

CIRCULAR ECONOMY IN REAL ESTATE SECTOR

A Thesis

Submitted in partial fulfillment of the requirements for the award of
Master of Architecture degree in Building Management

by

LISHALI K (39840011)



**DEPARTMENT OF ARCHITECTURE
SCHOOL OF BUILDING AND ENVIRONMENT**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

MAY 2021



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Accredited with Grade “A” by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

www.sathyabama.ac.in



DEPARTMENT OF ARCHITECTURE

BONAFIDE CERTIFICATE

This is to certify that this Report is the bonafide work of **LISHALI K (39840011)** who carried out the Thesis entitled “**CIRCULAR ECONOMY IN REAL ESTATE SECTOR**” under our supervision from February 2021 to May 2021.

Internal guide
(Ar. DEEPALAKSHMI)

Internal Panel Member
(Ar. SUKIRTHA SURESH)

External guide
(AR. SARATH C KANTH)

DR. DEVYANI GANGOPADHYAY
Head of the Department

Submitted for Viva voice Examination held on _____

Internal Examiner

External Examiner

DECLARATION

I **LISHALI K** hereby declare that the Thesis Report entitled “**CIRCULAR ECONOMY IN REAL ESTATE SECTOR**” done by me under the guidance of **Ar. DEEPALAKSHMI** (Internal) and **Ar. SARATH C KANTH** (External) at Sathyabama Institute of Science and Technology is submitted in partial fulfillment of the requirements for the award of Master of Architecture degree in Building Management.

DATE:

PLACE:

SIGNATURE OF THE CANDIDATE

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to Board of Management of **SATHYABAMA** for their kind encouragement in doing this Thesis project and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr. Devyani Gangopadhyay, Dean and Head of the department, Dept. of Architecture, School of Building and Environment**, for providing me necessary support and details at the right time during the progressive reviews.

My special thanks to **Dr. Suresh Kuppusamy**, our Design chair and **Ar.Sarath C kanth** (External guide) and **Ar. Sukirtha Suresh** (Thesis Coordinator) for their valuable comments and guidance during the project work.

I would like to express my sincere and deep sense of gratitude to my Project Guide **Ar.Deepalakshmi** for her valuable guidance, suggestions and constant encouragement which paved way for the successful completion of my project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the Department of Architecture who were helpful in many ways for the completion of this Thesis.

ABSTRACT

This research is aimed to apply Circular economy as a Business strategy to the Real estate market , which is based on the concept of sustainability and it is implemented by adoption of new business proposed business models. The term Business model refers to a companies business strategy or a plan to make a profit. This paper aims at providing profits by adoption of various models such de-constructable buildings, Adaptive re-use of buildings and flexible spaces. In this way the investor can enjoy less damaging , expanded life of an product / system, more productive systems and higher value of assets . Since these models have large benefits as they directly increase the income stream and constantly improves the economic performance .Also giving the asset owners to reposition the value of assets and providing profit opportunities.Real estate community that investing in circular economy development projects will deliver improved financial performance in their real estate sector . In this paper it is described about the need of circular economy in the current market and these business models which work with these trends , and the barrier and limitations to implement each model and stakeholders involvement at each stage are identified . A building with lost value is been identified and the current market trends are analyzed and in the final stage the financial feasibility of all these models have been established. This research explores the possibility of the new circular real estate business models that can deliver better returns on a reduced resource footprint with more productive and less damaging real estate sector accelerating the global transition to a circular built environment.

Key words : Circular economy (CE) , Real estate , Business models , Financial performance , reduced carbon footprint.

TABLE OF CONTENTS

CHAPTER No.	TITLE	PAGE No.
	ABSTRACT	v
	LIST OF TABLES	xii
	LIST OF FIGURES	xiii
1	INTRODUCTION	1
1.1	INTRODUCTION	1
1.2	AIM	1
1.3	NEED FOR THE STUDY	1
1.4	OBJECTIVE OF THE STUDY	2
1.5	SCOPE AND LIMITATIONS	2
1.4	RESEARCH QUESTIONS	3
1.5	METHODOLOGY	3
2	LITERATURE REVIEW	4
2.1	RESEARCH PAPER	4
2.1.1	Research paper - 01	4
2.1.2	Research paper - 02	7
2.1.3	Research paper - 03	10

2.2	INTRODUCTION	13
2.2.1	Why circular economy concept is booming again	13
2.2.2	Real estate sector	14
2.2.3	Core principle of CE	14
2.2.4	Benefits of CE	15
2.2.5	Area of concern by various concepts	15
2.2.6	How do real estate investments influence it	17
2.2.7	Circular business models	18
2.2.8	Barrier to implement CE business models	19
2.2.9	Circular models	21
2.2.10	Implementation of CE model at design stage	22
2.2.11	Current building process evolution cycle	23
2.2.12	Business model types	23
2.3	BUSINESS MODELS	24
2.3.1	Flexible spaces	24
2.3.2	Relocatable building	28
2.3.4	Adaptive reuse	29
2.3.5	Cost benefit analysis	30
2.3.6	Why these models	33
3	CASE STUDY	33
3.1	LITERATURE CASE STUDY	33

3.1.1 The Economics of Adaptive Reuse of Old Buildings A Financial Feasibility Study & Analysis	34
3.1.2 Realizing the value of circular economy in RE sector	41
3.2 LIVE CASE STUDY	52
3.2.1 Workafella co-work space	52
3.2.2 AWFIS Co-work space	56
3.2.3 Container building -client perspective	68
3.2.4 Container building -Contractor perspective	70
4 LIVE STUDY	78
4.1 SITE SELECTION	78
4.2 SITE INTRODUCTION	82
4.2.1 Site details	82
4.2.2 Proximity	83
4.2.3 SWOT Analysis	86
4.2.4 Reason for lost value of the building	87
4.2.5 Current condition of the building	88
4.3 SUITABLE TYPOLOGY	89
4.3.1 Introduction to the site	89
4.3.2 Real estate market	90
4.3.3 Real estate market Analysis	92
4.3.4 As per survey from real estate consultant	93
4.3.5 Analyzing each typology	95
4.3.5.1 Residential	95

4.3.5.2	Educational	97
4.3.5.3	Assembly	98
4.3.5.4	Hospital	100
4.3.5.5	Hotels / Lodges	101
4.3.5.6	Restaurant	102
4.3.5.7	Recreational	103
4.3.5.8	Retail	104
4.3.5.9	Office	104
4.3.5.10	Warehouse	105
4.3.6	Feasibility of flexible office space	109
4.3.7	Various drivers made it to re-use the building	110
5	FINANCIAL ANALYSIS	112
5.1	FACILITIES PROVIDED	112
5.2	SITE DETAILS	113
5.3	DEVELOPMENT COSTS	114
5.4	REVENUE COMPONENTS	116
5.4.1	Cost of each space	118
5.5	CASH FLOW ANALYSIS	119
5.5.1	Optimistic cash flow analysis	119
5.5.2	Pessimistic Cash flow analysis	120
5.5.3	Average cash flow analysis	121
5.6	CASH FLOW ANALYSIS PER YEAR	123

5.7	PAY BACK PERIOD	123
5.7.1	Cumulative cash flow analysis	124
5.7.2	Payback period	125
5.8	BENEFIT TO COST RATIO	125
5.9	NET PRESENT VALUE	126
5.10	IRR	126
6	CONCLUSIONS AND RECOMMENDATIONS	127
6.1	Analysis from payback period and IRR	127
6.2	Feasible among these models	129
6.3	The other factor that affect the final outcome of the model	130
6.4	Non Monetary benefits	130
6.5	Recommendations	131
7	REFERENCES	132

LIST OF TABLES

TABLE No.	TITLE	PAGE No.
3.1.1	Pro-Forma Analysis,Construction cost	40
3.2.2.1	Status of the building & occupant4s at each floor	59
3.2.3.1	Various category of analysis from client perspective	68
4.1.1	Site selection based on various criteria	80
4.2.1	Site details	82
4.3.5.1	Suitable typology	106
4.3.5.2	Traditional office space occupancy	107
4.3.5.3	Co-working office space occupancy	108
5.3	Development costs	114
5.4.1	Revenue Components and facilities provided	116
5.4.2	Cost of each space	118
5.5.1	Optimistic scenario cash flow analysis	119
5.5.2	Pessimistic cash flow analysis	120
5.5.3	Average cash flow analysis	121
5.6	Cash flow analysis per year	123
5.7.1	Cumulative net cash flow	124
5.7.2	Payback period	125
5.8	Benefit to cost ratio	125
5.9	Net present value	126
5.10	Internal rate of return	126
6.4	Non-monetary benefits	130

LIST OF FIGURES

FIGURE No.	TITLE	PAGE No.
2.1.1	Benefits of circular economy in real estate	6
2.1.2	Dooleys 8 components of CE	7
2.1.3	A model for adaptive re-use decision making	12
2.2.5	Evolution of CE	16
2.2.6	Motivational factors in CE to adopt it	18
2.2.7	CE business model process	19
2.2.8	Micro and macro level barriers	20
2.3.1	Concept of sharing	26
2.3.2	Concept of relocatable building	28
2.3.5	Methodology of CBA	32
3.1.2.1	Building in layers	43
3.4.2.2	Source of lost value	44
3.1.2.3	Various stakeholders in Flexible spaces	45
3.1.2.4	Occupied & unoccupied desk at different operational years	46
3.1.2.5	Cash flow in circular model	46
3.1.2.6.	Additional space use scenario	47
3.1.2.7	Key stakeholder involved at adaptive assets	48
3.1.2.8	Occupancy level of each scenario	49
3.1.2.9	IRR of market downturn scenario	49
3.1.2.10	Key stakeholders involvement at relocatable building	51

3.2.1.1	Accessibility to Workafella	53
3.2.1.2	Site photos	53
3.2.1.3	Site photos	55
3.2.2.1	Site accessibility to AWFIS	57
3.2.2.2.	1 , 2 , 3 and 4 Floor plan	58
3.2.2.2	Building area and efficiency	64
3.2.2.3	AWFIS site photos	67
3.2.2.4	Profit percentage by building use	67
3.2.2.5	AWFIS Site photos	68
3.2.4.1	Container dimensions	71
3.2.4.2	Size of container	72
3.2.4.3	Container workstation plan	74
3.2.4.4	Container photos	75
4.1.1	Various site for live study	79
4.2.1	Building view	82
4.2.2	Area of the site	82
4.2.3	Site plan	85
4.2.4	SWOT Analysis	86
4.2.5	Current condition of the building	88
4.3.2.1	Connectivity from the site	89
4.3.2.3	Demography of keelkatalai	91
4.3.2.3	Percentage of typology of building in Keelkatalai	92

4.3.4.1	Real estate market development in Chennai	93
4.3.4.1	Current real estate development tin Thoraipakkam	94
4.3.5.1	Demand for residential in Keelkatalai	95
4.3.5.2	Location of various educational Institutions in Keelkaralai	97
4.3.5.4	Hospitals located in Keelkatalai	100
4.3.5.6	Restaurants located in Keelkatalai	102
5.0	Scenarios for comparison	112
6.1	IRR of three scenarios	128

LIST OF SYMBOLS AND ABBREVIATIONS

CE - Circular economy

IRR - Internal rate of return

RE - Real estate

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

By 2050, 60% of India's population will live in urban areas – up from about 30% today. Urbanization is happening at an unprecedented pace. Growth is so rapid that 70% of the building stock that will be used in 2030 is yet to be built, and choices made today will determine India's mid- to long-term development. Applying circular economy principles to developing this vast amount of infrastructure and building stock could create annual benefits of ₹4.9 lakh crore in 2050, compared with the current development path, together with environmental and social benefits. By providing circular economy with business models would make the building sustain for the other

1.2 AIM

The aim of the topic is to bring back lost value to a place by using circular business models (by using circular economy principles) by not only improving the economic performance and by reducing the impact to environment by developing business models.

1.3 NEED FOR THE STUDY

Construction industry such as construction material and other material are responsible for 1/3rd of global resource consumption. Typically buildings are responsible for 40% of greenhouse gas emissions to the environment (this is a report produced by World Green Building Council).

This is because, hike in global population, as the population increases the demand for the construction industry increases, hence we consume large amount of resources.

This consumption of large resources leads to the pollution which in turn provides a larger sustainability impact and a burden to the environment.

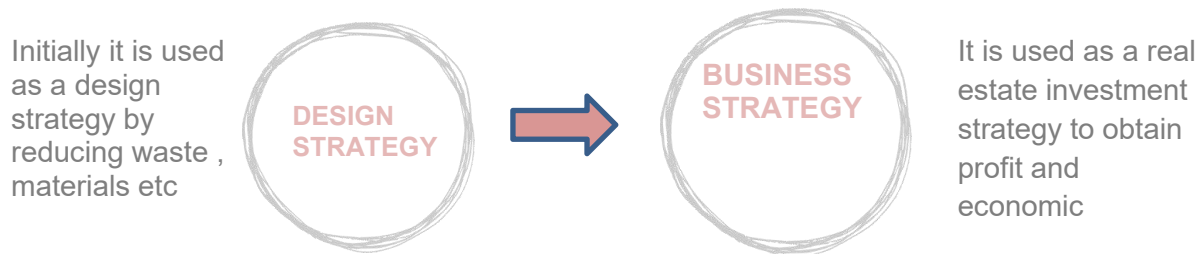
Hence traditionally the construction industry uses a LINEAR MODEL - “ Take - Make - Dispose “ will be unstable in the future where the resources are constrained which leads to lots of Challenges.

The current linear method is not so efficient hence there needs to be a change.

By adapting to circular model becomes more advantages likewise one projects waste become other projects resource and hence increasing the efficiency by doing more with less and reducing the pressure on the environment.

Circular economy offers investors a framework for achieving social and environmental goals and also delivers a better economic performance.

The principles of a circular economy, establishing an urban system that is regenerative, accessible and abundant by design, thus supporting human well-being and natural system



1.4 OBJECTIVE OF THE STUDY

The main objective of my study is to define how circular economy business models are more feasible and advantageous in the present scenario .And analysing the present scenario .

1.5 SCOPE AND LIMITATIONS OF THE STUDY

SCOPE:

- Identifying the importance and need of circular economy in real estate sector
- Providing its benefit over linear economy models
- Barriers to circular economical models
- Key drivers to adapt to circular models
- Identifying the lost value and analyzing it and providing a better solution
- Proposing new business models based on the feasibility and opportunities
- Finally scrutinizing the proposed business models and its profitability

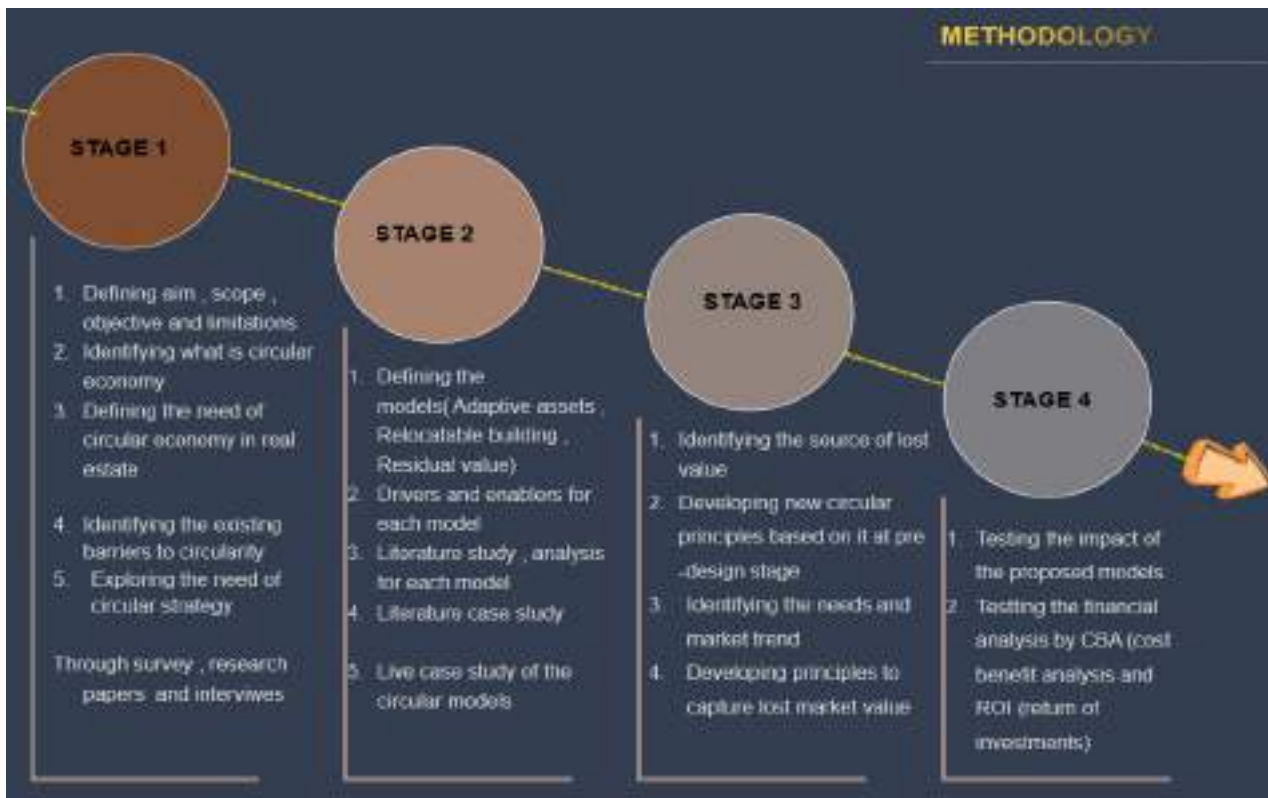
LIMITATIONS:

- Limiting the study to the number of business models
- Detail aspects of the structural

1.6 RESEARCH QUESTIONS

- What is circular economy ?
- Why real estate needs circular principles?
- Driving and enablers for CE ?
- Barriers in Each business models?
- What are the lost values in current market?
- How circular model would be more beneficial for investors?

