.**

Improving aesthetics and usable floor space and modifying for intended use were the reasons cited, especially by those who meant it for tile and textile business. When residences were adopted for reuse, among all other reasons increasing usable floor space

was comparatively less attempted. Eateries and hospitals either had been refurbished to qualify for regulatory mandates and /or to upgrade services respectively.

2.3.2. Time taken for Conversion: The time taken to complete the projects is presented in Table 25.

Table 25: Time taken for conversion

Particulars			Percent responding (n-30)				
Conversion type			Duration of refurbishment process (in months)				
From	To	Specification	1- 3	3 – 5	5 – 7	7 – 9	12 and more
Residence	Showro-oms	Tile	8				3
		Kitchen and bathroom		3			
		Textile	3				3
		Furniture		3			
		Wedding card	3				
		Jewellery					3
	Eateries	Restaurants	8	11	8	3	
		Cafés	3	3			
	Offices	Government	3				
		Private	8				
	Health care	Hospitals	3		3		
		Clinic	3				
	Services	Play school		3			
		Salons	3	3			
Office	Eateries	Restaurant	3				
Theatre	Eateries	Restaurant					3

Nature of business, urgency felt for occupation, space availability, investment potential, fitness for purpose, extent of refurbishment and the type of conversion preferred decided the duration allowed for the refurbishment process. Basically, on an average 48 per cent of the samples had completed refurbishment within the minimum time allotment of three months followed by 26 per cent who took upto five months. The others had extended upto a year or more depending upon the nature of refurbishment and outcome expected.

2.3.3. Personnel Responsible for the Projects: Tables 26 provides the details regarding the personnel entrusted for the execution of the projects.

Table 26: Personnel responsible for execution of the projects

Particulars			Percent responding (n-30)				
Conversion type			Refurbishment by Self/owner	Refurbishment project done by professional			
From	To	Specification		Architect	Interior Designer	Engineer	Carpenter
Reside-nce	Showro-oms (n=9)	Tile	23		11		
		Kitchen and bathroom	11				
		Textile		22			
		Furniture		11			
		Wedding card				11	
		Jewellery		11			
	Eateries (n=10)	Restaurants	20	30	20	10	
		Cafés	10	10			
	Offices (n=3)	Government					33
		Private	67				
	Health care (n=3)	Hospitals	33	33			
		Clinic	34				
	Services (n=3)	Play school		34			
		Salons		33	33		
Office	Eateries (n=1)	Restaurant	100				
Theatre	Eateries (n=1)	Restaurant				100	

Only 63 per cent of the samples had appointed personnel to execute the projects. **Incorporating refurbishment ideas by self (tenant/lease holder) or owner was quiet evident showing a growing trend in thinking (being resourceful/eco friendly/adopting green technology etc.), exposing an appreciable attitudinal change visible among the population studied.** Role of architects was found to be patronized more in refurbishment projects especially among showrooms, eateries, healthcare and services categories where residences were chosen for adaptive reuse and where structural modifications were a felt need requiring professional intervention. Services of interior designers were sought by tile showrooms, restaurants and salons. While a small percentage preferred engineers for the project, government offices were found to have entrusted the job to local carpenters. Details of the professionals who worked on the refurbishment projects and the specific reasons for choosing them are highlighted in Table 27.

Table 27: Reasons for choosing specific professionals

Particulars		Percent responding (n-19)			
Professionals	Reasons for choosing the professionals	Professional hired from			
		Coimbatore	Chennai	Bengaluru	Mumbai
Architect	Business Associates	21			
	Appointed by the brand		11	5	5
	Like previous work	5			11
Interior Designer	Business Associates	5			
	Appointed by the brand	5			
	Like previous work	11			
Engineer	Business Associates	11		5	
Carpenter	Appointed by the brand	5			

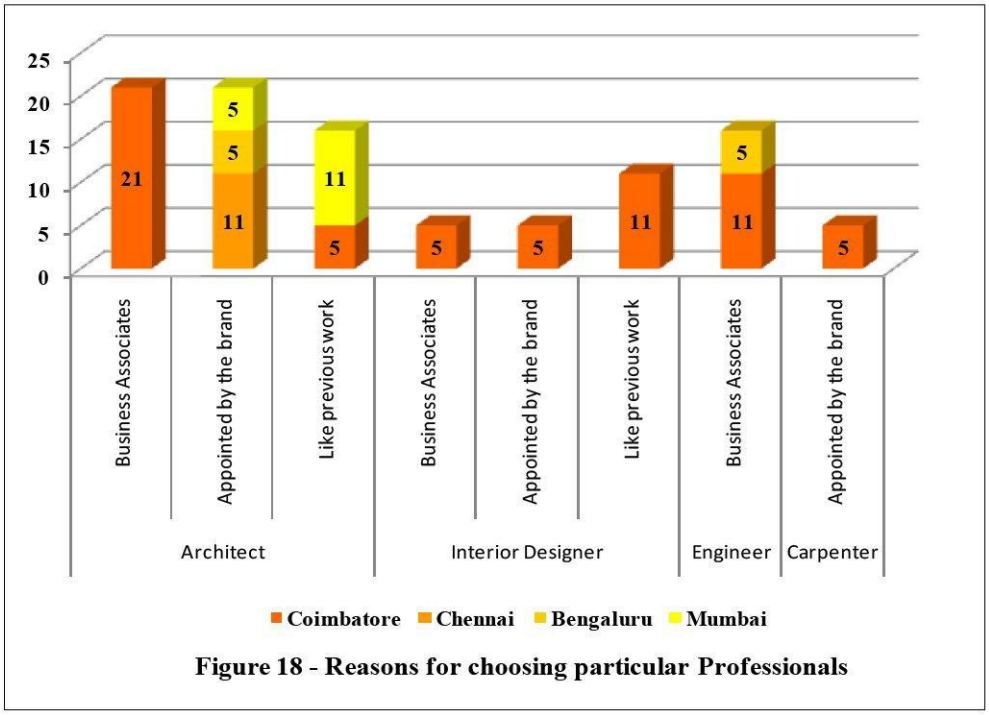


Figure 18 - Reasons for choosing particular Professionals

The professional sector for refurbishment projects seemed to be dominated by local architects and engineers known through business associations. A preference to expertise, mainly for architects from other Cities was evident for enterprises that had opened up ***chain stores*** and therefore insisted on a particular style and theme for all their stores. Intervention by established business joints in this endeavor was also thus evident. Success stories evinced through previous projects had lured clients to invite interior designers and architects for the refurbishment projects. Nevertheless, dependence on local expertise was a highlighting factor (63%). **Fortunately this trend had set in**

another sector for successful entrepreneurship – one more positive outcome of the endeavor.

2.3.4. Design Compatibility to Specifications Preferred: Among the group studied 57 per cent of the total sample interviewed considered suitability criteria for conversion before choosing buildings for their respective uses. Table 28 elaborates on the suitability criteria and design specifications considered by them.

Table 28: Design compatibility to preferred specifications

Particulars		Percent responding (n-17)				
Conversion type		Building suitability and main design specifications preferred				
Conversion	Specification	Small segregated spaces	Large segregated spaces	Attractive façade	Open space around the building	Vehicle parking space
Residence to Showrooms	Tile			6		
	Kitchen and bathroom		6			
	Textile		6	6		
	Furniture				6	
	Jewellery			6		
Residence to Eateries	Restaurants		6	6	10	
	Cafés	6				
Residence to Offices	Private			6		
Residence to Health care	Hospitals	6				
	Clinic	6				
Residence to Services	Salons	6				
Office to Eateries	Restaurant				6	
Theatre to Eateries	Restaurant					6

Design specifications were dictated only by 57 per cent of the samples. Showrooms, restaurants and offices stipulated attractive facades with open spaces around the building. Cafes, healthcare centers and salons insisted on buildings that had small segregated spaces while showrooms and restaurants demanded otherwise. Functional segregation and allocation of space was business-specific. Importance for parking space was given by a minimum sample. Ultimately, attractive façade, small segregated spaces

and ample 'setback' confirmed their decisions as cited by approximately 30, 24 and 22 per cent of the samples respectively.

2.3.5. Level of Refurbishment Affording Adaptive Reuse: Refurbishment at optimum levels should help promote adaptive reuse prospects. The following Table delineates on this aspect.

Table 29: Level of refurbishment affording adaptive reuse

Particulars			Percent responding (n-30)			
Conversion type			Level of refurbishment			
From	To	Specification	Minor/ cosmetic	Services	Structural	Major
Residence (n = 28)	Showrooms (n = 9)	Tile	23	11		
		Kitchen and bathroom				11
		Textile		22		
		Furniture		11		
		Wedding card		11		
		Jewellery		11		
	Eateries (n = 10)	Restaurants	10	40	20	10
		Cafés	20			
	Offices (n = 3)	Government	34			
		Private	33	33		
	Health care (n = 3)	Hospitals		67		
		Clinic	33			
	Services (n = 3)	Play school	33			
		Salons		67		
Office (n = 1)	Eateries (n = 1)	Restaurant	100			
Theatre (n = 1)	Eateries (n = 1)	Restaurant				100

Showrooms, residences converted to eateries, offices, health care and services are different entities that require customer services on strategic scales as their prime motto and therefore emerged as the major reason for opting for refurbishment; but for all others it was only minor/cosmetic changes. Only restaurants required structural refurbishment. Above all, residences and theatres converted to restaurants exclusively required major refurbishment. It is evident therefore that intended purpose of use decided the scale/magnitude of refurbishment.

2.4. Refurbishment of Various Parts of the Building: Attempts on refurbishment by the selected sample would definitely contribute considerably towards reducing carbon emissions, it is sure. This section illustrates the building components refurbished by the selected sample on the following lines:

2.4.1. Refurbishment of Sub and Super-Structure

2.4.2. Refurbishment of Fenestrations

2.4.3. Refurbishment of Service Components

2.4.4. Refurbishment of Aesthetic Components

2.4.5. Refurbishment for Extension and Conversion

2.4.6. Factors which Warranted Refurbishment

2.4.1. Refurbishment of Sub and Super-Structure: Table 30 gives the details.

Table 30: Refurbishment of sub and super-structure

Particulars		Percent responding (n-30)				
Building Components		Retained original	Repaired/ renewed	Replaced with better alternative	Removed	Introduced new component
Sub structure	Foundation	100	-	-	-	-
Super structure	Building envelope	57	40	3	-	-
	Flooring	10	10	57	-	23
	Structural walls	77	23	-	-	-
	Partitions	27	-	-	30	43
	Ceiling	40	3	7	-	50
	Roof	100	-	-	-	-

All the samples retained the foundation and roof as of the original. Structural walls were retained by more than three fourth of the sample, and the envelope by more than one half. Almost 50 per cent had introduced a new ceiling by means of false ceilings, though 40 per cent was found to use the original one. Only a negligible proportion retained the existing flooring. Change was implemented either by completely replacing the old one with a better alternative (57%) or by installing a new component above the existing flooring by the use of vinyl and wooden floors (23%). Regarding partitions, a good 30 per cent had removed it completely, in order to enlarge space, while

43 per cent had introduced something novel to segregate areas where needed. It is clear therefore that all the samples surveyed had meddled with buildings that they had chosen for adaptive reuse, impressing upon the fact that ***'Form follows Function'***. Aesthetics, enhancing performance standards of functional space and defining maximum exploitation of space use effectively and efficiently were the objectives in carrying out refurbishment.

2.4.2. Refurbishment of Fenestrations: Table 31 gives the details on this aspect.

Table 31: Refurbishment of fenestrations

Fenestration components in the building	Percent responding (n-30)				
	Retained original	Repaired/ renewed	Replaced with better alternative	Removed	Introduced new component
Doors (frame, shutter)	10	10	40	33	7
Door openings (Jambs, grills)	63	-	17	7	13
Windows (frame, shutter)	53	10	10	20	7
Window openings (Jambs, grills)	73	-	-	20	7

The oxford dictionary defines fenestration in architecture as "the arrangement of windows in a building". According to the International Code Council (2013), the term fenestration in energy code refers to light-transmitting areas in a building's thermal envelope. The definition includes windows, skylights, and opaque and glazed doors.

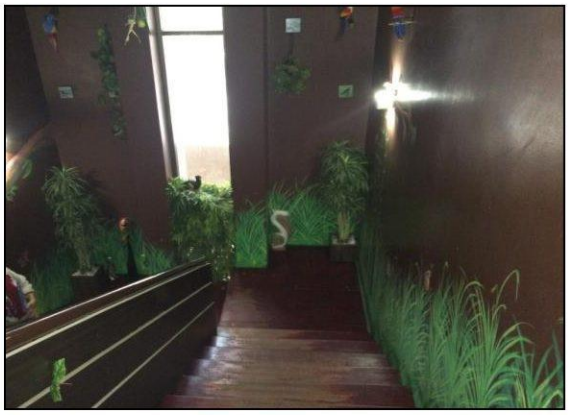
Making ample room for natural ventilation and lighting and creating functional ambience and ergonomically designed spaces emerged as primary objectives of such refurbishment projects. While maximum door and window openings were retained by the sample, the others had introduced a few openings to enable entry of more air and light

and removed or concealed a few for privacy, HVAC purposes and kinetic systems. Existing doors were replaced with better alternatives by a maximum of 40 per cent of the sample; existing windows, on the other hand were retained by 53 per cent.

2.4.3. Refurbishment of Service Components: Table 32 presents the details.

Table 32: Refurbishment of service components

Particulars	Percent responding (n-30)				
Service components in the building	Retained original	Repaired/ renewed	Replaced with better alternative	Introduced new component	Not installed
Plumbing	3	30	17	50	-
Sanitary facilities	7	-	93	-	-
HVAC Equipment	3	-	3	91	3
Electrical Fixtures	3	3	27	67	-
Stairs/Elevators	27	17	10	6	40 (Not applicable - single floor)
Security systems	-	-	-	70	30



New electrical and plumbing lines were laid satisfying current requirements and uses by 70 – 90 per cent of surveyed samples. While 91 per cent of the samples had made provisions to install new HVAC equipment as the old buildings did not have the required provisions, 93 per cent had replaced all the existing sanitary equipment with better alternatives to enjoy technical advancements, honoring the availability and ease found in the fixtures.

While 27 per cent of the sample retained the existing stairs, 17 per cent had made a few repairs that were required to be made to keep them strong, safe and beautiful. Forty per cent of the surveyed sample operated on a single floor hence nothing regarding

stairs or elevators concerned them. Security systems being a necessity of the recent times and because existing buildings did not have such systems, 70 per cent had introduced security and surveillance systems like alarms, CCTV cameras and smoke detectors.

Safety, security, ease of work and mobility and providing an enabling environment through artificial lighting and ventilation had been the target behind such ventures. Introduction of intelligent/smart systems as a 'value addition' measure is visibly made evident through such refurbishment.

2.4.4. Refurbishment of Aesthetic Components: Table 33 presents the details

Table 33: Refurbishment of aesthetic components

Aesthetic components of the building	Percent responding (n-30)				
	Retained original	Repaired/ renewed	Replaced with better alternative	Removed	Introduced new
Façade	17	47	23	-	13
Interior wall finishes	3	47	13	-	37
Landscaping	33	7	7	20	33

The façade of any building is like a cover page of a book that embodies the type and use of the building; it was hence repaired or renewed by 47 per cent who preferred the heritage look and replaced with better options by 23 per cent of the sample. Forty seven per cent renewed the interior wall finishes while 37 per cent added finishes to undressed walls. A good 33 per cent of the sample retained the existing landscape while an equal proportion had introduced landscape on bare grounds. A minimum number (7%) repaired existing landscape and an equal number replaced existing components with better alternatives like greener lawn, ornate fountains and better garden plants and accessories that were high in aesthetics and low on maintenance.

Cosmetic changes thus became imperative in refurbishment; only 80 per cent of the sample bothered to either enhance aesthetics or to adopt one major green tech option (to raise a garden). These reflect the attitudinal changes among the samples.

2.4.5. Refurbishment for Extension and Conversion: This part of the findings is presented under Table 34.

Table 34: Refurbishment for extension and conversion

Particulars			Extension required - room/balcony/portico Percent responding (n-14)			
Conversion type			Built up area in 1000 square feet			
From	To	Specification	1-3	3-5	5-7	11-13
Residence	Showrooms (n=7)	Tile	15	15		
		Kitchen and bathroom			14	
		Textile		14		
		Furniture				14
		Wedding card		14		
		Jewellery		14		
	Eateries (n=6)	Restaurants	17	66		
		Cafés		17		
	Offices (n=1)	Private			100	

While 53 per cent of the sample did not require any extension, the others said that they required extension. Of the 47 per cent that required extension, buildings with a built up area between 3000 and 5000 square feet and those used for converting to showrooms and eateries required maximum extension. Restaurants requiring extensions made up the

maximum. It was however surprising to know that even palatial residences with a built up area between 11,000 and 13,000 square feet also required extension.

2.4.6. Factors which Warranted Refurbishment: Of the many problems that the existing buildings had and those that showcased prospects for refurbishments at various levels, the most cited ones are those stated in Table 35.

Table 35: Factors which warranted refurbishment

Problems ascertained warranting refurbishment	Percent responding (n-30)*
Inadequate emergency exits	50
Insufficient natural lighting	40
Orientation of the building (Vastu)	20
Inadequate natural ventilation	13
Crampedness	10
Scarcity of potable water supply	3
Inappropriate circulation routes	3
Dearth of usable space	3

* Multiple response

Inadequacy in the number of emergency exits was a problem faced by half the samples studied followed by insufficiency in natural lighting. Problems related to vastu and inadequacy of natural ventilation and roominess followed next. A minority stated that there was a scarcity of potable water and usable space and the circulation routes were inappropriate.

These facts highlight one more aspect in that, such significant aspects were never of any concern in old buildings. Mere enclosure of space alone sufficed for a building, which is no more the case in recent years.