1.7 METHODOLOGY



CHAPTER 2 LITERATURE REVIEW

2.1 RESEARCH PAPERS

2.1.1 Research paper - 01

Circular economy in real estate investment companies

(Source :Thesis paper , Author : Johanna Markkanen, Finland)

Aim of the study:

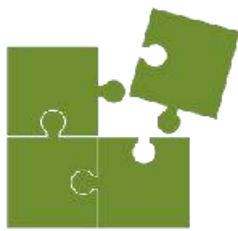
- The aim of the research is to discuss elaborately the concept of circular economy in real estate investment companies and defining certain practical measures to adopt circular economy.
- The study attempted to find answers to the following research questions:
- What is the circular economy in real estate investment companies?
- How is the circular economy realized in real estate investment companies at the present time?

Methodology:

- Certain research questions were developed and answer to those questions were obtained by interviews from expertise and enquiring about the present scenario and future feasibility of circular economy in real estate
- Workshop were conducted to investigate the same.
- Identifying the limitations which are barrier to implement circular economy.
- Motivational and obligatory factors for the development of the circular economy were studied
- A case-study building was evaluated in terms of the present situation of the circular economy.

- These two methods are based on qualitative to research about the concept of circular economy

Principles of circular economy:



4. Adaptability and versatility are to be prioritized in systems to increase resilience towards instability in the



2. waste does not exist any longer if products are designed to act as biological or technical nutrient



3. The third principle urges systems to aim to run on energy from renewable sources

Benefits of circular economy in real estate:

- The lifespan of an investment in real estate industry is relatively long , therefore, the business depends greatly on the profit which should correspond to the level of risk related to the investment
- The profit comprises rental income and changes in the value of the property, and it is used to Cover operational and maintenance expenses of the property during its lifetime
- Sharing economy is a part of circular economy has social benefits
- The principles of circular economy gives majorly 3 benefits;
- Lower costs , Increase property value , Green image.
- Lower cost - in operation and maintenance (for example : O & M cost can be reduced by using renewable energy)

Increased property value - The property value get increased by constantly developing the property according to the trend . Property development requires investment. There is a misunderstanding that investing on green buildings or projects are involved in high costs

BUT it actually consumes 2 % - 9% higher and the investment returns will be considered long rather than conventional

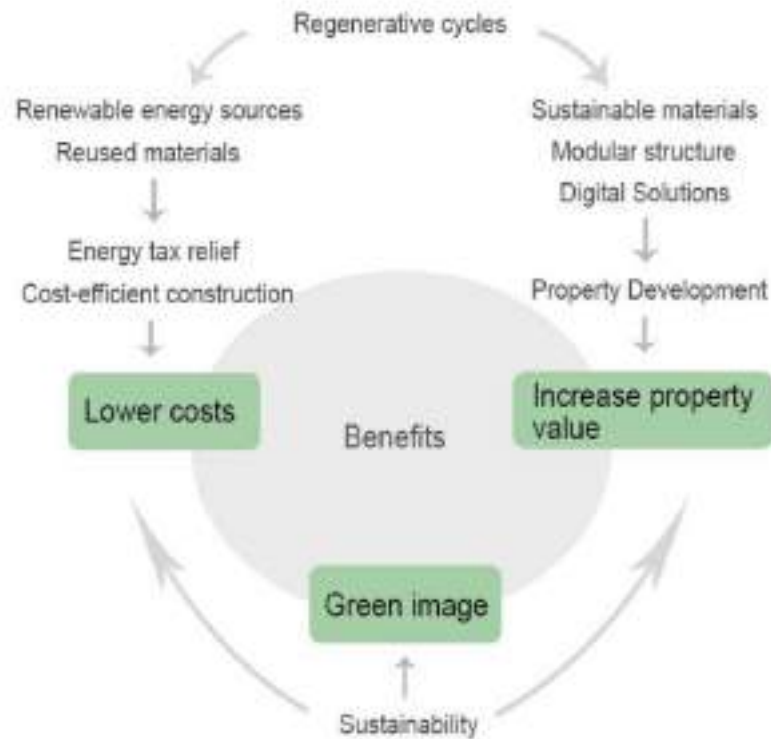


Fig : 2.1.1.Benefits of circular economy in real estate

Green image - It will produce an positive outlook of a company and attracts investments

Circular Economy in the Built Environment					
	Materials	Design	Construction	Use	End of Life
Natural Materials	✓	✓	✓		✓
Reuse, Refurbishing, Recycle	✓	✓	✓		✓
Design for Disassembly	✓	✓	✓		✓
Sharing Economy Solutions		✓		✓	
Rent Ownership Models		✓		✓	
Sustainable Lifestyles		✓		✓	
Resource Efficiency	✓	✓			✓
Industrial Symbiosis	✓	✓			✓

Fig:2.1.2.Dooleys 8 components of CE

- Dooley have identified eight components of the circular economy which appear the most promising in built environment
- From this image it is observed that , the core concept of circular economy is waste reduction and minimizing material consumption.
- Keeping the material in loops
- BUT the concept of renewable energy is not mentioned here.

The results from the study are :

CE in real estate investment companies concerns their properties and construction work. The full circular economy can be implemented in any building, but from a cost-efficient point of view the core aspects bring the most benefits. The sustainability aspects adopted in the building brings in profits. And investment companies need motivations and drivers to change from linear to circular.

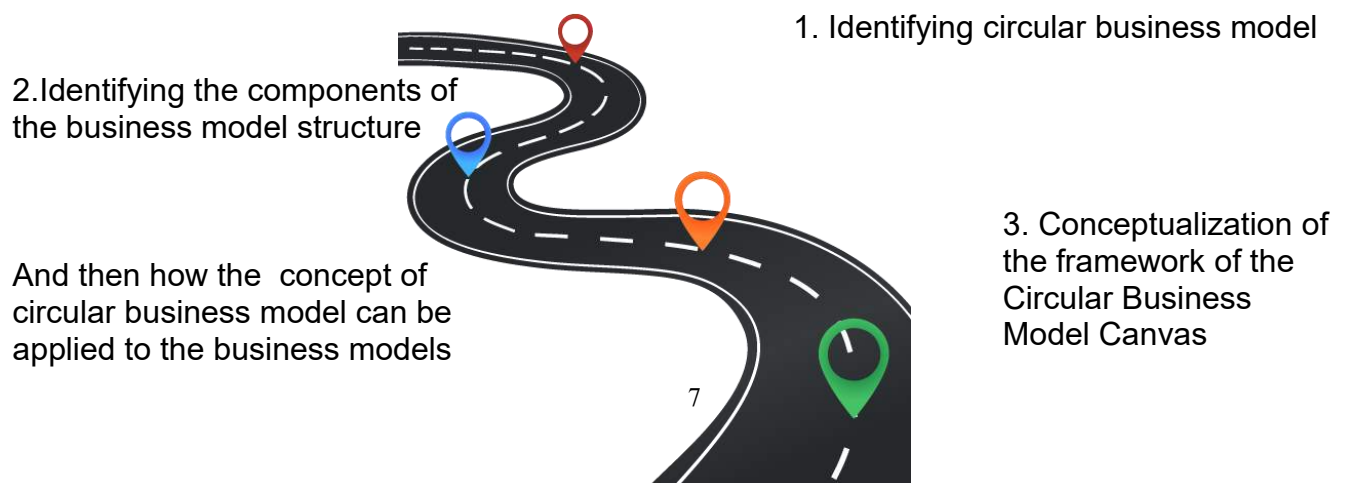
2.1.2 Research paper - 02

Designing the business models for circular economy - Towards the conceptual framework

(Source: Received: 12 November 2015; Accepted: 30 December 2015; Published: 18 January 2016 Academic Editor: Adam Jabłoński)

Aim of the study:

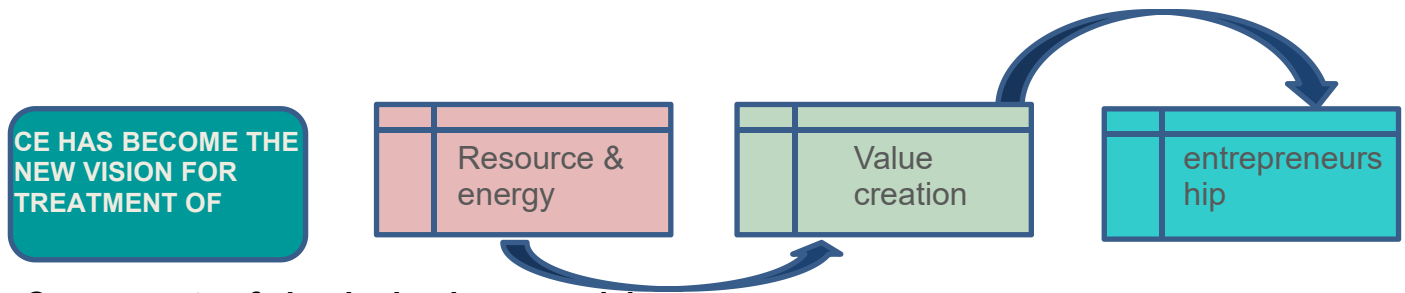
according to business model structure and define business model for circular economy



Research on circular business models:

The circular business model have been an opportunities to change or shift from traditional “end - of - life “ TO cradle - to - cradle

By using renewable energy , by eliminating waste through design of models , materials and product systems.



Components of circular business models:

They have defined the components of the business models as **ReSOLVE**

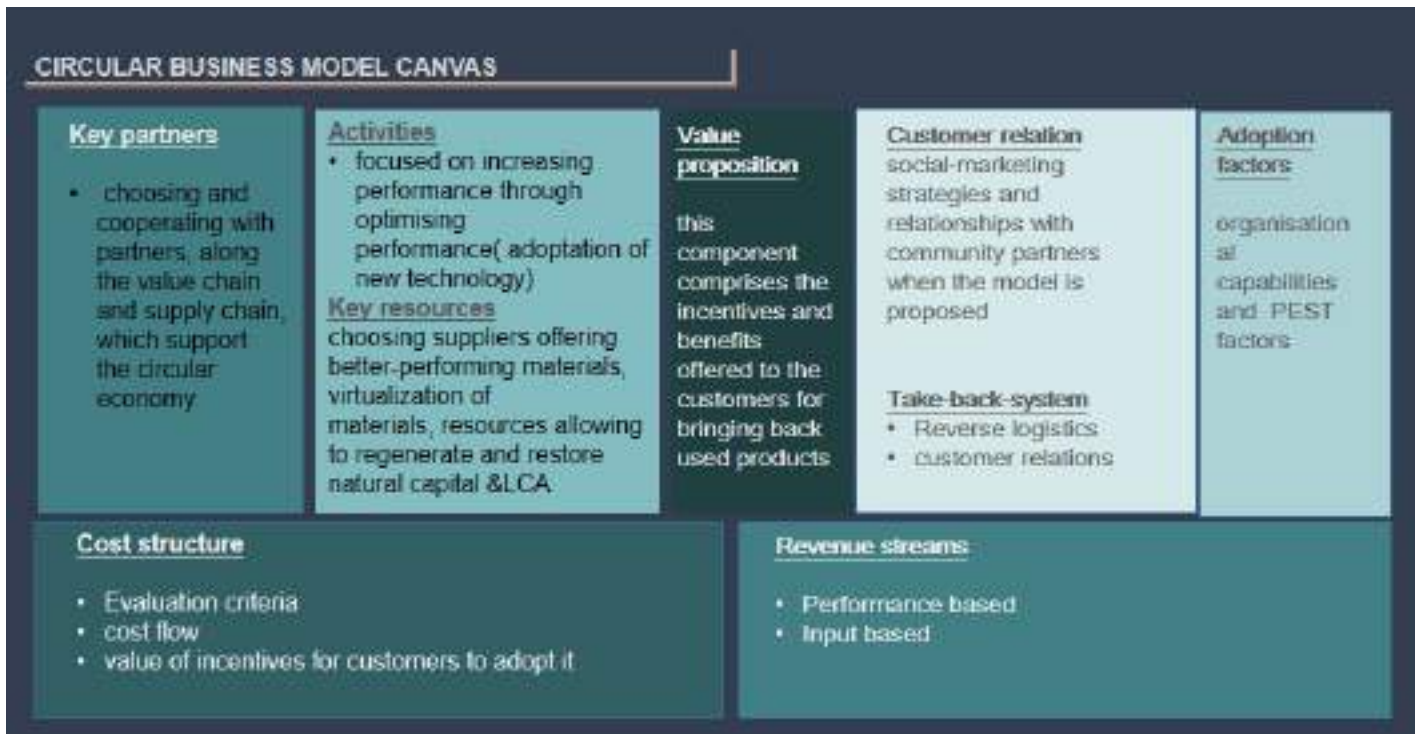
RE	Re-generate : Regenerate signifies the shift to renewable energy and materials
S	Share :Share actions aim at maximizing utilization of products by sharing them among users
O	Optimise :Optimise actions are focused on increasing the performance/ efficiency of a product and
L	Loops : Loop actions aim at keeping components and materials in closed loops
V	Virtualise : Virtualize actions assume to deliver particular utility virtually instead of materially
E	removing waste in the production process and in the supply chain Exchange Exchange actions are focused on replacing old materials with advanced non-renewable materials and/or with applying new technologies

One of the most important components of circular business models is the reversed supply-

chain logistics

Reverse logistics is the process of collecting and aggregating products, components or materials at the end-of-life for reuse, recycling and returns. Reverse logistics, also referred to as “aftermarket supply chain,” closes the loop

Circular business model canvas:



2.1.3 Research paper - 02

A new future for the past : A model for adaptive re-use decision making

(Source : Peter Bullen and Peter Love Department of Construction Management, Curtin University, Perth, Australia)

Aim of the study:

This paper therefore aims to develop a model to assist practitioners with their decision-making when considering to re-use or demolish an existing built asset.

Methodology:

In depth interviews among stakeholders, architects, developers, building owners.

Content analysis was used as the primary analysis technique on the collected data

Findings:

The analysis of the interviews revealed three key criteria are used to examine adaptive reuse decision making:- capital investment, asset condition and regulation

In financial criteria - development and construction cost were the primary criteria which influences the decision of reuse or demolish a building.

adaptive reuse has been identified as a process that can significantly improve the financial, environmental and social performance of existing built assets.

It is a safer strategy as it reduces the amount of disturbance due to hazardous materials, contaminated ground and the risk of falling materials and dust

The reuse of heritage buildings can provide community with new housing and commercial opportunities

Benefits and barrier of Adaptive re-use:

BENEFITS	BARRIER
1. Lower material, transport and energy consumption 2. Reduced resource consumption 3. Less material waste 4. Rising energy costs 5. Building functionality 6. Less disruption 7. Reduce negative impact of	1. Condition of external fabric and finishes 2. Maintenance costs 3. Higher rental in reuse buildings 4. Building regulations/planning restrictions 5. Complexity

Capital Investments:

It is identified from the paper that investors usually concentrate on development and construction costs, operational costs, marketing and maintenance requirements. But even

though the investors are aware of sustainability ,it is seldom considered during the decision making process.

(Capital is a large sum of money which is invested in order to make more money)

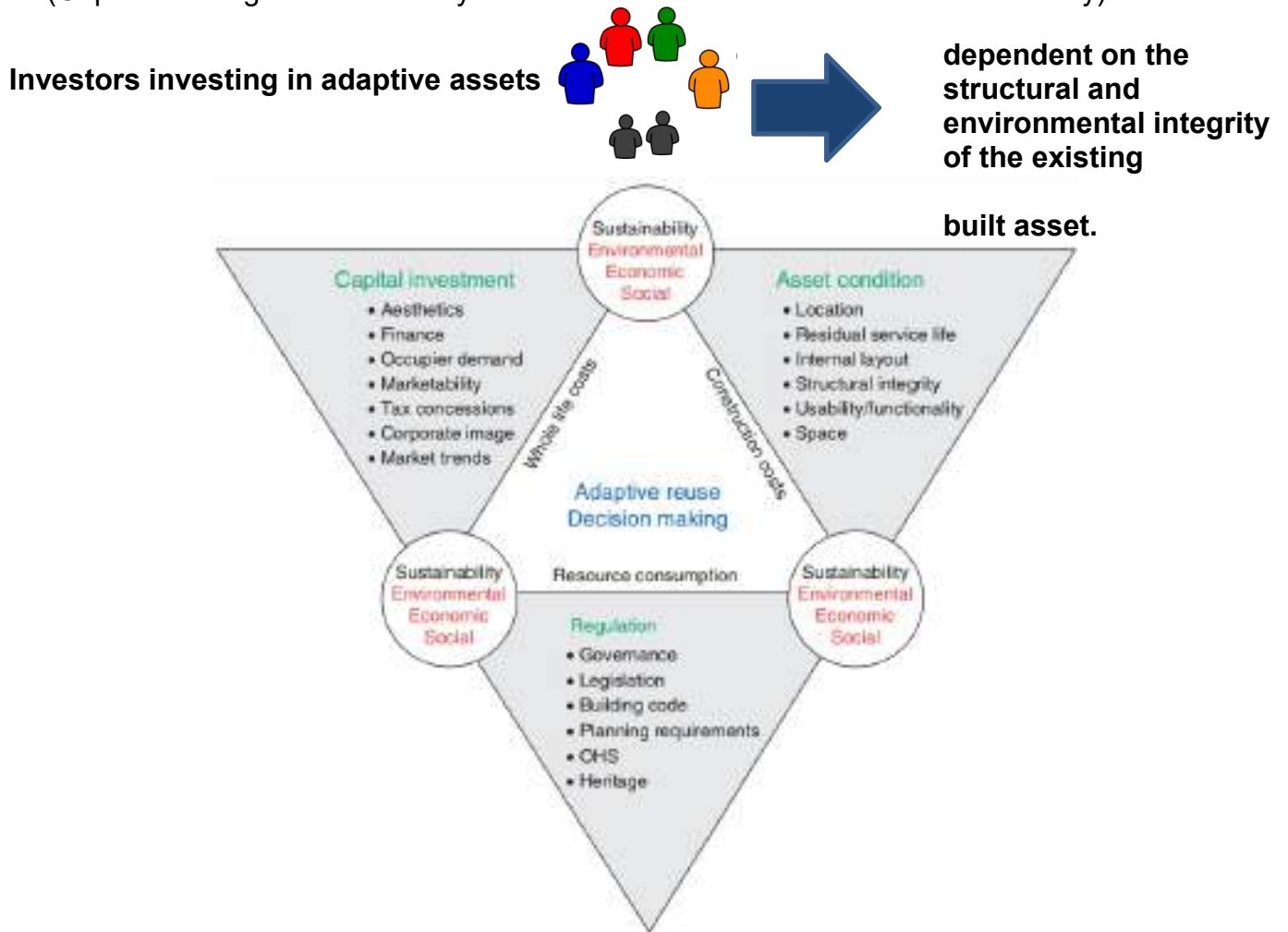


Fig:2.1.3.A model for adaptive re-use decision making

Asset condition:

- Buildings that are suitable for adaptive reuse-
- Large steel sheds or factories
- Heritage listed building
- Buildings not suitable for adaptive reuse-
- Prisons
- Low rise buildings(based on zoning)

- Small cottages

Regulations:

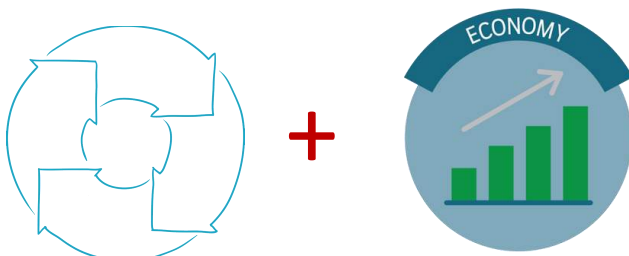
- It is observed from the interviews in this paper is that , the legislation can make adaptive reuse as an mandatory
- Growing awareness among CO2 emission and waste generation to achieve sustainability are pillars for initiating change

Conclusion:

- Adaptive reuse ,reaps the benefits of the embodied energy and quality of the original building in a sustainable manner.
- Building owners and occupiers need to evaluate various kind of options when considering to discarding, expanding or changing the function of their buildings.
- key drivers influencing the decision-making process are environmental, economic and social tenets of sustainability.
- long-term benefits that can contribute to sustainability, economic costs and short-term returns on investment still appear to be the determinants for reusing a built asset

2.2 INTRODUCTION

- Recently circular economy is a arising topic , as an outcome of concern about the economy
- CIRCULAR - Closed as a loop/ Circular flow
- ECONOMY - It defines the economic life (deals with money)
- **CLOSED LOOP OF A MATERIAL / PRODUCT / MODEL - HOW DOES IT IMPACT THE ECONOMIC LIFE**



The concept of CIRCULARITY has been introduced to the economy / human economy by MIMICKING from natural cycles that already exists

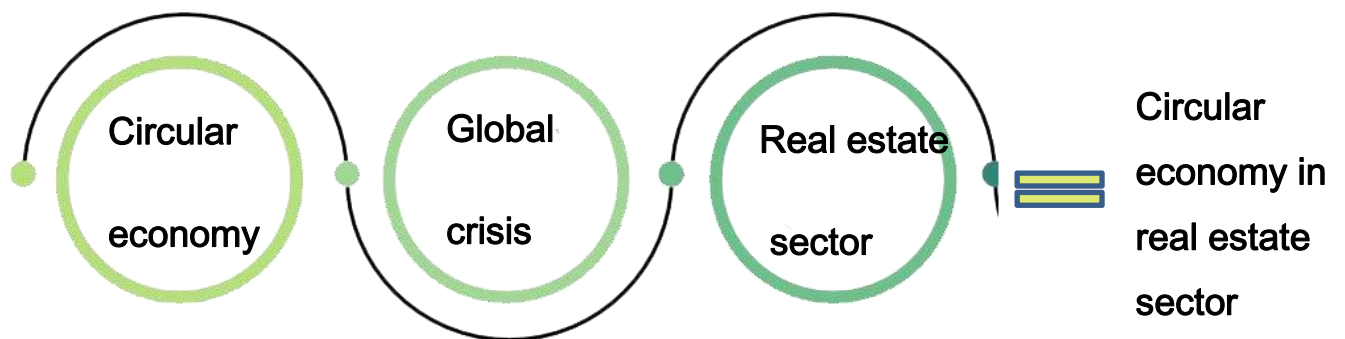
2.2.1 Why circular economy concept is booming again ?

- The industrialization factor hit the environment with large amount of pollution and affects the environment , which affected both locally and globally
- As a result of industrialization , the impact of pollution was recognized . And the Scarcity of resources are noted
- Hence , environmental protection enters the POLICIES and LEGISLATION

Hence, they maximize the Reuse and optimization of resources

2.2.2 Real estate sector

- Real estate is considered as the backbone of India,because lot of investment happens in real estate industry
- They are also the driving factors for growth in economy.
- But due to the current fluctuating markets , the sector need an change in-order to be stable and long time
- Most of the real estate investments are in construction works, which is a larger consumer of natural and finite resources



Circular economy is a simplest form of economic model where , circular flow of materials and energy is the main principle.

In production usage of virgin materials and throwing away after use in not considered circular .

Where in linear model , they take - make- and dispose.

2.2.3 Core principle of circular economy is:

1. SUSTAINABILITY

Sustainability is considered as the core aspect of circular economy, since circularity in any model provides sustainability

2. RESOURCE EFFICIENCY

Using less resource and minimizing the negative impact to the environment.

3. LOOP

Loop actions aim at keeping components and materials in closed loops and less use of virgin resources.

4. PROLONGED USE OF RESOURCE

Increasing the life time use of resources , by reusing it

5. ADAPTIVE TO VERSATILE ENVIRONMENT / FLEXIBLE

Flexible in nature and adapting to the current scenario

2.2.4 Benefits of circular economy

- 1) Less resource consuming and intense strain on resources
- 2) Less impact on the environment
- 3) Increases economic growth
- 4) Prolonged life of a product / material
- 5) Use age of renewable resources
- 6) Employment growth
- 7) Increased competitive among market
- 8) Safeguard supplies and volatile reduction
- 9) Stimulates innovation and uniqueness

2.2.5 Area of concern by various concepts



Green building covers the aspect that are related to the building alone.

Whereas sustainable building relates the environmental , technical with profit , people related it also

Where the circular buildings which relates and co-ordinates all the aspects such as environmental , technical , social , economical , governmental (it becomes the foundation of forming or marking policies and behavioural aspects which leads in decision making.

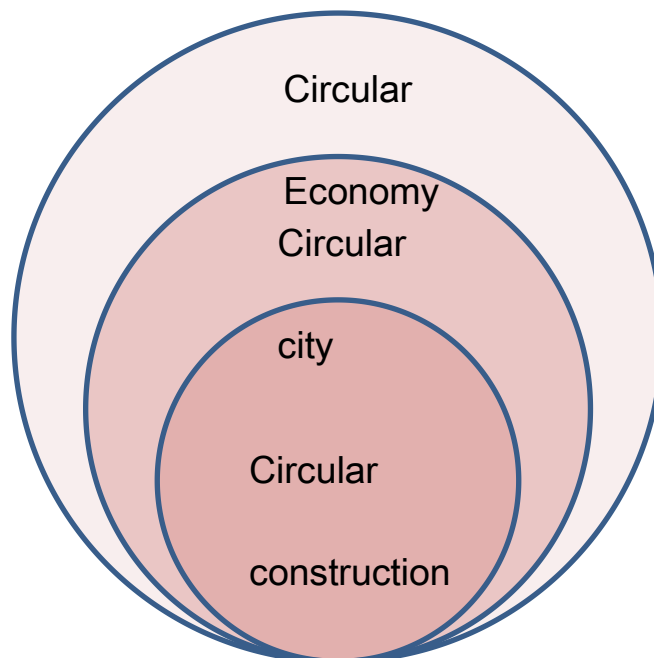
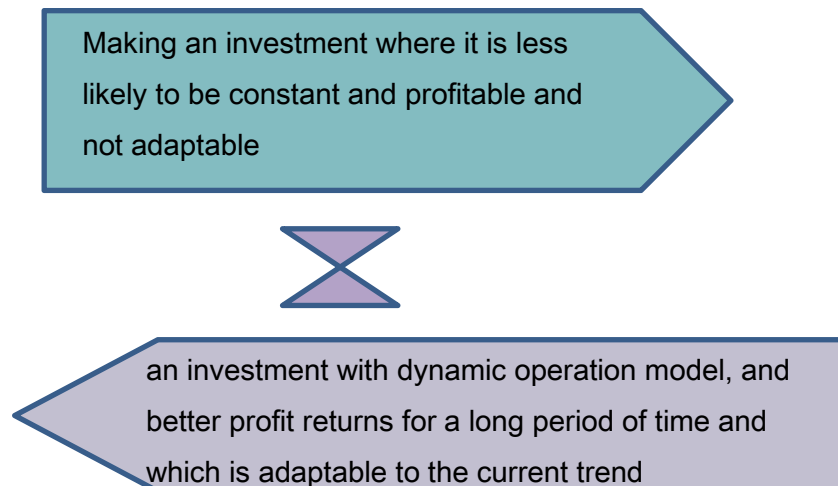


Fig: 2.2.5 Evolution of CE

- The process of circular economy starts with construction of circular building
- Then leads to development of circular city
- Then finally these together helps in the formation of circular economy at real estate
- Combining all these factors provides VALUE to the economy
- Hence , the concept of circular economy solves major problems of global issues , pollution, global warming , CO2 emission, by closed loop principles.

2.2.6 How do real estate investments influence it

- In real estate they mostly invest in properties.
- Traditionally the investment will be more direct ,like buying vacant land or building with land , or shares
- Most of the investments will be on new buildings rather than old one
- This characteristic of investment provides a good chances
- of for creating a circular economy , where they can influence the design of a new building.
- The real estate investment companies can have the majority of chances to influence the usability of building , design of the building , types of material used and the policies adopted can be changed according to circular economy.
- The core idea of circular economy in real estate sector is to provide new business models different from other , where it takes the chance to gain advantage from the changing spaces
- Hence by delivering flexible spaces , de-constructable and adaptable buildings , the ,



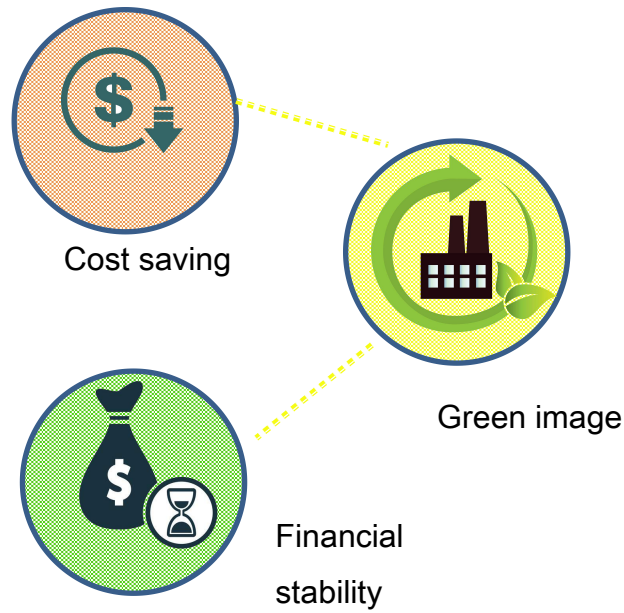


Fig:2.2.6.Motivational factors in circular economy to adopt to it

2.2.7 Circular business models

- Circular business model is companies business strategy to make it regenerative or restorative by intention and design. It replaces the idea of “end - of - life “ to cradle to cradle by reuse , restore , renewable energy ,elimination of waste.
- Due to effect on environment and other impacts leads the people to change in time , so designing a strategy that can be adopted and stay profitable while avoiding traditional build and demolish. The asset managers work with their tenants to maximize space utilization and revenue generation opportunities.
- To execute this there should be involvement of stake holders at various levels
- Re-thinking the building according to the life cycle approach considering the future value and impact to the environment at each stage.
- And Re- designing through shifting boundaries , changing systems

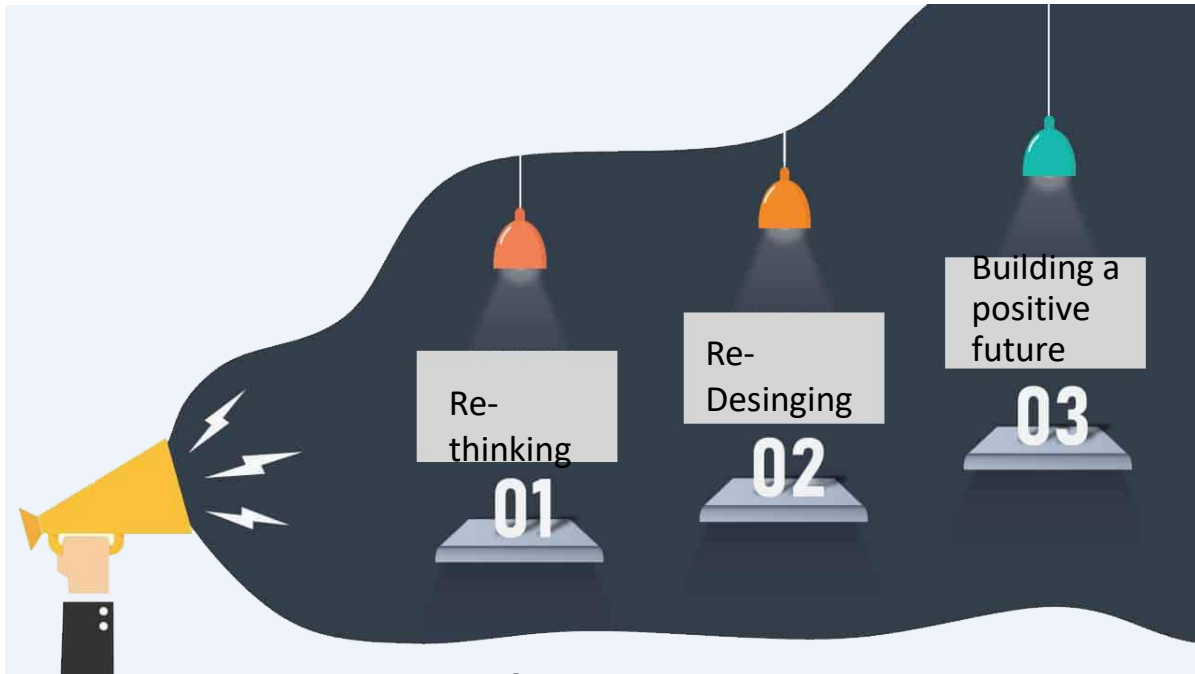


Fig:2.2.7.CE business models process

2.2.8 Barriers to implement circular economic models

There are various hindrance to implement circular economical models .The hindrance may be direct or indirect and these barriers are connected to each other . The barriers are majorly divided as MICRO and MACRO level barriers . Whereas Micro level barriers are the factors within the organization and Macro level barriers are outside the organization.

MICRO LEVEL:

1. Companies culture and belief influences the transition to new model ,The resistance of the companies to buy used or recycled products .Working in Linear model is comfort and well known rather than adapting to discomfort circular system The management systems are structured in a linear way.
2. Lack of knowledge about the technology and recycling process.Limited experience can be a major drivers for not to implement circular models. Lack of large scale demonstration .
3. Involvement of stakeholders are key factors.The amount of investment also decides the involvement of the stakeholders. Customer satisfaction or requirements . Financial profitability.



Fig:2.2.8.Micro level and macro level barriers

4. Lack of infrastructure and networks, with sufficient certain infrastructure from the organization and capabilities to achieve the circular concept (recycling , disassembly) the amounts of equipment required .

MACRO LEVEL :

- 1) Government rule and legislation

To accept new model legislation and rules are important driving factors .The current legislation supports linear models .Since many laws and standards do not support the new innovative concepts to adopt.These legislation they lack in supporting the market of secondary raw material.The approval process will also be difficult in circular systems.

- 2) Market

There is a lack of customers acceptance to new new models (adaptive asset rather than demolition) and recycled materials.Once circular economy provides enough profit and low risk are described the market value may change towards circular.Lack of standardization.

- 3) Supply chain management

There is 3 main concept for supply chain management : Circular supply, resource recovery or reuse , and extending the life of a product .These are co-related . The first of all circular supply is not sufficient due to minimum number of suppliers and in Reuse & product life extension the quality of the product remains unknown.

- 4) Not sufficient infrastructure : The awareness among the consumers and the suppliers. Not sufficient infrastructure to implement the strategies. Since , less suppliers the cost of it becomes relatively high. And lack to deliver in high quality

2.2.9 Circular models



Reusing of an existing building for a purpose other than which it was originally designed or planned

It is one of the model because it uses less resources and energy rather than creating a new one

Lower investment costs and more room to focus on restoration and revitalization.

ADAPTIVE ASSETS



Relocatable building is also called as modular building

It allows for adjustments, deconstruction and reuse of its parts again

RE-LOCATABLE BUILDING



Recovering value from materials which is used during construction

A product that has reached the end of its useful life is not waste, but instead a complex of components and materials.



This flexible spaces are built on the concept of co-working spaces , mostly to unlock the potential of underused buildings .