2.5. Expenditure Incurred for Refurbishment: The details regarding the expenditure incurred for projects were based on various aspects like the built up area and scale of refurbishment practiced by the selected sample which are analyzed under the following headings:

2.5.1. Refurbishment Cost based on Built up Area

2.5.2. Expenditure on Refurbishment based on Ownership

2.5.3. Purpose redefined Vs Cost of refurbishment

2.5.4. Nature of Refurbishment Preferred Vs Cost of Refurbishment

2.5.1. Refurbishment Cost based on Built up Area: Table 36 describes the required data.

Table 36: Cost of refurbishment based on built up area

Particulars		Percent responding				
Built up area (in 1000 sq.ft.) (n = 30)	Number of floors occupied	Expenditure incurred for refurbishment (₹ in lakh(s))				
		< 20	21-40	41-60	61-80	> 100
1.0 - 2.99 (n=13)	One (ground or first floor)	77				
	Two (ground +1 floor)	15		8		
3.0 - 4.99 (n=12)	One (ground or first floor)	25				
	Two (ground +1 floor)	59	8			8
5.0 - 6.99 (n=2)	Two (ground +1 floor)			50		
	Three (ground+2 floors)	50				
7.0 - 8.99 (n=1)	Two (ground +1 floor)					100
9.0 -10.99 (n=1)	Two (ground +1 floor)				100	
11.0-12.99 (n=1)	Two (ground +1 floor)					100

Maximum representation in expenditure incurred was in the below ₹ 20 lakhs category. There was a visible correlation between the built up area and the fund they were ready to shell out for refurbishment. Number of floors was seen to increase with the built up area. A preference for two floors was also seen evidently. Distribution was more in the 1000 – 2999 and 3000 – 4999 sq.ft. category.

To comprehend if the built up area of the building adapted for reuse had any effect on the expenses incurred for refurbishing the space, correlation analysis was done. The correlation coeffecient (r) for the data was found to be +0.50. There is a moderate uphill (positive) relationship between the built up area and the expenditure incurred to refurbish that area. Evidently it showed an increase in the built up area leading to a corresponding increase in expenditure.

2.5.2. Expenditure on Refurbishment based on Ownership: Table 37 presents the data.

Table 37: Type of Ownership Vs Expenditure on refurbishment

Particulars		Percent responding (n-30)				
Type of building	Ownership type	Expenditure incurred (₹ in lakh(s))				
		1-20	21-40	41-60	61-80	> 100
Owned (n=6)	Sole proprietor (n=4)	100				
	Partnership (n=2)	50				50
Rented (n=18)	Sole proprietor (n=4)	75		25		
	Partnership (n=12)	84		8		8
	Corporate (n=1)	100				
	Government (n=1)	100				
On lease (n=6)	Sole proprietor (n=2)	100				
	Partnership (n=4)	25	25		25	25

Figure 19 shows clusters of the samples in the minimal range of expenditure.

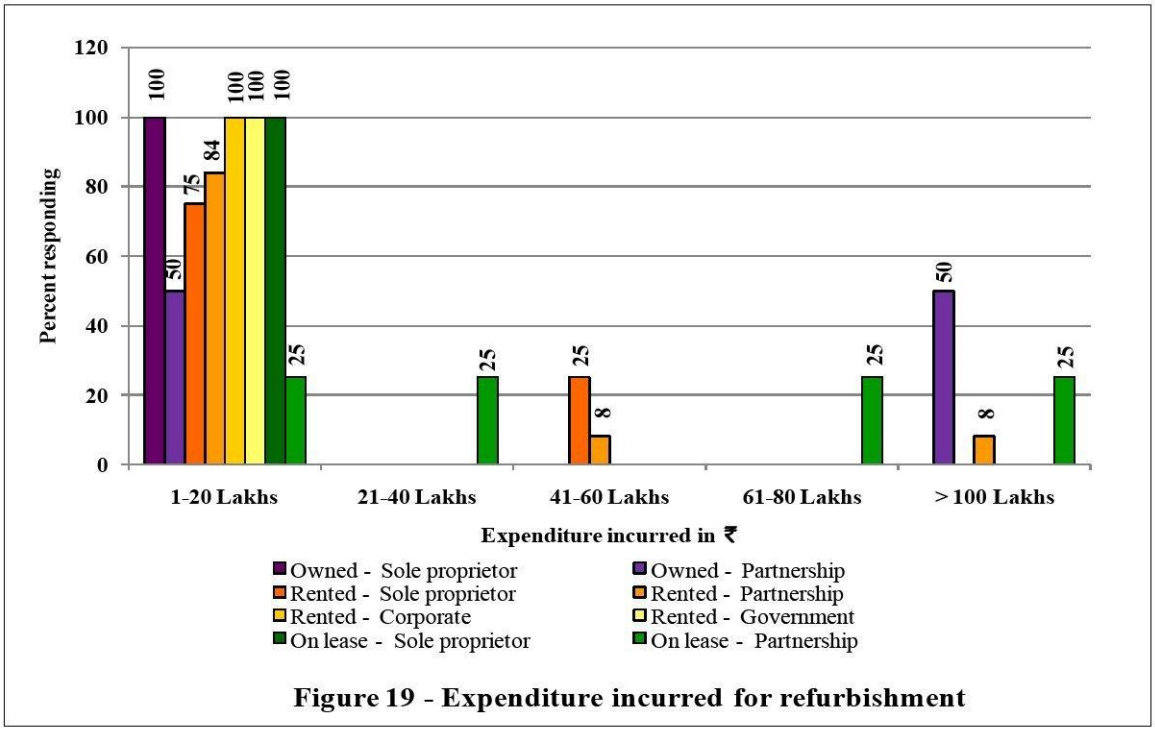


Figure 19 - Expenditure incurred for refurbishment

Irrespective of whether the premise was owned, rented or on lease, the study revealed that the samples showed willingness to part with only upto ₹ 20 lakhs for refurbishment, but those who had the support from fellow partners had ventured to invest higher, even upto ₹ one crore. Evidently proactive partners in business definitely urged higher investment on refurbishment. Another factor that could be inferred was that, the samples actually portrayed apprehension to siphon out lavishly on a venture which may not prove successful. Response from clientele to visit refurbished joints for any purpose

is still to set a pace in the region as aesthetics and the look of a commercial space counts a lot in recent years in attracting customers.

2.5.3. Purpose redefined Vs Cost of refurbishment: The findings are shown in Table 38.

Table 38: Purpose redefined Vs Cost of refurbishment

Particulars			Percent responding (n-30)				
Conversion type			Expenditure incurred (₹ in lakh(s))				
From	To	Specification	1-20	21-40	41-60	61-80	> 100
Residence (n = 28)	Showrooms (n = 9)	Tile	34				
		Kitchen and bathroom			11		
		Textile	22				
		Furniture					11
		Wedding card	11				
		Jewellery					11
	Eateries (n = 10)	Restaurants	60	10	10		
		Cafés	20				
	Offices (n = 3)	Government	33				
		Private	67				
	Health care (n = 3)	Hospitals	67				
		Clinic	33				
	Services (n = 3)	Play school	33				
		Salons	67				
Office (n = 1)	Eateries (n = 1)	Restaurant				100	
Theatre (n = 1)	Eateries (n = 1)	Restaurant					100

Despite the original use, refurbishment as showrooms (kitchen and bathroom, furniture and jewellery) and eateries (restaurants) on a larger scale demanded investment over and above the minimum – below ₹ 20 lakhs spent by others, though many had spent only that much. Depending on the expanse of area covered, investment also increased. These factors highlight the investment potential of the selected sample and their scale of business. **Ultimately the nature of business decided the investment potential**. Creating functional spaces from existing buildings probably would have motivated readiness for investment in the higher ranges. Purpose, as is well known, revealed that it has a say in the sample's preference for going in for a 'dead investment' – which lacks the much preferred liquidity in business.

2.5.4. Nature of Refurbishment Preferred Vs Cost of Refurbishment: The following Table explains the same.

Table 39: Nature of refurbishment preferred Vs Cost of refurbishment

Particulars	Percent responding (n-30)				
Type of refurbishment	Expenditure incurred for refurbishment (₹ in lakh(s))				
	1-20	21-40	41-60	61-80	More than 100
Minor / cosmetic	30			3	
Services	44				7
Structural	3	3			
Major			7		3

Type of refurbishment ranged from minor or cosmetic changes to major changes in the structural components itself. Except for a meager 13 per cent who were ready to expend from ₹ 21 – 80 lakhs for the exercise, ten per cent had spent more than a crore. Expenditure incurred was higher for installing services in the refurbished spaces (51%), followed by minor/cosmetic changes (33%). Only ten per cent had spent above ₹40 lakhs to a crore for major refurbishments. **Status of the building requiring refurbishment, intended purpose, investment potential and the like had decided the type and nature of refurbishment opted for.**

3. Green Technology Aspects Incorporated

Only 37 per cent of the samples knew about or agreed to have practiced the use of eco friendly materials for construction and refurbishment. ***The alternate hypothesis set for the study is hence rejected.***

This part of the study has analyzed the major ways in which they contributed to the global cause under the following headings:

3.1. Energy /water conservation measures incorporated

3.2. Eco friendly aspects installed

3.1. Energy /water conservation measures incorporated: None of the original buildings housed any energy and/or water saving components. Hence, the 37 per cent of the sample who were aware of the importance of eco-friendly/green technology practices had decided to install the following devices to reduce wastage of resources and consumption of non-renewable energy and water (Table 40).