By doing so the revenue generation can be increased from additional tenants

FLEXIBLE SPACES



The performance procurement they extend the product as a service model

The payments are linked to performance and now the suppliers is the service provider who retains the ownership of the product and the supplier is responsible for repair & maintenance

PERFORMANCE PROCUREMENT

2.2.10 IMPLEMENTATION OF CIRCULAR MODELS AT DESIGN STAGE:

At current scenario transition from LINEAR to CIRCULAR is quite challenging in the design stage , rather than during the construction stage

CONSTRUCTION PHASE

- Limited accessibility
- All the models cannot be implemented
- It will be limited to material reuse and materials only

DESIGN PHASE:

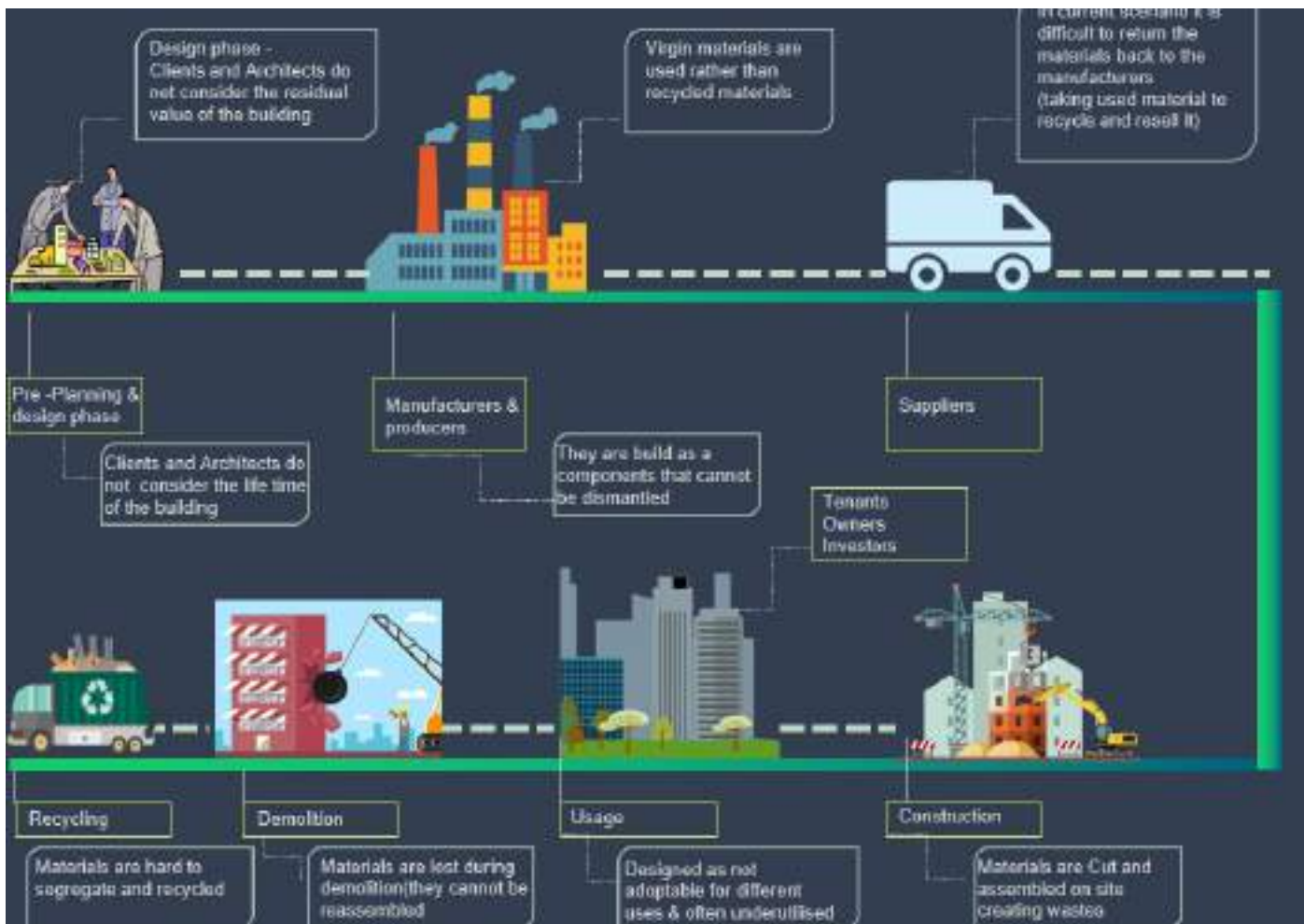
- Flexibility of application will be more
- Can be able to apply the model at free of restrictions

POST DESIGN PHASE

Limited accessibility

- Flexibility of application of the business models is restricted
- Planning of materials cant be done
- (if i want to adopt to residual value model , the planning of materials at design phase would make it efficient to apply .

2.2.11 Current building process evolution cycle :



2.2.12 Business models types :

1. CIRCULAR DESIGN:

The products and the system , the building designed are for last longing and obtain high residual value.BY –

Bio based materials that are recyclable and usage of renewable materials

Hence it becomes easy to repair , refurbish, and recycle than traditional methods

CHALLENGES –

3 Major risk in this are –

- Technological risk(since not much standards available for it ,
- Market risk relates to customer satisfaction,
- Operational risks relates to uncertainty in the operational cost
- Includes higher initial investments

2. CIRCULAR RECOVERY:

- This is at the phase of END of product LIFE , Where in this the revenue is generated by transforming the product into new one.

BY – Re use of the materials and recycle

CHALLENGES –

- Financial risks
- Regulation around waste management, product performance and health and safety all create barriers to recapturing materials

3. CIRCULAR USE:

- It is the keeping in control the retaining value of
- Assets - It is the operational phase of the asset

BY –

Providing leasing and sharing opportunities

Hence this generates the companies to expand , by using this it also provides long-term revenue generation

CHALLENGES –

Analysis of the operation cost during this phase produces lots of risks

Risk due to the changing in price in the market for the materials and services

2.3 BUSINESS MODELS

2.3.1 FLEXIBLE SPACES

The main concept of Flexible space is innovative sharing of spaces - Multipurpose users

and shared utilities and facilities.

They fuse many facilities and give as a single product to the consumers

Production factors for this model:

1. Space :

Space is a important production factor to this model because defining different spaces as the per the consumer need is necessary(different spaces such as single unit , private desks , open desks, common spaces).

2. Services:

Service is an important factor in production of the business model , since it is the profit generator of the flexible spaces.

3. Community:

Community is the core aspect of flexible / co-working spaces.It is the important factor that distinguish from traditional spaces of work. And directly increases the growth and revenue stream .

Drivers for this model:

1) Technology

Development of technology , enables the people to work at anytime , anywhere. Since , there can be a need of workspace with more convenience and less rental (which is cost efficient)

2) Demographics

New generation has new needs and behaviors , which changes the way they usually live and consume resources. They are more willing to share a workplace

3) Economy

Entrepreneurship , small start up business and free-lancing is increasing in the economy .

Concept of sharing :



Fig.2.3.1: Concept of sharing

Revenue drivers:

1. Membership fee:

- The major revenue from this model is from the membership fee - which is the TENANT pays to USE and ACCESS the working space.
- Its either monthly , weekly and also include utilities , cleaning and internet fees
- This fee or money completely various from space to space and based on their provision of utilities

2. Service fee :

- Its like charged upon use
- The service fee will include for paying for the personal services.
- Service fees contribute for 5%-10% of the flexible workspace -revenue.
- Its like service for private facilities and events etc.

Cost drivers:

- **UPFRONT COST:**

The cost in the preliminary stage - Hard cost = Cost of construction , furnitures , systems ,IT system

Soft cost = cost of design , engineering , legal cost , brokerage fee , administrative expenses etc.

- **OPERATING COST:**

The cost in the operating stage

The building operating expenses such as building insurance , property tax , regular maintenance expenditure ,Market cost

Renting contributes to the major operating cost of about 60%-70%

- **FINANCING COST :**

Its like how do they acquire their capital .

The flexible spaces does not include high initial capital cost

Its based on the capital money either from own , bank , venture capital etc

RISKS IN FLEXIBLE SPACES

Leasing option

Insurance and the risk cover

Provision of high security and consumption of high maintenance

Growing concern about the data privacy

Revenue sharing model

Instability in the revenue

2.3.2 RELOCATABLE BUILDING:

- The concept of relocatable building = Building in LAYERS , which can be dismantled and relocated to the other area based on need.
- Using of relocatable building in a vacant site would be more appropriate , can generate a short term income .The materials used for it are long term
- The shipping containers are used at large scale because of the reason SPACE DEMAND and RECREATING VALUE by product sharing from the used product
- The life span of the container building is 25-30 years

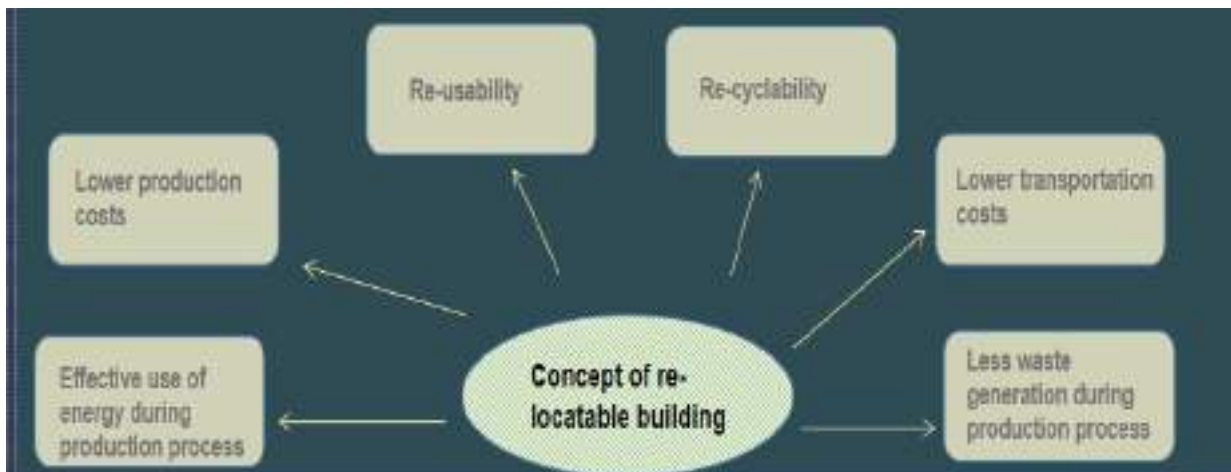
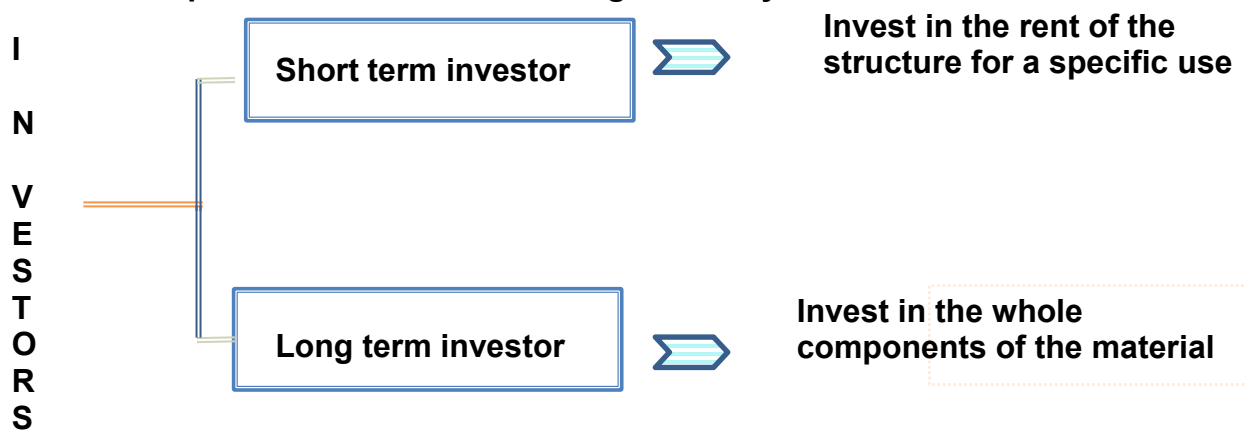


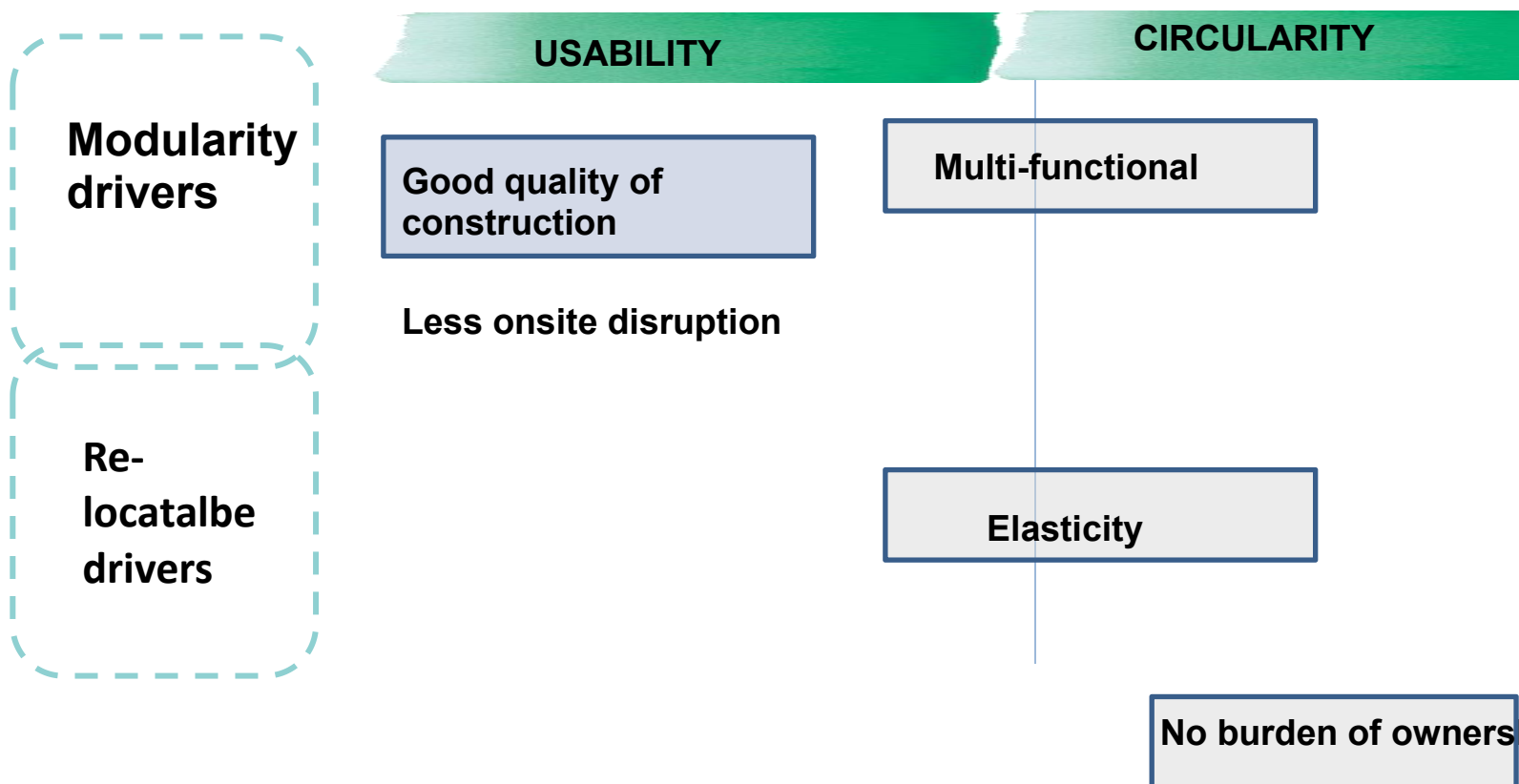
Fig.2.3.2: Concept of relocatable building Revenue drivers:

- **Rapidity in construction-** The construction process is very quick and the cost is saved in it
- **Maintenance cost** - Less maintenance compared to the conventional building

- **Transportation and re-using , off site construction** - Re-using the building for .3.4

Cost drivers:

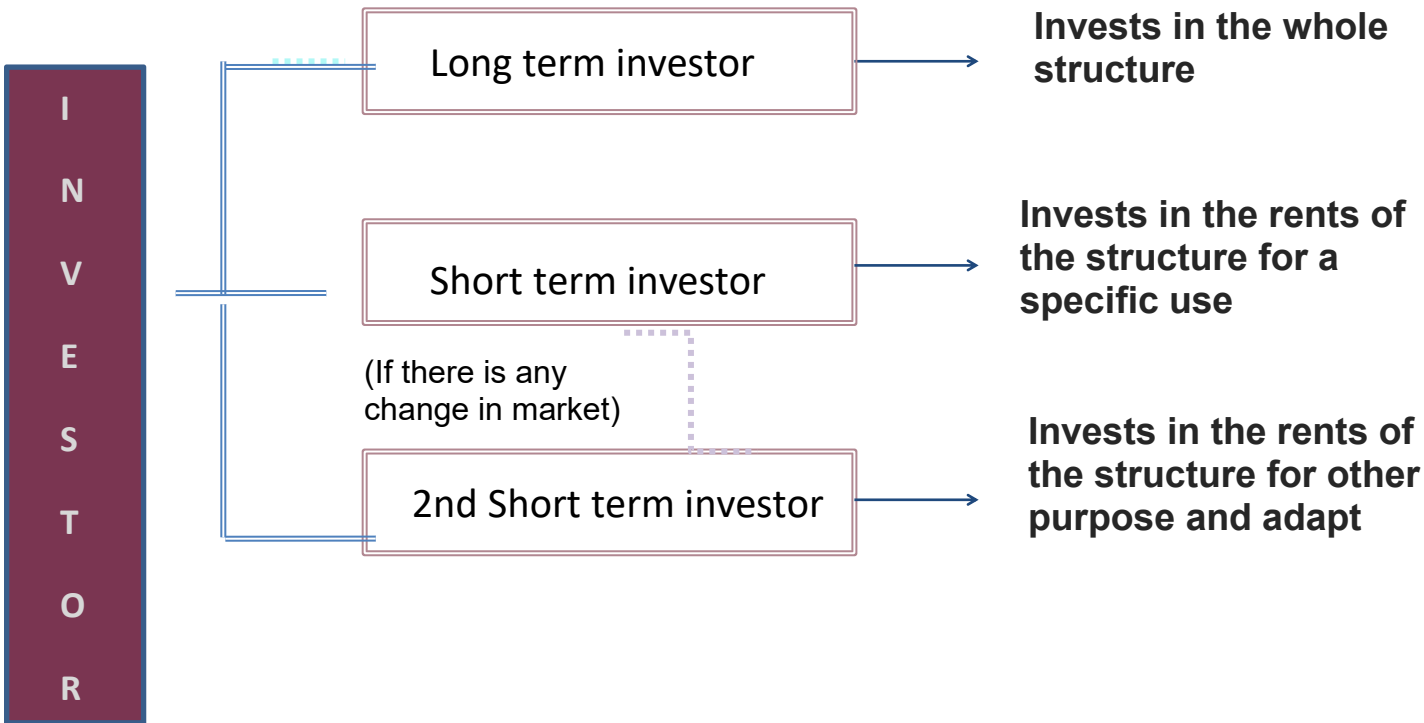
- **Insulation cost** - Since the container building cannot be directly used , it has to be insulated completely
- **Flexibility in width of the building**-Since , the room comes in a standard size , the flexibility according to the client requirement requires alteration ,which inquires additional cost
- **Additional charge for services and customization**- Since the complexity of the services are quite difficult in this scenario



2.3.4 ADAPTIVE RE-USE :

Adaptive reuse can have a variety of advantages for commercial real estate investors and developers. Primary reason is that demolition and new building construction can be extremely expensive. Adaptive reuse can lead to substantially lower construction costs. Buildings targeted for adaptive reuse have a significant historic past and pleasing aesthetic

qualities, which can often help attract and retain tenants.



- **Tax credit:**

Historic building that is adapted for new use is applicable for a tax credit of 10%.

2.3.5 COST BENEFIT ANALYSIS:

An important tool for decision making process -Fundamental method to compare the financial cost that is incurred for new initiatives and benefits generated form them

Purpose of CBA -

1. To find whether the decision is sound
2. To compare the basis of alternative investment options

Types of cost benefit analysis:

Ex ante CBA

used to assist the decision making before

Ex Post CBA

conducted after the project been

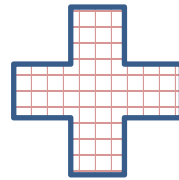
All the costs included in doing a project. Includes construction cost , cost of services , hard costs , softs cost during construction



Benefits can be either monetary(financial) includes increase in profit margin or non monetary(non financial) benefits includes social benefits , improved people behaviour etc.

C
O
S
T
S

B
E
N
E
F
I
T
S



- If the benefits is more than the cost then the project is feasible or the proposal will be taken for the further implementations

1

Discounted method

considers the time period, interest, inflation etc. while calculating the costs and benefits

2

Non- Discounted method

Does not consider the effect of interest and time period

Methodology of CBA:

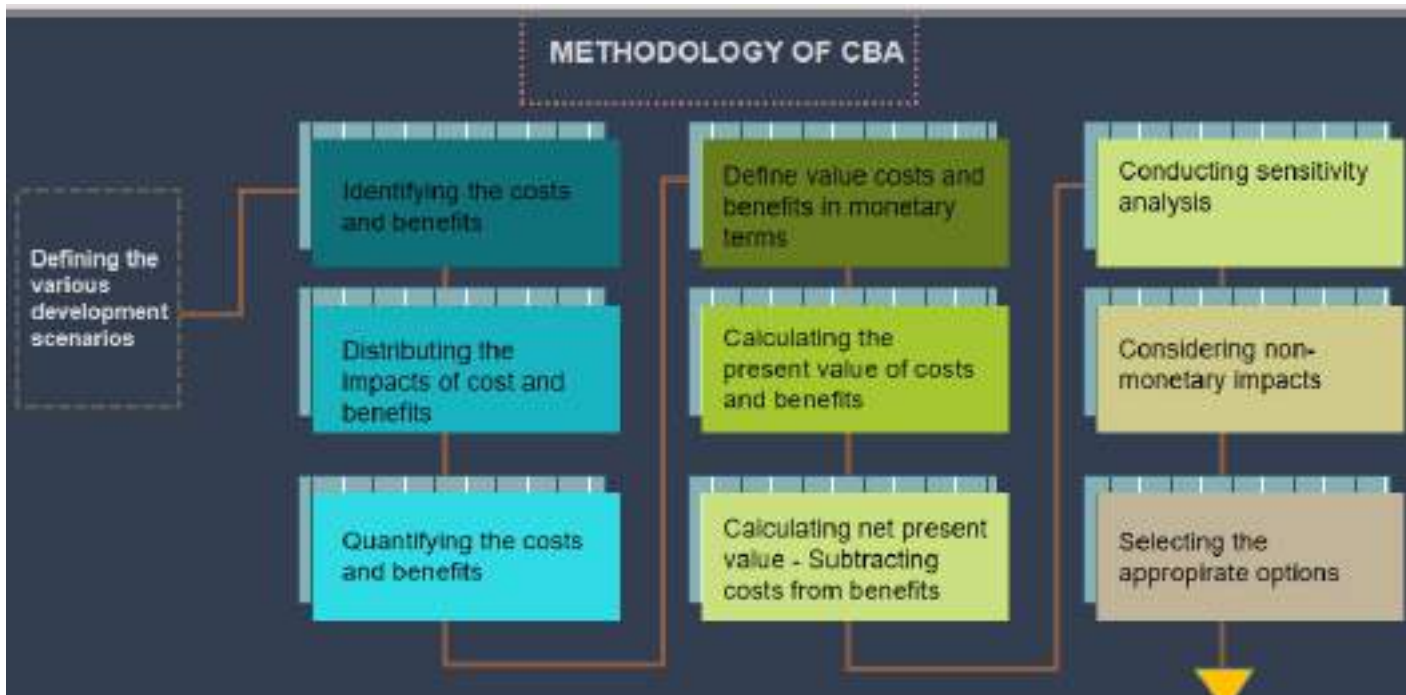


Fig2.3.5: Methodology of CBA

TO BE IDENTIFIED :

- Present value of the costs
- Future value of the benefits
- Present value of benefits
- $PV = FV/(1+r)^n$ (where r stands for rate of discount of money, n stands for time period)
- 4. Net present value
- 5. Internal rate of return

Guide lines for decision making to be considered:

- $NPV > 0$. Higher the NPV the BETTER the project is.
- BCR should be more than 1. Higher the BCR, the benefits outweigh the cost more.
- ROI should be high. Higher the ROI, the better is the investment opportunity.
- IRR should be high. Higher the IRR, the better is the opportunity.
- Payback period should be lower. Lower the payback period, the better seems the opportunity.

2.3.6 WHY THESE MODELS :



Investments

- Usually every development happens due to the industrial growth.
- Mostly the **Investment is based on the rental yielding capacity** of the building and based on DCR



Investments zone

- The yield was better in IT zone and Large office spaces
- Hence constructed a quantum of building
- The profit was quite large in that period

Change of market

Large supply than the demand lead to vacancy rate of the office spaces in CBD and off CBD spaces to 12.6% - 31.24%. (as per market report of Q4 2020)



The current status of 66L square feet off underutilized office spaces in chennai

New scenario

- Occupiers are adopting to new scenarios
- For the next 10 yrs the profit generating yield would be small spaces for office .
- By utilizing the underutilized space

2.4 LITERATURE CASE STUDY

CHAPTER 3 CASE STUDY

3.1. NET CASE STUDY

3.1.1. The Economics of Adaptive Reuse of Old Buildings A Financial Feasibility Study & Analysis (Waterloo, Ontario, Canada)

This study scrutinizes , from a private sector perspective - the economic costs and the various risks involved in selected adaptive re-use projects in Ontario

The main aim of the study :

Profitability of various options



Key factors that affect outcome of adaptive re-use development



Return of Investment of various options

METHODOLOGY used to analyse :

The methods used to collect data from Interviews from experts and Analysis of scenarios hypothetically and through basic level surveys to analyse the economic development of the specified area

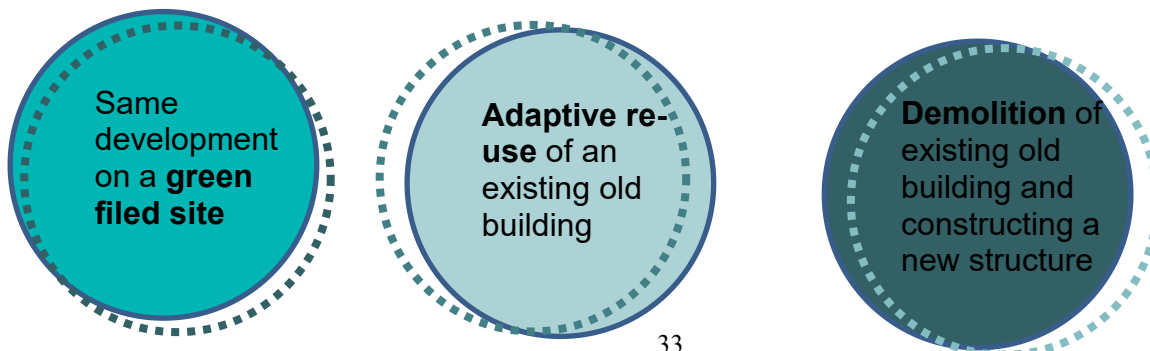
Introduction:

This study mainly focuses on the economic feasibility of the adaptive re-use of the old building versus alternative investment scenarios.

The main objective of the study is not to justify only that investment in preservation project is profitable rather the aim is to investigate and identify the economic outcome of investing in preservation or older buildings by comparison with the alternative scenarios.

Approach:

Analyzing the Return of Investment = With 3 adaptive reuse REAL LIFE projects are compared and calculated.



Comparison of these three scenarios

1. Current urban planning trends:

The major situations that lead to change in the urban planning trend is ,

Urban sprawl

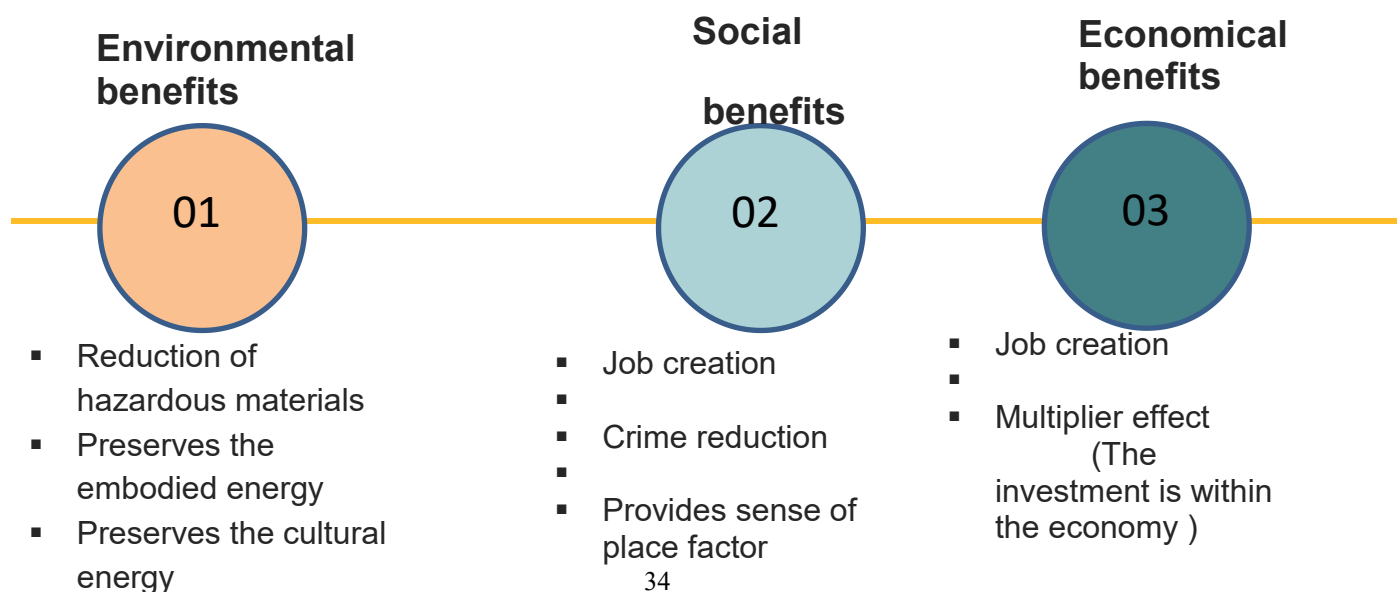
- Decentralization - This Decentralization of the business cores due to rapid development of cities at the outer area (peripheral area) left a number of empty old buildings and vacant sites
- This has lead to the reduction in the market value
- Then Decentralization of jobs and population in the urban centers,
- Sub -urban sprawl and inner city decline lead to a new concept called New urban-ism which helps in re-vitalize the shape of the cities

2. Adaptive re-use:

The decline of industry during the early and mid twentieth century due to shift from industrial based economy to other economy has left many buildings abandoned and underutilized in the urban centers

Hence , this become a core and advantageous concept to revitalize the urban city.

3. Benefits of Adaptive re-use:



4. Benefits of Adaptive re-use:

The investors, developers and the owners are the major stakeholders who face problems in adaptive re-use

Functional problems:

- The buildings that are constructed in the early century they are not equipped with the modern day requirements of mechanical and electrical systems
- The structures are complicated with different shapes provides difficulties to adapt for new generations
- Characteristics of adaptable buildings include modest scale, simple shapes, large open spaces, wide structural bays (distance between columns).

Zoning by laws:

- Zoning = regulatory barriers (for adaptive re-use)
- It defines the size , height , density .
- The extra cost and lengthy administrative process provides a negative impact on the profit of the project .

Building code:

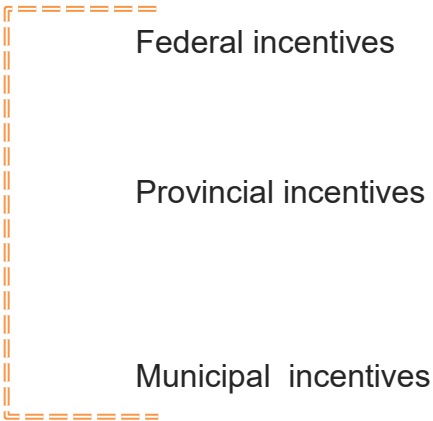
- Compiling with the local building code is a challenging concern in adaptive reuse
- When a building is changed to a other type , there is increase in the performance level of the building to meet the requirements of the occupancy (such as fire rating floors , doors sprinklers etc).

Contamination:

It is considered as the most significant barrier to redevelop the structure. Most of the contamination could be found in soil , materials etc

5. Incentives to be considered:

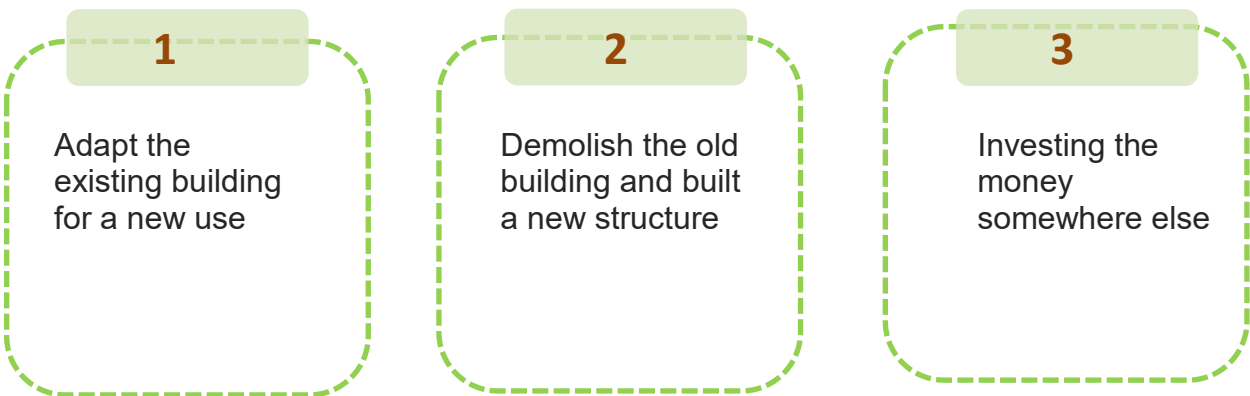
The main advantage of the incentives is to encourage private investors , and does get disadvantaged by the regulatory



6. Research method:

In this the case study approach is on collecting the financial data to evaluate and analyse the cost and return of investment of a adaptive re-use scenarios with other alternative comparisons

When a developer considers a site with an existing old building in it , the choice of investment would be either



So to make it feasible to compare they have considered three scenarios :

➤ Development scenario 1 - **DEMOLISH + NEW STRUCTURE**

This concept completely demolishes the existing building and builds a new structure .

This new building have the same use or typology as Adaptive re-use . The height and

other building requirements are as per zoning as per laws and other requirements.
In this scenario they have completely developed on the entire site area

They have considered no value from the demolition of the building.