Table 40: Energy and/or water conservation devices incorporated

Particulars		Percent responding (n-11)*
Devices installed	To save	
Automatic water level controller circuit	Energy and water	91
Solar water heater	Energy	27
Dry mist cooling system		9
Solar powered UPS		9
Timers for automated functioning of hoarding lights		9

* Multiple Response

A maximum proportion comprising mostly, owners of restaurants, followed by cafes and salons had installed automatic water level controller circuit systems to save energy and water. Solar water heaters were installed in restaurants and salons to reduce conventional energy use. Other modern devices like dry mist cooling system, solar powered UPS and timers for automated functioning of hoarding lights were also incorporated by a negligible proportion to conserve electric energy. However, these efforts, especially having been established in refurbished spaces are definitely a welcome change. At the same time, measures should also be designed or drafted to rope in the other groups too - ones who never practiced eco friendly methods.

3.2. Eco Friendly Aspects Installed: It was very heartening to record that the samples were cautious about eco-friendly aspects in their respective buildings. Overt observation revealed the measures considered and incorporated as shown in Table 41 and Exhibit 6.

Table 41: Eco friendly aspects incorporated

Categories	Eco friendly aspects incorporated	Percent responding (n-30)*
A. Site & Facility Management	1. Waste Collection & Disposal practices (segregation, recycling)	23
B. Water Efficiency	1. Water Efficient Fixtures	73
	2. Rain Water Harvesting	60
	3. Waste Water Reuse (watering landscape gardens)	13
C. Energy Efficiency	1. Lighting fixtures	97
	2. HVAC equipment	93
	3. On site Renewable Energy	10
D. Other Sustainability Concepts	1. Isolation of Polluting Equipment & Systems	87
	2. Use of low VOC paints	73
	3. Facilities for the Differently- abled	17
	4. Reuse of materials/components from site	13
	5. Occupant Well-being Facilities	10
E. Innovation	1. Innovation in performance of existing building	77

* Multiple response

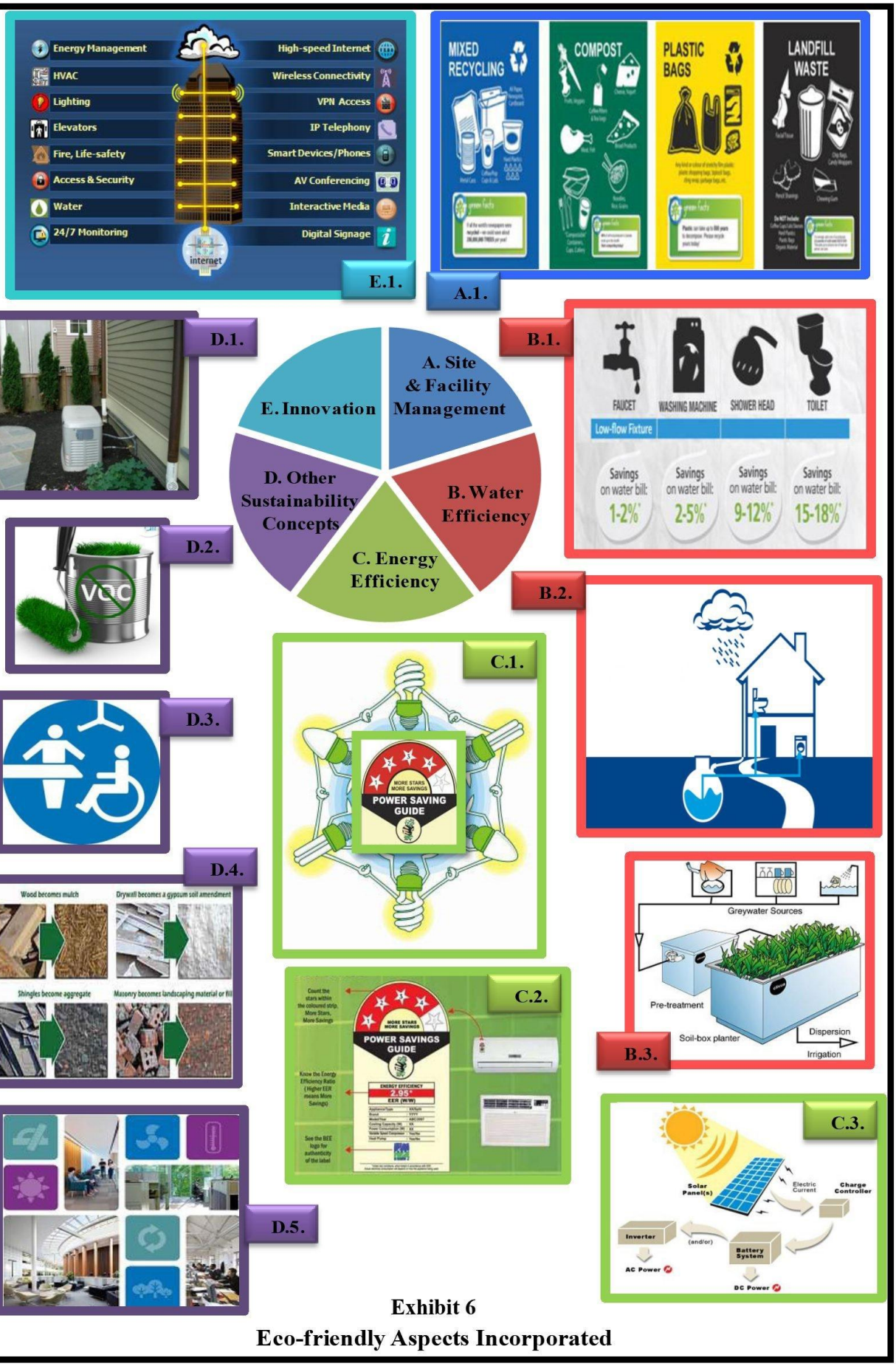


Exhibit 6

Eco-friendly Aspects Incorporated

Eco friendly aspects incorporated included efforts on Site & facility management, Water efficiency, Energy efficiency, other sustainability concepts and Innovation. A considerably good proportion of the sample had focused on energy efficiency by using BEE star labeled lighting fixtures and HVAC equipment (Air Conditioners). Eighty seven per cent of the samples managed to isolate all their polluting equipment and systems so that it would not cause any discomfort to the people. Intelligent devices like automated devices with sensors for lighting, heating, security, CCTV and alarm systems, access control, audio-visual and entertainment systems, ventilation, filtration and climate control mechanisms and the like were installed by many to introduce innovation in the performance of the existing buildings. Use of low or zero VOC paints and water efficient fixtures for water closets, faucets, taps and urinals followed next. An eye on the 9R's (Restore, Reduce, Renew, Recover, Recycle, Reuse, Rethink, Replenish, and Replace) was also observed. Rain water harvesting systems were installed in only 60 per cent of the buildings despite the concept being a mandate by the State government. A minimum number (10%) of the sample invested on solar powered devices to enable on-site renewable energy production. A similar number committed to provide its occupants with well-being facilities such as gymnasium, aerobics, yoga, meditation and games.

4. Efforts on Modernisation and Value addition

A major method of modernisation with respect to buildings is the incorporation of aspects contributing to value addition.

The Merriam-Webster dictionary defines the concept of value-addition as that of, relating to, or being a product whose value has been increased especially by special manufacturing, marketing, or processing. It is an improvement or addition to something that makes its worth more. According to Porter (1985) "In competitive terms, value is the amount buyers are willing to pay for what a firm provides them". In the purchase of a constructed facility, the buyer, or owner, values those components that are in place when the owner occupies the building. The activities necessary to place these components are hence "value – adding" (VA) in the owner's perspective.

Incorporation of intelligent/smart systems and assuring uninterrupted power supply are the rules of the day, which are visibly absent in old buildings. An analysis of the details recorded is described under the following heads:

4.1. Intelligent Systems Installed

4.2. Power Backup Devices Used

4.1. Intelligent Systems Installed: An intelligent system is a machine with an embedded, Internet-connected computer that has the capacity to gather and analyze data and communicate with other systems. Requirements for an intelligent system include security, connectivity, the ability to adapt according to current data and the capacity for remote monitoring and management.

Essentially, an intelligent system is anything that contains a functional, although not usually general-purpose, computer with Internet connectivity. An embedded system may be powerful and capable of complex processing and data analysis, but it is usually specialized for tasks relevant to the host machine (Ogochukwu and Nnamdi, 2015). The various intelligent systems installed are presented in Table 42 and Exhibit 7.