➤ **Development scenario 2 - ADAPTIVE RE-USE**

In this they have completely adopted the building to other use and the various costs involved in changing the space is considered

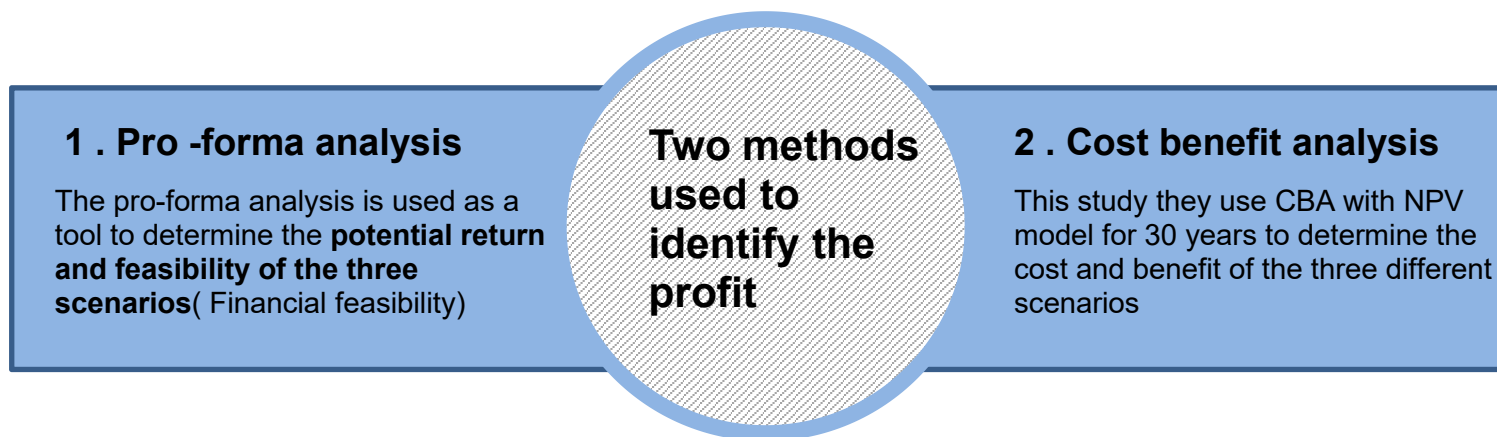
➤ **Development scenario 3 - NEW CONSTRUCTION OF GREEN FIELD**

In this scenario , a green field without any existing building or any other contamination present in it.

The reason why they have taken this scenario is to provide a legitimate comparison between the options.

The concepts they have considered is :

- ◆ This scenario has no demolition cost
- ◆ New development fees are considered
- ◆ They make full use of the site

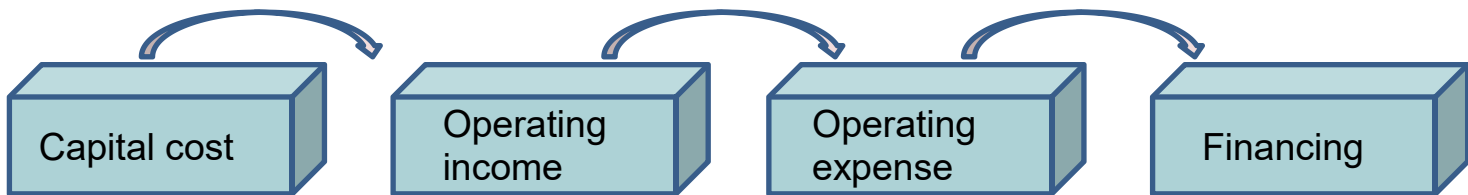


7. PRO-FORMA ANALYSIS:

The main objective of the pro -forma analysis is to identify the financial fallibility on each scenario

When a investor is investing on a real estate project , the investor will consider the amount

of investment in four different categories are:



❖ **Operating Expense:**

- Significance portion of a income money is spent on operating expenses
- Mostly the expenses will be maintenance cost , monthly utility bills , advertisement etc
- It mostly depends the type of construction methodology used here .
- Lower the operating expense the more profitable the investment will be

❖ **Financing :**

- The cost of money borrowed , is one of the major factor which decides the profit and it also defines the higher amount of risk
- There are 3 factors that affect the return of investments :
- **Interest rate** - It is the amount charged by the lender to the borrower .Higher the interest rate lesser the profit would be
- **Loan term**- The time period in which the loan has to be repaid . Increased time increases the risk to the owner . It actually referred as AMORTIZATION PERIOD

❖ **Loan to value ratio (LTV):**

- $LTV = \text{Total amount of loan} / \text{value of the property}$
- It defines how much risk the lender takes on a secured loan

They define the pro-forma analysis in TWO STAGES.

1. QUICK AND DIRTY

They define the main characteristics and the construction cost

2. MULTIPLE PERIOD

It shows the cash flow in a project ,like it includes the factors that affect the return of

investment , such as hard cost , soft cost ,operating income , expenses , financing , and other taxes and credits considered

The main purpose of the two stage pro-forma analysis is to provide a conception of the project cost , risks involved , and the feasibility at various stages.

Tab 3.1.1. Pro-Forma Analysis,Construction cost, Quick and dirty stages

Factor		Rehabilitation	New Same Site	New on Greenfield
1	Lot Size	0.00	0.00	0.00
	Building Gross Floor Area	Reuse (Residential)	0.00 sqf	0.00
		Reuse (Garage)	0.00 sqf	0.00
		New (Residential)	0.00 sqf	0.00
		New (Garage)	0.00 sqf	0.00
2	Total	0.00 sqf	0.00	0.00
3	Number of rentable units	0 unit	0	0
4	Number of parking required	0 space	0	0
	Number of parking provided	0 space	0	0
5	Hard Costs			
6	Demolition	\$0	\$0	\$0
7	Building Construction Hard Cost (sq.ft)	Reuse	\$0	\$0
8		New	\$0	\$0
9	Building Construction Hard Cost (Total)	\$0	\$0	\$0
10	Site cleanup	\$0	\$0	\$0
11	Outdoor Parking / paving	\$0	\$0	\$0
	Other Site Work	\$0	\$0	\$0
	Total	\$0	\$0	\$0
12	Soft Costs			
13	Consulting fees	\$0	\$0	\$0
14	Demolition Permit	\$0	\$0	\$0
15	City of Guelph Permits and Fees	\$0	\$0	\$0
16	Insurances	\$0	\$0	\$0
17	Development Charges	\$0	\$0	\$0
18	Total	\$0	\$0	\$0
19	Total Construction Costs:	\$0	\$0	\$0

20	Capital Costs:			
21	Acquisition Cost	\$0	\$0	\$0
22	Construction Cost	\$0	\$0	\$0
	Unit Price (Dollar per sq/f)	\$0	\$0	\$0
24	Total Capital Cost	\$0	\$0	\$0
25	Operating Income:			
26	Vacancy Rate	0.0%	0.0%	0.0%
27	Average Rent per sq/ft	\$0	\$0	\$0
28	Net to Gross Ratio	0%	0%	0%
29	Rentable Square Feet	0 sqf	0	0
30	Rent Total	\$0	\$0.00	\$0.00
31	Vacancy	\$0	\$0.00	\$0.00
33	Total Annual Operating Income:	\$0	\$0	\$0
34	Operating Expenses:			
	Property Tax	\$0	\$0	\$0
35	Operating Expense Ratio	0%	0%	0%
36	Total Operating Expenses	\$0	\$0	\$0
37	Net Operating Income	\$0	\$0	\$0
40	Financing:			
41	Capitalization Rate	0%	0%	0%
42	Value Based on Appraisal	\$0	\$0	\$0
43	Loan to Value Ratio	0%	0%	0%
44	Available Loan	\$0	\$0	\$0
45	Investor Cash required	\$0	\$0	\$0
46	Loan Term	0 year	0	0
47	Interest Rate	0.0%	0.0%	0.0%
48	Annual Payment on Loan	\$0	\$0	\$0
49	Cash Flow	\$0	\$0	\$0
37	Unleveraged Investment Return	0.00%	0.00%	0.00%
50	Investor Cash on Cash Return	0.00%	0.00%	0.00%
51	Gap Between Cost and Value	\$0	\$0	\$0
	Available Incentives			
	Government Grant	\$0	\$0	\$0
	Capital Cost After Adjustment	\$0	\$0	\$0
	Investor Cash required After Adjustment	\$0	\$0	\$0
	Unleveraged Investment Return	0.00%	0.00%	0.00%
	Investor Cash on Cash Return After Adjustment	0.00%	0.00%	0.00%

Pro-Forma Analysis

ROI - Multi period cash flow analysis

Conclusion : The return on investment is , 6.71% for adaptive re-use, 5.09% for new

same site ,new on green field 5.27%.

NOTE:

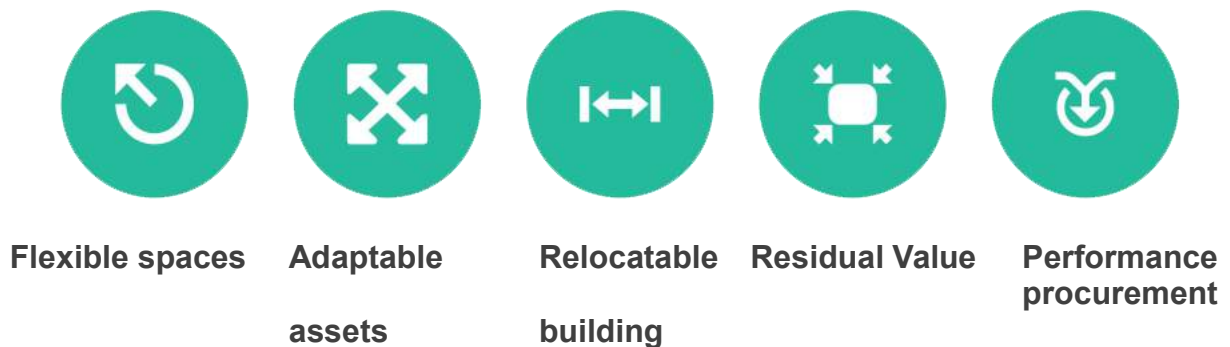
(The procedure of cost analysis is not feasible because it cannot be applied to the current Indian scenario due to change in the population , culture ,location and other demographics and market value , hence its not taken into considerations)

3.1.2. Realizing the value of circular economy in real estate sector

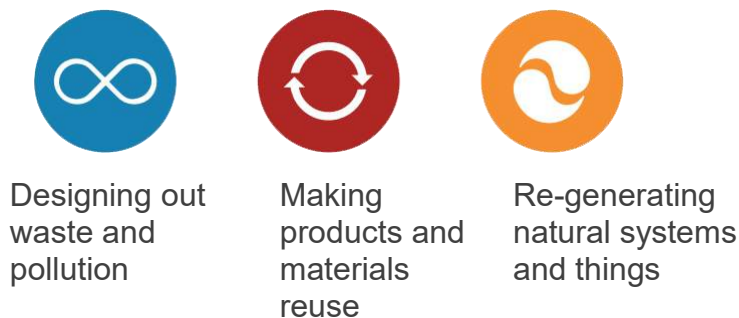
(This report was prepared by ARUP in collaboration with Ellen MacArthur Foundation and expert advisors as JLL).

(Improved financial performance of up to 18% over 12 years is available to investors and construction clients who unlock the potential of underutilized space)

- They have proposed a five business model in order to improve the resource productivity of real estate while also contributing of the De-carbonisation of the sector



- **Main aims of circular economy:**



- **Investments in circular economy:**

1. Minimizes sources of lost value
2. Increases Return of interest

- **Building in layers:**

- Building in layers defines the different elements and components in a building and its life span various.
- A building built in layers enables the owners to repairs , replace or adapt at a different times without affecting the whole building
- By implementing this it reduces unwanted degradation of a building and also increase flexibility and long term usage

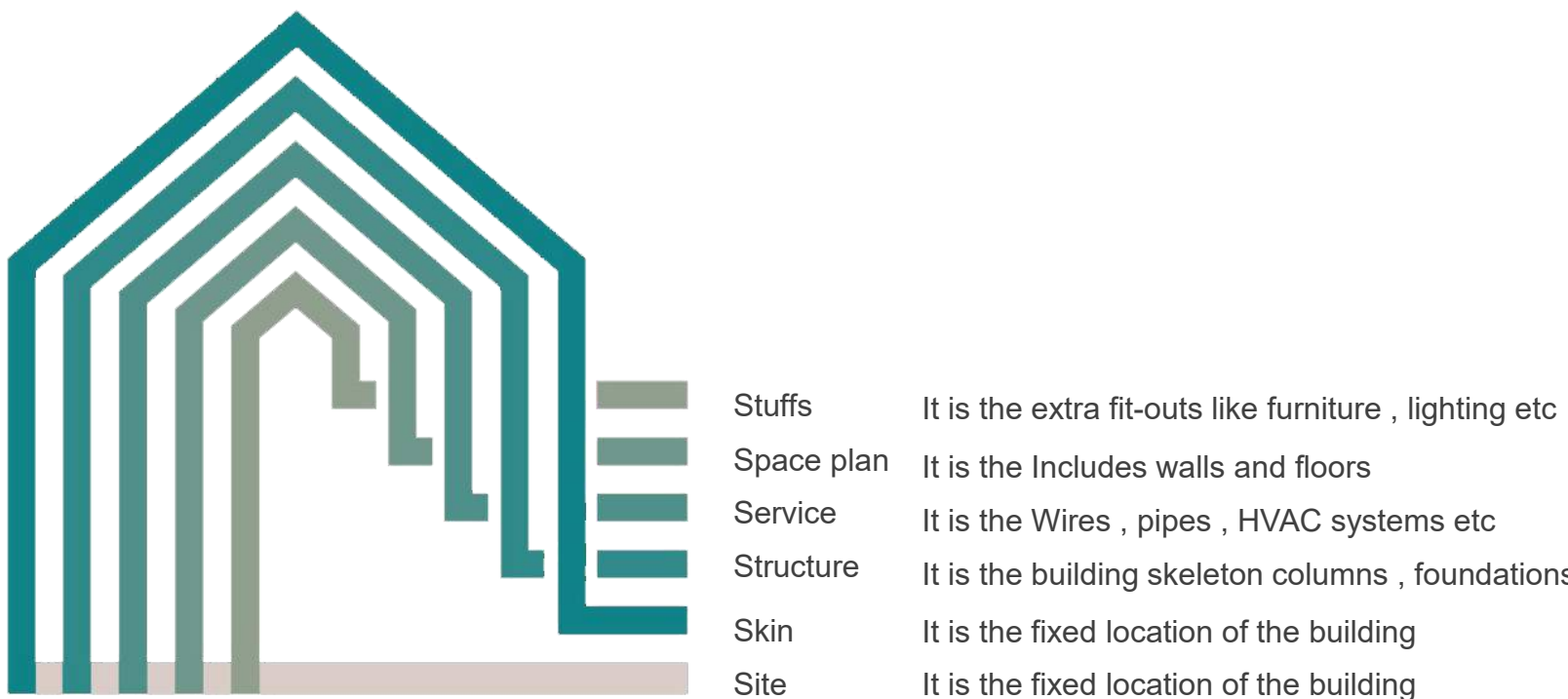


Fig:3.1.2.1: Building in layers

- In this study they haven't considered site location in financial performance , because This is because the economics of site location will vary dramatically according to geography and market dynamics

- Before creating a business strategy or model , they are first identifying the reason for lost value

➤ **Source of lost value:**

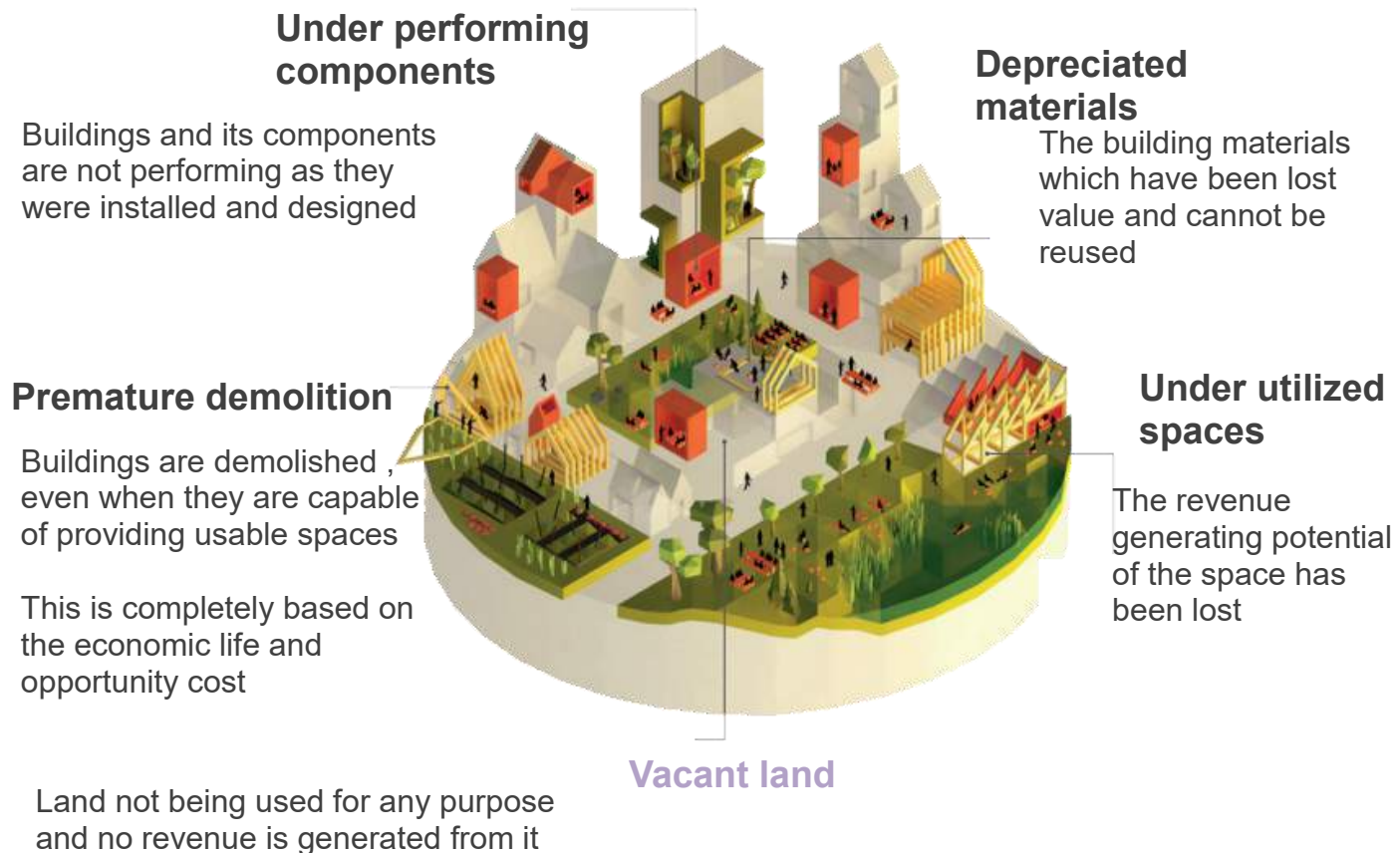


Fig:3.1.2.2: Source of lost value

After defining the business models and source of lost value , each model is discussed in detail.

➤ **Methodology:**

Discounted cash flow analysis (DCF) - Used for determining Net Present Value of a project

NPV = Net present value

CF= Cash flow

r= Discount rate

n= cash flow period

$$NPV = \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \dots + \frac{CF_n}{(1+r)^n}$$

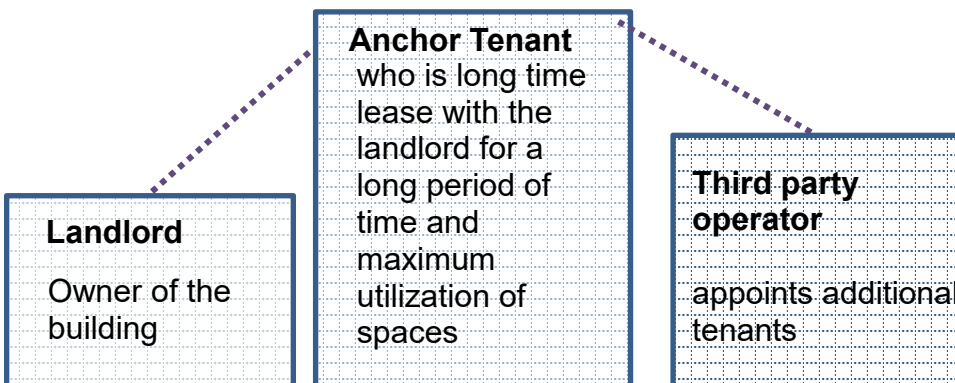
- Financial performance is calculated either in NPV method or Internal rate of return
- The IRR calculates what the discount rate would need to be for the NPV to equal zero. If the IRR exceeds the opportunity cost of capital (rate of return that can be earned elsewhere), the project should be accepted.
- The NPC is the sum of the present value of all costs over the evaluation period and has been calculated in cases

1) FELXIBLE SPACES

Sharing the spaces

Profit opportunity = Increased revenue stream from multiple tenants

First they have listed the underutilized spaces and less occupied spaces.



Stakeholders involved at flexible spaces at different life cycle stages



Fig:3.1.2.3. Various stakeholders in flexible spaces

➤ **Testing the model**

- They took a office space in Milan , where the tenant organization is extending the space up-to 250 sq m , with the agreement from the landlord.And it took over one month to complete it.
- In the linear model the desk space in the office remain underutilized during core working hours in the early lease term, as the year increases the unoccupied desk space is being increased in linear than circular
- The open space and the convertible meeting rooms are the one they use during core working hours

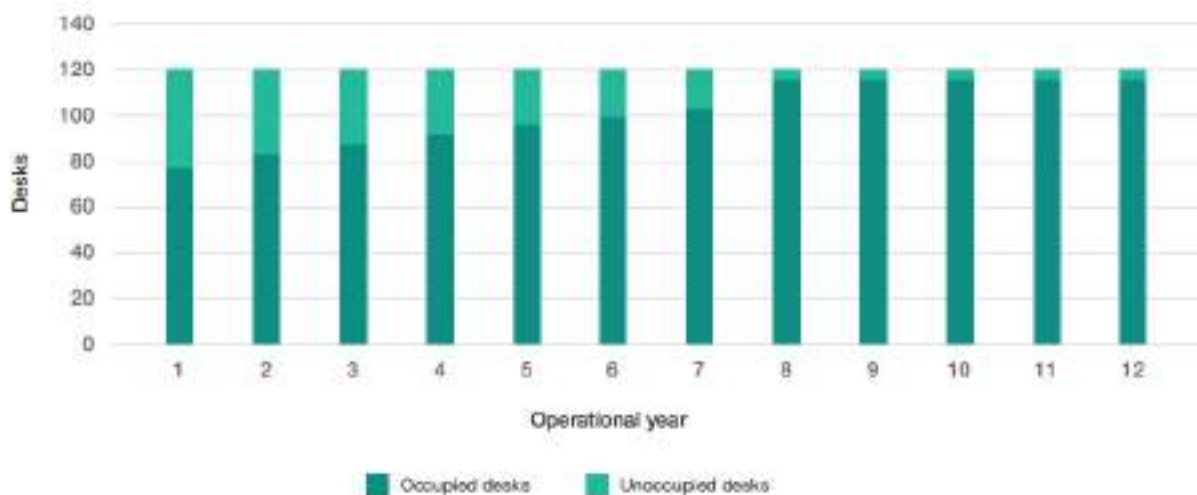


Fig:3.1.2.4.Occupied and unoccupied desks at different operational years

- In this the circular model , they rent out available desks during core hours for additional revenue and they offer UN-used open spaces and meeting rooms for fitness class and corporate meetings



Fig:3.1.2.5.Cash flow in circular model

➤ **Exploring the financial performance:**

- By applying circular business model they got a revenue of about 12% (NPV) increase than that of linear model. Which is been shared among the landlord and tenants
- They considered 4 scenarios:
 1. Linear
 2. Pessimistic (Circular) - pessimistic scenario considers an uptake of 50%,
 3. Moderate(Circular) - Moderate scenario considers an uptake of 55-65%
 4. Optimistic(Circular) -The optimistic scenario considers a greater uptake of
 5. co-working from 75% to 90% of unoccupied desks

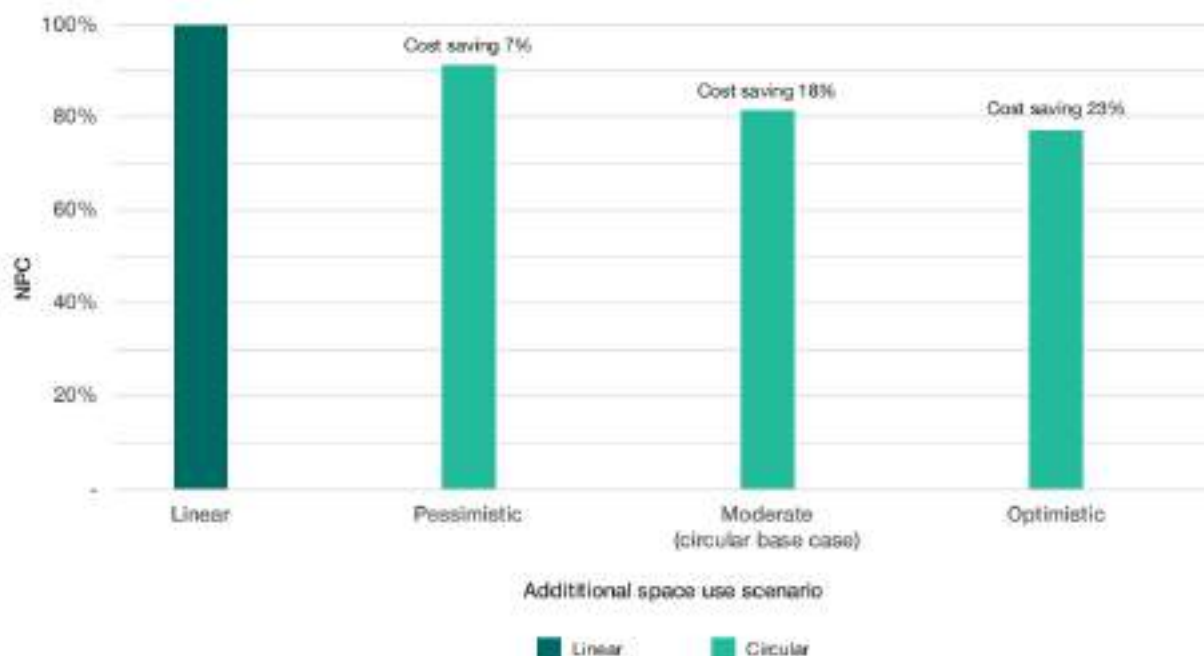


Fig:3.1.2.6.Additional space use scenario

Additional cost in linear model is not required but additional cost is required for circular base which increase with years based on expectations and future expansions

2) ADAPTIVE ASSETS

AIM -is to keep buildings in use for as long as possible at their highest value

- Where they can have more than one use of a building
- The skin and the structure of the building accounts for half of the construction cost
- Two types of investors are involved –
- Long term and short term investors

- In short term investors there include two types of Tenants one is adaptable user and other is the same

	Life cycle stage			
Building layers	Design and construction	Operation	Adapt	Operation
Skin	Shell and core contractor	Long-term investor		
Structure				
Services		Short-term investor 1	Fit out contractor 2	Short-term investor 2
Space plan	Fit out contractor 1			
Stuff		Tenant 1		Tenant 2

Fig:3.1.2.7.Key stakeholders involved at adaptive assets

Key design parameters are:

- floor-to-floor height • plant-room sizing and positioning
- floor plate depth - core positions and entrances

Key stakeholders by life cycle stage and building layer for Adaptable Assets

➤ Testing the model

Location – Aarhus ,Denmark

Typology – Residential , with 5 floor and 15 unit residential blocks

Flat size – 50sqm

REASONS - It is assumed and built that the housing demand will remain constant , but due to change in economic and demographic , the residents start moving , leaving the space vacant

- DOWNTURN leads to 60% of VACANCY
- Then based on feasibility and demand , it is converted into an Micro logistics occupancy

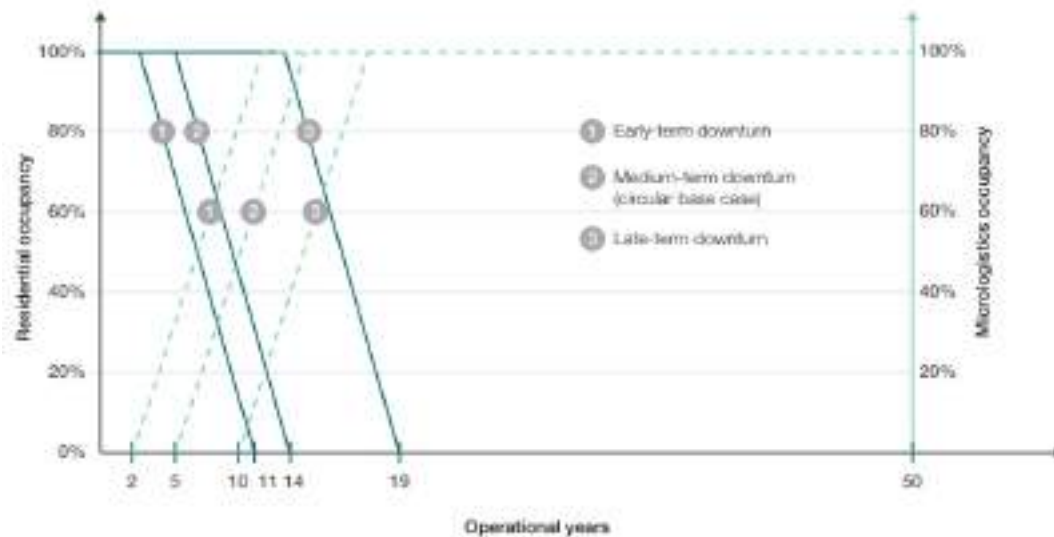


Fig:3.1.2.8.Occupancy level of each scenario

- The way in which each scenario affects residential and micro logistics occupancy is provided in the graph

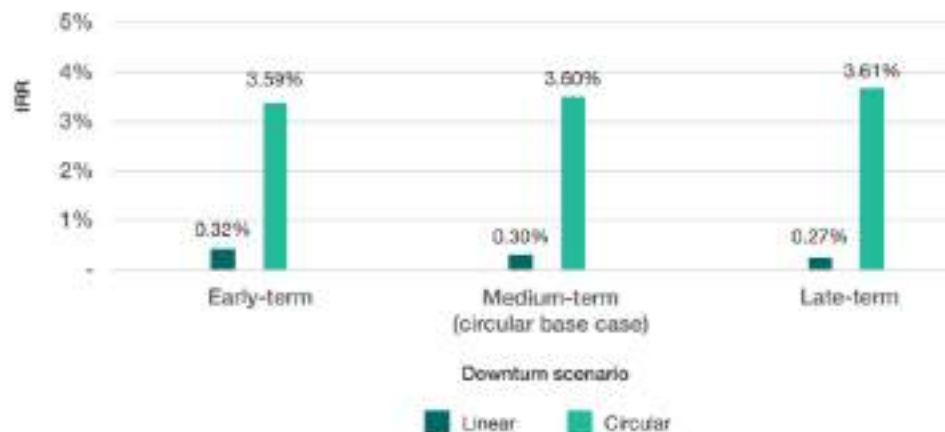


Fig:3.1.2.9.IRR of market downturn scenario

➤ **Internal rate of return (IRR)**

- They assumed that all tenants would maintain the same income throughout the life of the building, i.e. 50 years.
- The internal rate of return was – 3.7%
- When this linear model is demolished and reconstructed for other purpose ,then the IRR -0.3%

- The implementation of the circular system on each floor, converting it into a micro logistics use, then the IRR - 3.6%
- The results obtained indicated a break-even between the circular and linear models in the medium-term scenario, with a 110% increase in construction costs.
- During preparation and brief stage – horizon scanning (detecting early potential threats and opportunities) AND scenario planning (is a strategic planning method that some organizations use to make flexible long-term plans).

Then IRR for each market downturn scenarios (mid term , medium term and long term) are done.

Finally, the report analyzed the impact on IRR of changes in rental income resulting from the second use of the building, verifying an increase for this option.

3) RE-RELOCATABLE BUILDING

Reason for lost value – vacant land

- **Profit opportunity** - short term space use and revenue generation
- They are modular and are designed for de-constructable and movable to other places.
And are made with durable and high quality materials

DRAWBACK :

- The operator is responsible for identifying the tenants for this space
- Planning and licensing plays a major role.
- The revenue generated from it should be shared among the owner and the operator.
- So when the space is no longer needed , they dismantle the building and move it to the other use and place.

Testing the model:

Location – Amsterdam

Typology – Mixed use development- 2200sqm

It is considered that the relocatable building is assembled in a site and remain operational in SITE 1 for 5 yrs

After 5 yrs they are relocated to another site and remain operational for next 5 years

So in between no storage space is required.

Relocatable building portfolio	Life cycle stage						
	Design	Transport and construction	Operation	Deconstruction, transport and reconstruction	Operation	Deconstruction, transport and reconstruction	Operation
Relocatable building 1	Relocatable building operator						
		Landowner 1	Tenants		Tenants		Tenants
Relocatable building 2	Relocatable building operator						
		Landowner 4	Tenants		Tenants		Tenants
Relocatable building 3	Relocatable building operator						
		Landowner 7	Tenants		Tenants		Tenants

Figure 23. Key stakeholders by life cycle stage for Relocatable Buildings

Fig:3.1.2.10.Key stakeholders involved at relocatable building

An IRR of 26% has been achieved using relocatable building over 11 years

A desk study suggests that rents charged to tenants for spaces created from temporary buildings are typically lower compared to the same for permanent buildings

INFERENCE:

- This report indicates that there has been a improved financial performance by application of circular economy models in real estate .
- Improved performance among the investors and clients , enables it for others to adapt these models in current scenario
- Even though it is calculated for some other site , the profit varies according to the site location and characteristics
- Used buildings being reused as a tactic for regeneration schemes to bring life
- In relocatable building the value chain will reshape of services providers to the clients
- And these models directly reduces the impact on the environment

3.2 LIVE CASE STUDY

3.2.1 WORKAFELLA

A co-working space at Teynampet ,Mount road.

- Workafella aims at a decent margin at its co-working spaces
- Workafella started due to the demand in the market for co-working spaces in Tier 1 Cities.