Table 42: Intelligent systems installed

Intelligent systems installed	Percent responding (n-23)*
Surveillance systems – CCTV	87
Automatic water level controller	27
Access control systems	27
Smoke Detectors with alarm systems	17
Dry mist cooling system	4
Timers for automated functioning of hoarding lights	4
Automatic pressure pump	4
Electronic rodent repellent systems	4

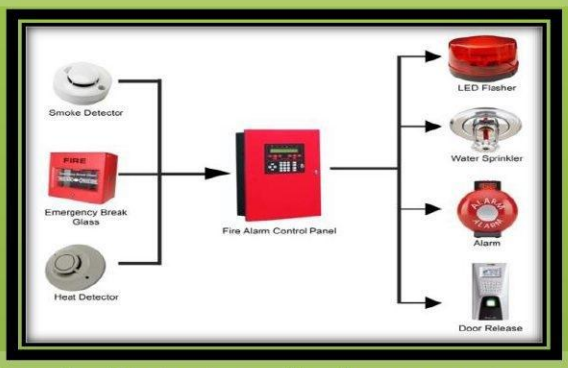
* Multiple Response

Of the 77 per cent who had installed intelligent systems to enhance the building's performance, 87 per cent had installed CCTV cameras for surveillance purposes. Access control systems and automatic water level controller circuits were installed by 27 per cent each and smoke detectors were installed by 17 per cent of the sample. Among the other devices installed by a minority of the population, dry mist cooling system and rodent repellent systems were new systems gaining momentum in markets.

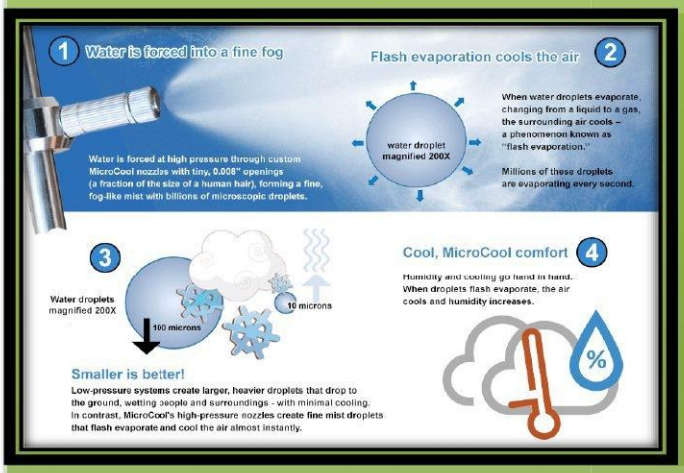
Surveillance systems

Automatic water level controller

Access control systems



Smoke Detectors & alarm systems



Dry mist cooling system

Rodent repellent systems

Automatic pressure pump

Timers for lights

Exhibit 7 – Intelligent Systems Installed

Modern building promoters/builders boast of many such intelligent/smart systems as mandatory components that are included in their buildings. **It is an agreeable factor that the owners of the refurbished buildings had thought of including them in the refurbishment plans. They qualify verbatim for 'value addition', because in recent years, inclusion of these aspects had assumed more of an 'economic value', eclipsing their real work in terms of safety, security and utility.**

4.2. Power Backup Devices Used: Humanity has become slaves to electricity. Gone are the days when people banked on other artificial sources of light and power. Assurance for alternate sources of power supply during times of emergency/need has become an unwritten dictum in all buildings. Refurbished spaces cannot be spared. Hence it is not surprising that all the samples had foreseen this plight and had provided for alternate sources of power supply. A major portion of the sample used generators to harness power during power cuts and 33 per cent had installed both generator and UPS to aid during load shedding. UPS was used as power backup by a minimum of 13 per cent of the sample. These devices had become part and parcel of human living. These facts prove that production of these devices have achieved a good take off as everyone used them.

5. Issues and Drawbacks of Reusing Existing Buildings

Incorporating green technology along with modernisation and value addition techniques had augmented the game for the users for reused buildings. However, the projects were not without any bottlenecks. They are explained through Tables 43-45.

5.1. Problems Faced During the Execution of the Project: Table 43 gives the details.

Table 43: Problems faced during the execution of the project

Problems stated	Percent responding (n-30)*
Expenditure exceeded estimated budget	57
Delay in project completion	47
Irregularity in work	33
Improper execution of plan	20

* Multiple Response

Problems faced by owners during the execution of the refurbishment project seemed to be no different than the ones of a new construction. More than one half of the sample stated that they had to expend more than the budget they had estimated. Delay in

project completion and irregularity in work were the complaints of 47 and 33 per cent of the samples respectively. Dissatisfaction with the execution of the project, either because the finished product did not satisfy functional requirements and or aesthetic aspects were a major point of contention for 20 per cent of the sample.

5.2. Hassles Faced after Occupation: Despite all odds and occupation and use of the premises the selected sample stated to have experienced certain problems (Table 44).

Table 44: Hassles faced after occupation

Hassles faced after occupation	Percent responding (n-15)
Water seepage	73
Inadequate ventilation	13
Rodents and pests	7
Voltage fluctuations	7

Like the two sides of a coin, while 50 per cent of the sample stated that they were satisfied with the present functioning of the building, others had different notions. Of the 50 per cent who were experiencing problems almost 3/4th of the sample stated that water seepage was a major problem. Inadequate ventilation was a problem stated by 13 per cent of the sample. Structural lacunae definitely emerged as a major bottleneck in all types of constructions.

5.3. Disadvantages of Reusing Existing Buildings: Owners felt certain disadvantages during and after reuse of existing buildings. This facet of the study is given in Table 45.

Table 45: Disadvantages of reusing existing buildings

Particulars	Percent responding (n-16)		
Disadvantages of reusing existing buildings	Type of ownership		
	S (n=7)	P (n=8)	G (n=1)
Compromise on the dimensional problems of spaces	14	26	100
Imperfections in construction	30	12	
Cannot make urgent repairs as the core of the problem area is difficult to locate		26	
Openings for cross ventilation not planned properly	14	12	
Residential façade makes it difficult to be identified as a commercial outlet	14	12	
Fire safety of old structures is not very good		12	
Underutilization of spaces due to niches and walls	14		
Cannot do anything completely new to the structure as it doesn't match the existing components	14		

Among the sample surveyed, 47 per cent expressed that they felt no disadvantage in reusing an existing building after refurbishment. Partnership firms seemed to have a winning situation as a maximum sample revealed no disadvantage in reusing existing buildings and so did all the corporate firms that were a part of the sample. Maximum single ownership firms (30%) felt that imperfections in construction like weak walls, dry walls, surface imperfections, flawed construction procedures were major disadvantages. Twenty six per cent and cent per cent of partnership firms and government organisations respectively felt that they had to compromise on the size of the rooms or segregated spaces whether too big or small for the required function.

The session brings to light the details of the various ways in which modernisation and incorporation of green technology elevated adaptive reuse to make it sustainable. The study of the 'Users' of adaptive reuse buildings have proved that these prospects have a bright future ahead.

C. Outcomes of the Case Study

This section is a documentation of the experiences of users in adapting buildings for reuse. Details on conversion from original use to a desired use visualized, refurbishment aspects considered and satisfaction derived were deciphered appointing them in individual case studies. Data collected regarding multiple creative ways practiced in refurbishing and adapting existing buildings for successful and contented reuse are presented under the following headings:

1. Building 'A' - Theatre to Restaurant

2. Building 'B' - Residence to Restaurant

3. Building 'C' - Residence to Kitchen and Bath Showroom

4. Building 'D' - Residence to Hospital

5. Building 'E' - Residence to Jewellery Showroom

6. A Version on Redefined Purposes Adopting Adaptive Reuse

1. Building 'A' - Theatre to Restaurant

Building 'A' was converted from its original use as a theatre to a restaurant.

1.1. Background:

SMS Hotel, the Building 'A' chosen for the study is one of the many fine dine restaurants in Avinashi road, Coimbatore which was inaugurated in 2014. The seeds were sown in 1968 when Shri PNT Mani established Anna Unavagam in Udumalpet. It was later taken up by his sons, Tamil Selvan and Aanantha Gophal and family friend, Prakasham Kumar. It was the success of this establishment that paved way to further accelerate their hotel business leading them to establish three other hotels individually known as Sun Hotel in Udumalpet, Mayura hotel in Tirupur and Surya Hotel in Pollachi. They named the joint venture SMS Hotel, by coining a name from the first letters of each of the partner's previous restaurants.

1.2. Motivation: Looking for an existing building in a commercial setting and one that could park 100 cars at a time, owners of SMS hotel turned to the famous Shanthi Theatre with the idea that reusing a building would fast track approvals for their restaurant. It was the biggest theatre of its time that had a 70 mm screen and seating capacity of 1500 but with the emergence of shopping malls that provide parallel avenues for shopping, eating and entertainment it was struck with ***Functional and Technological obsolescence*** and was sold to the present owners of the hotel in 2011.

1.3. Journey: The entire property was spread across 80 cents of land, with the theatre taking up 7200 sq.ft. Converting the theatre building to a Hotel with major components like restaurants, party halls and a kitchen required major refurbishment in order that it adapted itself to change in use and to improve its aesthetic appeal. Since the building reuse fell in the purview of ***Adaptability across User***, two professionals - a structural engineer based in Bangalore and an architect from Coimbatore were appointed. Once the plans were drafted the building was cleared completely by demolishing leaving only the building envelope intact. It was also calculated that the construction and installation of all components like partition walls, floors, ceilings, insulation, electrical and plumbing installations, interiors, furniture, sanitary fixtures and HVAC and other appliances would add an approximate weight of 13 tonnes to the existing beams and columns which were not configured to shoulder such a massive weight. After consulting, surveying and testing a lot of options to distribute the weight safely to the ground, the engineer came up with

the plan of reinforcing the existing and new partition walls with I-beams instead of the conventional reinforcement of beams. Installing the I-Beams made the partition walls also load bearing components that would distribute the weight and transfer it safely.

After the structural capacity of the building was increased, the ground floor was divided into an office, a lobby, two restaurants, two party halls and a kitchen. The kitchen is a long kitchen (70x60 sq.ft) strategically placed in between the restaurants, party halls and the take away outlet, making it the heart of the food service chain. There are various components that make up SMS Hotel, they are:

Name	**Purpose**	**Floor area in sq.ft.**	**Capacity**
Spice Bay	South-Indian restaurant	40 x 60 (2400)	150
Pink Pepper	Multi-cuisine restaurant	20 x 60 (1200)	100
Galaxy 1	Party hall	60 x 40 (2400)	350
Galaxy 2	Party hall	60 x 20 (1200)	150
Cream stone	Ice cream parlor	20 x 50 (1000)	50
Maghai paan house	Space rented out for a retail outlet	7 x 7 (49)	-
SMS take away outlet		7 x 10 (70)	-
Car park		70 x 90 (6300)	100
Space left unused for future expansion		550	-

The theatre had an eleven feet high ceiling and a roof two feet above it. The false ceiling for the ground floor was given at six feet and all the area above the ground floor was converted into two big halls for accommodating staff. The first floor thus has 2300 sq.ft of area that has the halls which can accommodate fifty members of the staff and is complete with four bathrooms each and a common area. After the main structural issues were sorted out all the interior work was completed with tiles and granite for the floors, textured wall papers and laminates for the walls and decorative false ceiling. The façade was changed to give the building a fashionable and elegant up-lift with Aluminum Composite Panels.

Exhibit 8 – Building 'A' – SMS Hotel

1.4. Outcome: Though the owners did not consider using eco-friendly materials and construction methods they have tried to do their bit by installing Automatic water level controller circuit to monitor and save water and electricity due to spillage and wastage. They plan to install solar panels so that there is onsite renewable energy. To keep up with the technological advances surveillance systems – CCTV and biometric access control for employees have been installed. After 24 months of planning and refurbishment work and an expense of over ₹ 5 crores an obsolete Shanthi Theatre lent itself to being not only a good building for the purpose of adaptive reuse but also had became the reason of pride and complete satisfaction of the joyous owners, satisfying as many food lover's cravings for a different ambience in its wake.

2. Building 'B' - Residence to Restaurant

Building 'B' was converted from its original use as a residence to a restaurant.

2.1. Background:

The restaurant that is named Tangerine after a small citrus fruit, especially one of a variety with deep orange-red skin, is a charming old renovated house with teak windows and doors, recently opened in an enviable location in Race Course Road, Coimbatore. It is a multi-cuisine restaurant but they specialize in sizzlers and steaks. It reflects sophisticated earthy ambience and warm hospitality that blend together to create a delightful sensory journey for food lovers.

2.2. Motivation: When partners Prabhu and Vijay Shankar Rajarathinam were looking for places to start an outlet for the franchise for Tangerine, they were determined to look for a building that portrayed an old world charm and was located in a commercial area. Their liking for old buildings with a vintage charm landed them in a residence that was originally built in 1965 in Race course, Coimbatore. The 30 years old house was chosen not only for its aesthetics but also for economical reasons as the rent for that building was low when compared to other residential buildings as it had become ***physically and***

aesthetically obsolete. The building was taken over in 2013 and inaugurated as Tangerine after six months of major refurbishment and an expenditure of ₹ 50 Lakhs in 2014.

2.3. Journey: The 2300 sq.ft. space for the restaurant is spread across the ground and first floor. The project was handed over to Mr. Suresh, a structural engineer who is a business associate too. During initial inspection it was reported that the beams were not strong enough to hold the tension that would be caused by the refurbishment work hence, the existing beams were reinforced with I-beams and it was also certified that the structure will remain strong henceforth for seventy years. In the process of reinforcing beams, rafters in the ceiling were removed. The rafters were used to build frames for the two new windows that were added to allow natural light into the spaces and also for decorating components like the ceiling and movable partitions. The tiles removed from the old flooring were reused to adorn the table tops which are used by the diners. A few existing partitions were removed to open up areas so that they could use the wide spaces for dining.

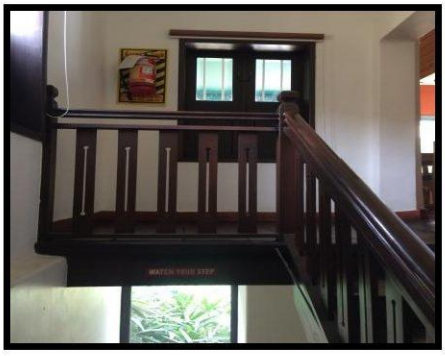
The restaurant uses both the ground and first floor for customer dining. The ground floor has the reception, waiting area, kitchen and a dining area that can seat twenty diners. A beautiful vintage staircase from the reception area leads to the first floor that has a mocktail counter and two dining areas with a combined seating capacity of fifty diners. Restaurants require an external staircase apart from the one in the building that is exclusive for the servicemen. So an aluminum staircase was made. Three emergency exits were also included apart from the one that was already present. Special custom made chimneys fitted with lights are installed above each dining table that enable the suction of all the hot vapour and smoke from the sizzlers and other dishes that might cause any discomfort to the diners and also provide lighting on the tables. These electrical chimneys are kept switched on during their regular dining hours without causing any disturbance to the diner as it does not produce any unpleasant sound.

The façade was altered, but only very little-a main entrance glass door was introduced and minor repairs and painting work was done. New plumbing, electrical and HVAC lines were laid as per commercial requirement and use. The décor in the interiors was also kept minimal yet eye catching to retain the vintage charm.

Dining area - ground floor

Mocktail Counter - First floor

Parallel dining areas – First floor



Retained structural component – stair case and window

Wood from rafters reused to decorate ceiling

Wood from rafters reused for window frames

Tiles reused to decorate the tables

Exhibit 9 – Building 'B' - Tangerine

2.4. Outcome: The partners have tried to reuse whatever was in good condition and have also installed Automatic water level controller circuit to monitor and save water and electricity due to spillage and wastage. To keep up with the technological advances surveillance systems – CCTV have been installed. It is also interesting to note that the partners share an interest in art and hence encourage young artists to showcase their individual pursuits on empty spaces left on the walls ready for art pieces – however modest or ambitious in scale.

3. Building 'C' - Residence to Kitchen and Bath Showroom

Building 'C' was converted from its original use as a residence to a showroom.

3.1. Background:

KIBA-Kitchen & Bath Studio - a unit of M/s Harish Marbles and Granites is the ultimate destination for Modular Kitchen and Tile concepts from the international brand CUCINE LUBE in the City. Being in the flooring industry for three decades, they have now ventured into the segment of Modular kitchens and exclusive tiles.

3.2. Motivation: KIBA was once a residence on a scenic corner plot ideally located on Bashyakarlu road in R.S.Puram. It was chosen for its location and low rent. Being in the field for a long time has given the owner rich experience to carry out this refurbishment project on his own. The residence being typical had segregated spaces- a setup that worked to their advantage as the showroom required segregated spaces to set up their mock ups for various styles of kitchen and bathroom. With the main criteria of segregating spaces sorted, the spotlight was shifted to aesthetics as the brand focused on designer and higher end kitchen and bathroom options. To create an impressive ambience, space around the building was required, which the building had in abundance.

3.3. Journey: Structural walls did not require any major alterations, but internal partitions were removed to provide easy movement from area to area and for clients to enjoy aesthetic comparison of the mock up spaces. The floor and wall finishes were

changed but kept simple as they believed in simplicity and elegance and also because they served as the backdrop for various material and other displays. The building housed two staircases – one internal and one external. The owner felt that the internal staircase was using up a lot of area and it was obstructing the look of the mock up spaces hence he decided to remove it. The ground floor was completely dedicated for designer kitchen and bathroom setups. The external staircase was converted into an internal component by extending the glass façade over the staircase so that it could lead to the first floor where, the segregated spaces there were used to display various types of tiles, marble, stone, both precious and designer wall and floor finishes. The space below the staircase was also used to create an interior landscape area. The first floor also had a conference room, a designing studio and a space assigned for mixing and matching tiles and stones to create new themes and patterns for various projects. To increase the usable space a little more the open portico was enclosed by glass panels and converted into the reception and waiting area for the clients. The height of the compound walls was reduced to unveil a large span of lush landscape which, added a picturesque ambience and also served as a setting for the display of designer pieces and materials for outdoors and landscapes.

KIBA -Entrance

Landscape

Reception area

Staircase

Mock up spaces **Design development studio**

Materials display area

3.4. Outcome: Major refurbishment took five months to convert a residence that had become functionally and aesthetically obsolete to KIBA that is the owners pride today who considers the fifty lakh rupees spent on the conversion an investment and asset. Spread across an area of 5600 sq.ft. the residence was originally constructed in 1988, used for the purpose for 25 years and was taken over for reuse as KIBA in 2014.

4. Building 'D' - Residence to Hospital

Building 'D' was converted from its original use as a residence to a hospital.

4.1. Background:

Eye Trust hospital is a "daycare" tertiary eye care hospital owned and run by Dr. Sathian. It is a hospital with state of the art machinery, which helps to deliver a comprehensive eye checkup supported with in-house pharmacy, a modern optical outlet and operation theatre facility which offers simplified "injection free" day care eye surgeries at

affordable cost with an experienced hand. The Hospital delivers care in the field of general ophthalmology, cataract surgery, glaucoma diagnosis and management, pediatric and neuro-ophthalmology for retinal problems. Hospital medical records are registered and coded through Healthcare Management System (software for registration, billing, electronic medical record etc.) with error free billing with maximum transparency.

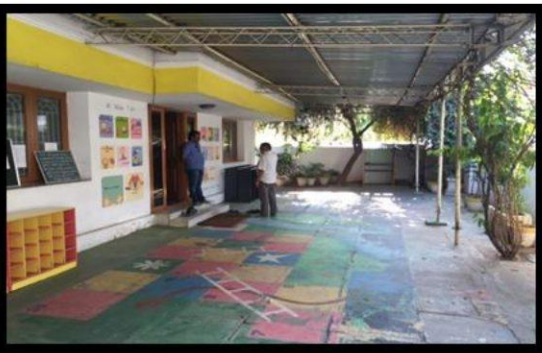
4.2. Motivation: Looking certainly for a place in Sivananda colony to be pioneers to set up an eye care hospital with all the facilities stated above, Dr. Sathian found a place that was ready to be let out for lease. The place being perfect, suiting his needs and one which required minimal refurbishment enabled him to open up the hospital within a short span. He chose the residence originally built in 1950 for his venture.

4.3. Journey: The residence has been adaptive to refurbishment and reuse even earlier when, in 2011 it was taken over to be reused as the "Yellow Train" playschool till 2014 after which it was taken over in April 2015 and within a short span of 45 days, converted and then inaugurated as "Eye Trust Hospital – Covai Glaucoma Care" on May 17th 2015.

Converting a residence to an eye care hospital required service refurbishment as the residence had become ***functionally obsolete. Locational and economical obsolescence*** also played role as all the other buildings in the area were currently commercial spaces. A typical residence as this was, it was helpful to segregate areas even when it was used as a playschool. The playschool had not made any alterations to the residence other than adding partitions and painting the walls wherever required.

To start off, all the temporary partitions were removed and all the walls painted in neutral white. Then the areas were segregated based on purpose into the front desk, optical section, eye testing section, doctor's cabin, sterilization room, operation theatre, pharmacy and the patient's waiting area. After the spaces were segregated the plumbing and electrical lines and outlet placements for regular and UPS backup use needed amendments, hence new electrical lines and outlets were laid based on the requirement of each section to enable a 24x7 power supply with UPS backup for specific investigative machinery and operating systems with a centralized stabilizer, delivering fluctuation free power at all locations. Sanitary and HVAC equipment were also installed. There was a lot of unused backyard space that was used to build a cafeteria and rest rooms for the staff. CCTV and biometric access systems were also installed for e-governance.

Before refurbishment – Yellow Train **After refurbishment – Eye Trust**



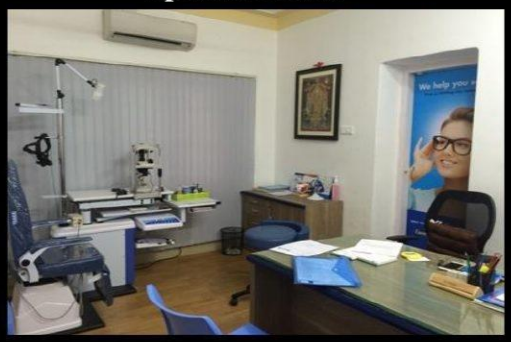
Entrance

Entrance

Reception and waiting area

Optical section

Play area



Doctor's cabin

Kitchen

Testing room

Exhibit 10 – Building 'D' - Eye Trust Hospital

Other areas in the eye trust hospital

Front desk

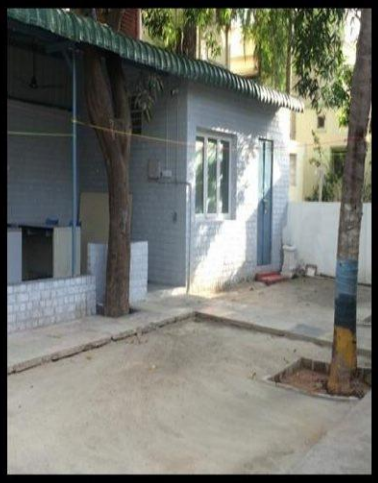
Patient's waiting area

Eye Testing section

Restrooms and Cafeteria

Operation theatre

Pharmacy



Backyard

Exhibit 11 - Building 'D' - Eye Trust Hospital

4.4. Outcome: The 3000 sq.ft. residence that was earlier used as a playschool was refurbished and converted to eye care hospital due to change in use. The project was handled by the Doctor himself to its completion in 45 days expending ₹ 16,00,000. The project thus has given Sivananda colony its first eye hospital that seems to always be full and busy with happy and satisfied beneficiaries.

5. Building 'E' - Residence to Jewellery Showroom

Building 'E' was converted from its original use as a residence to a showroom.

5.1. Background:

Shri. Padam Sacheti, the proprietor of Jaipur Gems is a founding member along with Mrs. Manju Sacheti, of the House of Jaipur Gems that has been nurtured by generations of craftsmen for over 700 years. They opened their flagship store in Mumbai in 1974. Since then Jaipur Gems has become synonymous with classic and luxurious jewellery inspired by India's royal past and offers a sense of fulfillment and pride to the modern day women wearers. It's that pride that the House of Jaipur Gems has captured and translated into an ornament that will last them a lifetime. The focus was primarily on gold jewellery, but they quickly graduated to diamonds and other precious stones. Jaipur gems made its debut with the inauguration of its outlet on Avinashi Road in Coimbatore on the 7th of March in 2008. They have stores in New Delhi, Hyderabad, Chennai and Dubai also.

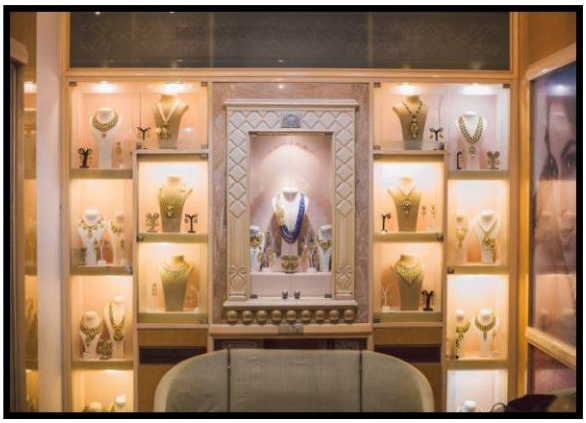
5.2. Motivation: When they decided to open up a store in Coimbatore, Mr. Sacheti was particular about the location of the store. The character and ambience of the building with adequate open space around it, and to adorn the brand name "Jaipur Gems", it was important that the building had a symbolic aura and a vintage Rajasthani charm to it.

They found an ideal location on Avinashi road, a residence that was constructed in the year 1980. It was not only available for lease but also gratified their requirement for a lot of open space all around the building that could be used as a parking lot and also for landscaping.

5.3. Journey: When they took over the building in 2007, it had the vintage charm but lacked the typical Rajasthani look. It was then decided that jharokhas and chatris that were synonymous to Rajasthani architecture were to be made a part of the design in order to create a façade that would complement the brand name.

A **jharokha** is a type of overhanging enclosed balcony from Mughal architecture. Jharokhas jutting forward from the wall plane could be used both for adding to the architectural beauty of the building itself or for a specific purpose. **Chatris** are elevated domed shaped pavilions supported by columns. They are used to depict elements of pride and honor in palaces, in forts, or to demarcate funerary sites. Having its germane from Rajasthani architecture, where they adorned memorials for kings and royalty, they were later adapted as a standard feature in all buildings in Mughal architecture.

The architect who was in-charge of Jaipur gems projects earlier was in-charge of this store also and he worked out plans to include the required architectural features. The foundation and the structure were first checked and tested for their strength and load bearing capacity to ensure that they could hold the weight of the jharokhas and chatris that had to be included. Once the result was positive they started clearing the building from inside as they required large spaces for ease in circulation between sections. Only minor repairs were then made to the walls and plumbing lines wherever required as they were maintained in good condition. Meanwhile all the furniture which comprised of mainly built-in cupboards and shelves and showcases and display counters for visual merchandising and window display were custom made on site.



Electrical and HVAC lines were laid new as their requirements in a commercial setting would be different. The ground floor and first floor together, had 3500 sq.ft. of usable space and to further increase the usable space an open balcony on the first floor was shielded off using metal frames and glass.

The exterior of the building underwent considerable refurbishment. The parapet wall of the balcony was embellished with decorative moldings on the exterior. Jharokhas were created outside the door frames to bring in the primitive Rajasthani look of antique jewellery in masonry. Decorative moldings were done outside the window frames on the exterior part of the building. Some areas on the walls also showcased lattice work panels to complete the look. Four chatris were built in ideal spots on the rooftop of the building and a parapet wall was constructed to join all the chatris and to give the components a completed look.

The interiors also showed interesting moldings around the built-in cabinets that exhibited and emphasized exquisite pieces of jewellery. The colour scheme chosen (for the floors, furniture and walls) was kept neutral in the interior to offset the beauty of the jewellery pieces kept against them. The colour scheme for the exterior was also kept sober with the choice of neutrals.

5.4. Outcome: It had taken 12 months to carry out the refurbishment as it required change in use, improve aesthetics and increase the usable

floor area. After an expense of over two crores in Indian currency on the entire project Jaipur Gems, Coimbatore stands proud with its traditional building encompassing many of the modern attributes like 24*7 power backup with UPS and generator, CCTV, alarm systems, security control panels, biometric access systems and smoke detectors. Ingenuity and creativity exhibited in the displays, their lighting and colour effects helped to offset the uniqueness of the jewellery displayed – a wonderful arrangement for visual merchandising and window display. From a drab, features-limited bungalow it is now a Jaipuri marvel on Avinashi road, Coimbatore.

6. A Version on Redefined Purposes Adopting Adaptive Reuse

To qualify as buildings for 'adaptive reuse', they need to satisfy a few major principles In finding the right balance, Loures and Panagopoulos (2007) had listed out five principles that should be integrated into adaptive reuse project designs. They are:

- ***Perform the functions well for which they are redesigned***
- ***Be long lasting and adaptable to new uses***
- ***Respond well to their surroundings and enhance their context***
- ***Have a visual coherence and create 'delight' for users and passers-by***
- ***Be sustainable – non- polluting, energy efficient, easily accessible and have a minimal environmental impact***

The sample buildings selected for the in-depth study were analyzed for satisfaction of these five principles.

❖ ***Perform the functions well for which they are redesigned***

The buildings were converted either from residential or commercial settings to their present commercial setting. They required refurbishments for various reasons and types of refurbishment so that they could perform well as planned for the redefined purpose. The rationale behind the stated types of refurbishment to enable better performance beckoning the redesigning process were analyzed, the interpretation of which is detailed in Table 46.

Table 46: Rationale for Refurbishment

Building	Conversion	Reasons for refurbishment	Type of Refurbishment
A	Theatre to Restaurant	- To improve building aesthetics - Fitness to purpose	Major
B	Residence to Restaurant	- To improve building aesthetics - Fitness to purpose - Abide by government mandates and regulations	Major
C	Residence to Showroom (Kitchen and Bath Studio)	- To improve building aesthetics - Fitness to purpose - To increase the usable floor area	Major
D	Residence to Play school to Hospital	- To improve building aesthetics - Fitness to purpose - Need to upgrade services	Service
E	Residence to Jewellery showroom	- To improve building aesthetics - Fitness to purpose - To increase the usable floor area	Service

❖ ***Be long lasting and adaptable to new uses***

Adaptation typically refers to 'change of use', maximum 'retention' of the original structure and fabric of a building as well as extending the 'useful life' of a property (Mansfield, 2002). Buildings form a major part of a society. They form the skeleton that lives, grows and stays with and beyond time frame. Their use and function mark the areas/zones into commercial and residential spaces. Refurbishment works were done to the selected buildings to enable them to adapt to new uses as well as increase the useful life of the building. The details given in Table 47 reveals that all the sample buildings chosen for case study belonged to the category of ***adaptability across use and user*** where in the building adapted to a whole new function and also adapted to the requirements of a completely new user after refurbishment. Overt observation proved that the buildings selected were quite strong, hence qualified for long lasting service.

❖ ***Respond well to their surroundings and enhance their context***

Langston and Kristensen (2013) quote Johnson (1996) to have indicated that as society advances, its use of buildings become more temporal. He had stated that 'advances in technology and commerce, including the growth of industrial and office

automation, and users demands for more comfortable environments for work and leisure had led to large number of buildings becoming obsolete or redundant and these changes had provided an abundance of buildings suitable for rehabilitation and reuse'. What he predicted in the fag end of the last millennium had come true now.

The buildings selected for the study had performed their function and had grown into disuse due to many reasons as stated in Table 47.

From a property perspective, 'obsolescence' can be defined as ***"a loss in value due to a decrease in the usefulness of property caused by decay, changes in technology, people's behavioural patterns and tastes, or environmental changes. Obsolescence is sometimes classified according to items of outmoded design and functionality, items with structural design unable to meet current code requirements, and factors arising outside the asset, such as changes in user demand"*** (API Glossary 2008).

Refurbishment saves obsolete buildings from the demolition ball hence enhancing their context in their surroundings.

Table 47: Capitalizing on obsolescence leading to conversion and adaptability

Building	Conversion	Reasons for disuse	Adaptability
A	Theatre to Restaurant	Functional and aesthetic obsolescence	Adaptability across use and user
B	Residence to Restaurant	Functional, aesthetic and physical obsolescence	
C	Residence to Showroom (Kitchen and Bath Studio)	Functional and technological obsolescence	
D	Residence to Play school to Hospital	Functional, locational and economical obsolescence	
E	Residence to Jewellery showroom	Functional and economical obsolescence	

The conversions realized have been quite creative and appropriate. They had capitalized well on the expanse of the spaces available (especially what is not necessary and preferred for residential purpose) to more functional spaces which can also end up very lucrative. Further, the selected sample had not only found out measures to tackle obsolescence but had also succeeded in their efforts on **'value addition'** to existing projects.

❖ ***Have a visual coherence and create 'delight' for users and passers-by***

Improving building aesthetics and change in use were the prominent and persistent reasons stated (Table 46) by all for refurbishment so that they were not only functional to use but also beautiful to look at. The selected buildings definitely had a face lift and had emerged as visual landmarks and reputed joints attracting very good clientele-those from elite groups too. ***Evidently they had added value to the City's landscape as well as revenue too.***

❖ ***Be sustainable – non- polluting, energy efficient, easily accessible and have a minimal environmental impact***

Eco friendly components and practices and the retaining, repairing and repurposing of various building components have helped the samples to reduce the damage caused to the environment if the building was demolished and rebuilt (Table 48).

Table 48: Components reused and eco friendly components introduced

Building	Eco-friendly components	Components reused		
		Retained	Repaired/ renewed	Repurposed
A	Water efficient fixtures, Energy efficient lighting and HVAC fixtures, Rain water harvesting plant, Low VOC paints	Foundation and roof	Building envelope and walls	-
B		Foundation and roof	Building envelope, walls, window - frame, jambs, grills, doors and stairs	❖ Excavated flooring tiles reused for adorning table tops ❖ Rafters from the ceiling were used to build frames for extra windows and partitions
C		Foundation, roof, walls, window- frame, jambs, grill and roof	Building envelope and stairs	-
D		Foundation, envelope, façade, walls, window – frame, jambs, grills, ceiling and roof	Flooring	-
E		Foundation, walls, window – jambs, grills, ceiling and roof	Façade, window frame, stairs	-

Value addition by means of introduction of various intelligent systems also helped make the buildings energy efficient. Contrarily, introduction of these which were earlier lacking in the buildings had in fact increased the carbon footprint. Hence, it was fell necessary to decipher the concepts wherever retained to bring down the carbon footprint. Engaged and creative design teams had thoroughly examined the potential of re-purposing the respective buildings, structures, and spaces. All the samples stand testimony to the fact that they had all earnestly tried to retain maximum components and gone in only for visible repairs to renew them, in tune to the literal meaning of the term 'refurbishment'. One case had even tried repurposing the waste that had emerged too to make useful components.

Clark (2013) declares that the energy consumption and whole carbon footprint of buildings in use comprise from three dimensions:

Operating *- Electricity, gas and other fuels used in a building for heating, cooling, ventilation, lighting, hot water, computers, servers and other equipment.*

Embodied *- Energy consumed in manufacturing, delivering and installing the materials used to build, refurbish and fit- out a building, and their disposal at the end of life.*

Transport *- Energy used to get people to and from a building.*

It is a happy state of affairs that debris from atleast 30 buildings and especially five case studies had not polluted the environment and by not demolishing structures they have saved the environment from the embodied energy that would have been vented out of the structures if demolished. They have also managed to save energy and water too. Evidently this practice and adaptation of the 9R's concept, if adapted by all can pave way for green practices in construction and sustainability. ***It can be concluded that these adaptive reuse projects hence had integrated all the five principles into the repurposing process and had contributed to the nation's call for being green tech savvy.***