➤ **AIM :**

- They major clients are the small and medium business
- and having 24/7 access to the space
- Moreover like an futuristic workspace
- And the main concept here is to make the space smaller , by increasing the power of technology

➤ **Choice of building:**

- Based on the Location , which is easily accessible .
- Mostly they are adaptive re-use the old buildings which are under-utilized
- CBD zones are mostly choose d for co-working
- Near prime transportation points

➤ **Proximity to transport:**



200 meter from the co-working space



500 meter from the co-working space



9 KM from the co-working space

➤ **OBSERVATION FROM THE OCCUPANTS:**

- Flexibility in space increased the performance from the people
- Improves the quality of behaviour among people
- Reducing stress and increasing the quality of work

- This office space in teynampet have high recreational facilities ,which in-turn increases the benefit
- Connect with the key business area such as Guindy , nandanam , tnagar, Mount road

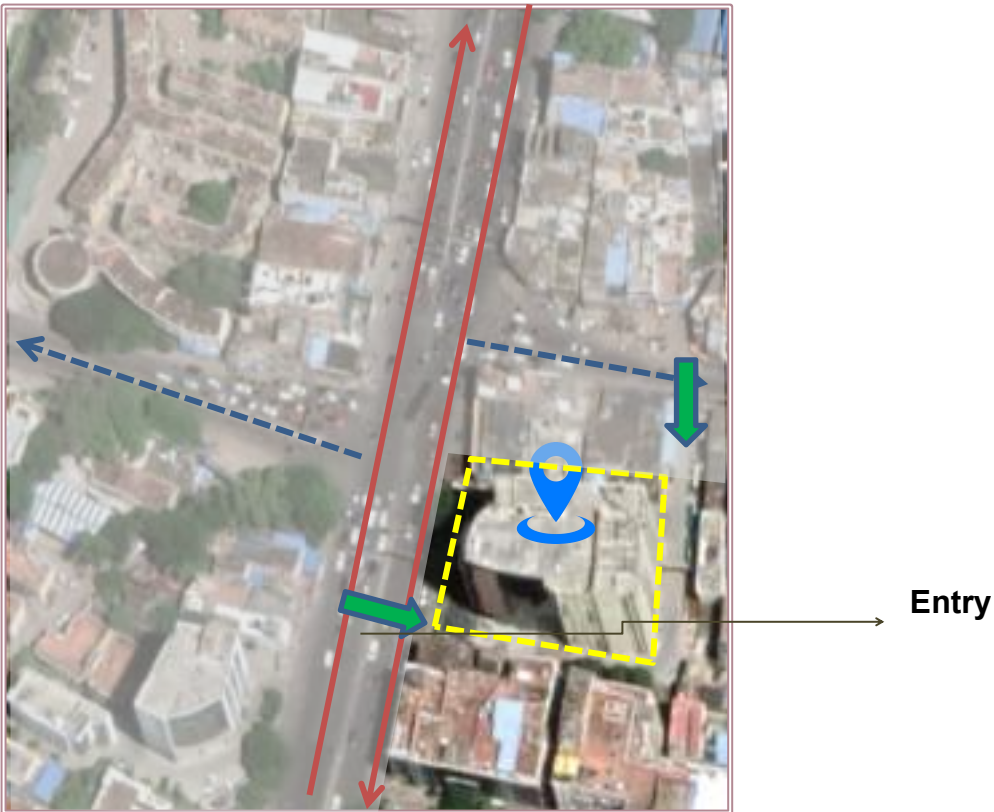
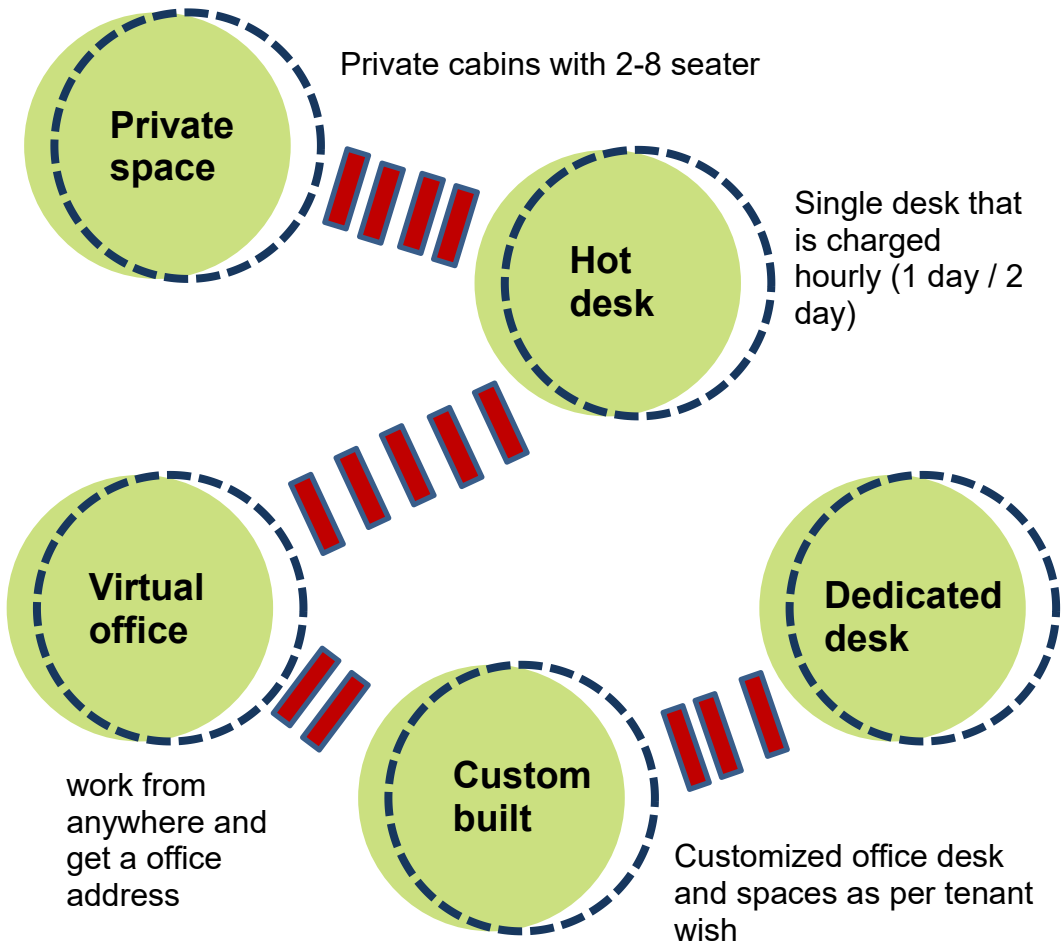


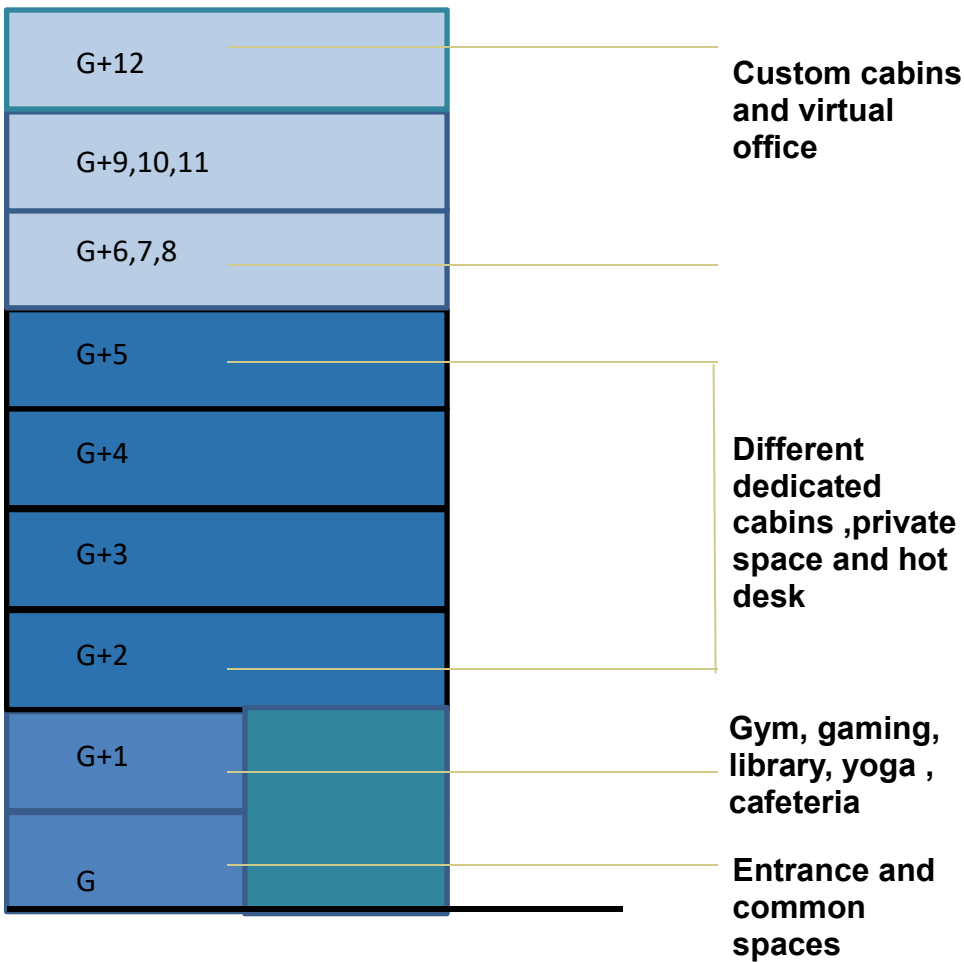
Fig:3.2.1.1. Accessibility to Workafella



Fig:3.2.1.2.Site photos

TYPES OF ROOMS





G+12 Building

Ambient car and bike park with one basement and peripheral parking

Can accommodate 220 nos of people per floor



Fig:3.2.1.3. Site photos

REASON FOR VACANT USE OF THE BUILDING:

- Issue between the multiple owners
- And larger supply than demand .
- Since there are larger number of offices due to larger tenants the rental was high

ANALYSIS AND QUESTIONARIE FROM THE OCCUPANTS:

- This building is highly efficient due to the amount of amenities provided .
- They have chosen the co-working space because they provide all the facilities (wifi, security , gym cafeteria) as a price compared less than the lease in the other building which includes maintenance costs also.
- The drawback is leasing option is not well provided.
- Since the occupants traffic cannot be decided the rental may affect

The profit and return of investment is 8% higher than than conventional office space , and by adaptive re-use

(The % of profit is subjected to oral value and is not a concrete value)

3.2.2 AWFIS

- Co-working space located at Nungambakam.
- Located at heart of chennais commercial zone.
- Surrounded by hotel, business zones and other related amenities



Major connecting roads are the Gemini flyover and the cathedral road , uthama gandhi salai

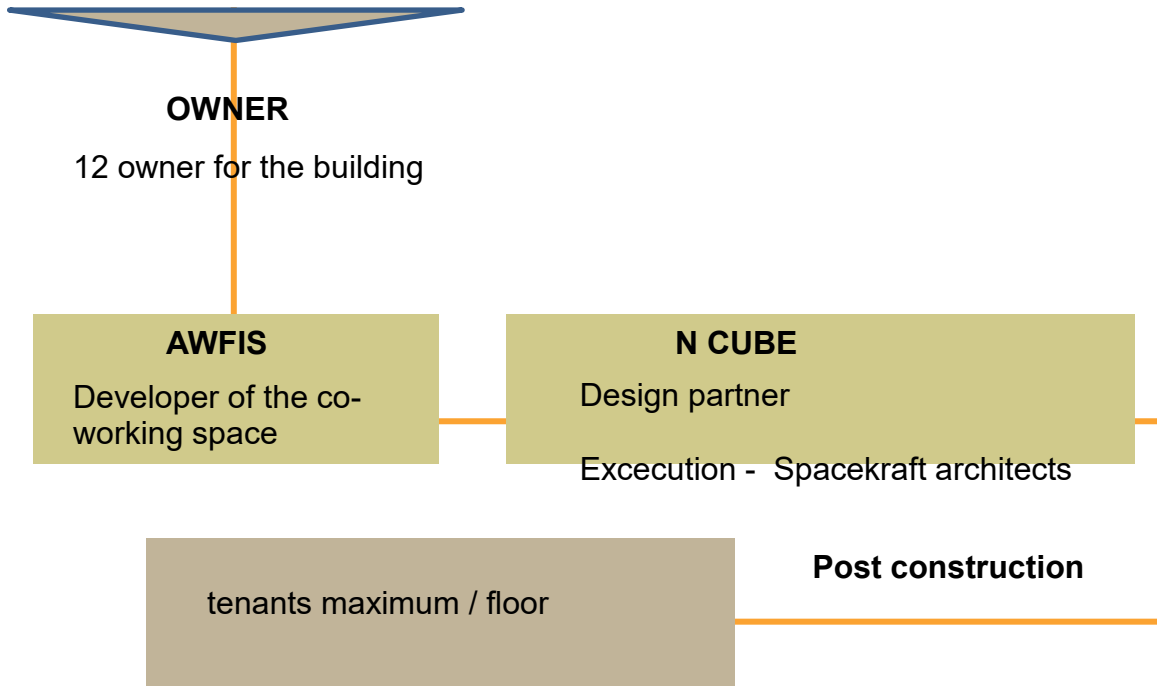


Connected to many local area bus stops withing proximity of 500m



Nungambakam and chetpet railway station are the closest proximity of 1-2 kms

AG-DMS Station is closest proximity of about 900m



Parking area

- G+ 8 structure
- With peripheral parking
- **Under renovation project**(not fully completed)
- Half of the ground floor is occupied by the YES Bank
-

Each floor area is 6500sqft

Previously there is **iflex office**

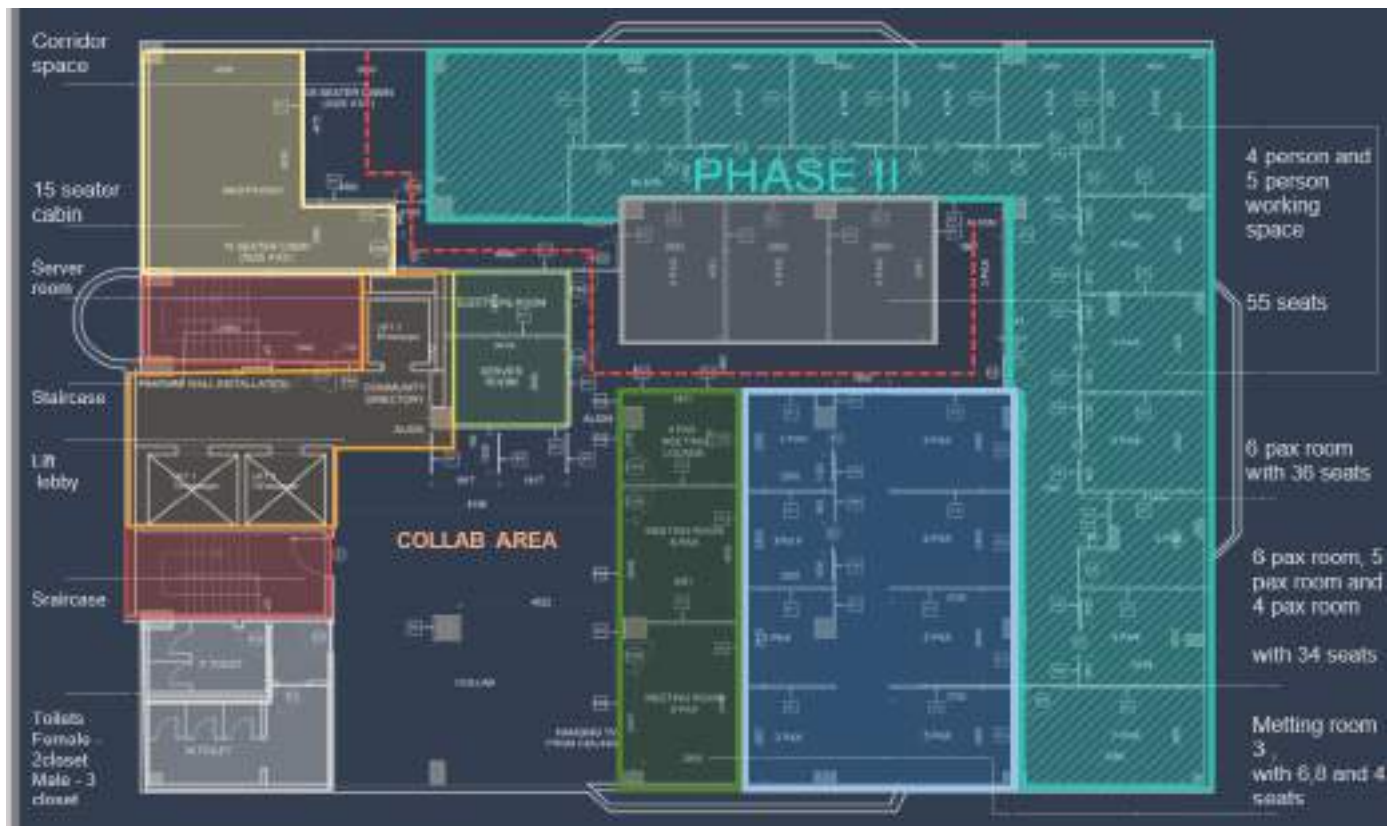


Fig:3.2.2.1.Site accessibility to AWFIS

Entrance to the AWFIS



Fig:3.2.2.2.1st and 2nd.3rd , 4th and 7th FLOOR PLAN

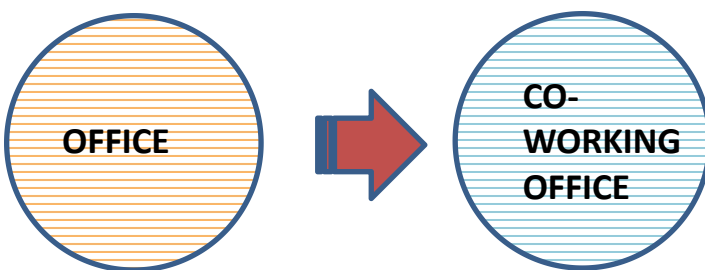


Tab: 3.2.2.1. Status of the building and occupants at each floor

Status of the building	
Ground floor	Completed
1st , 2nd, 3rd floor	Completed partially and occupied
4th-7th floor	Under excecution

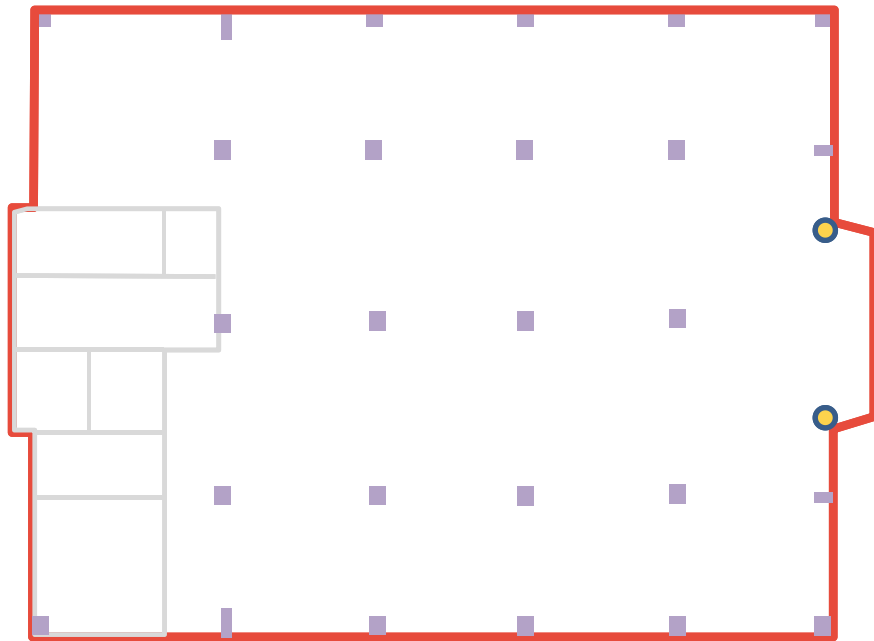
Occupants at each floor	
1st floor	180 Occupants
2nd floor	180 Occupants
3 rd floor	140 Occupants

➤ **ADAPTIVE RE-USE:**



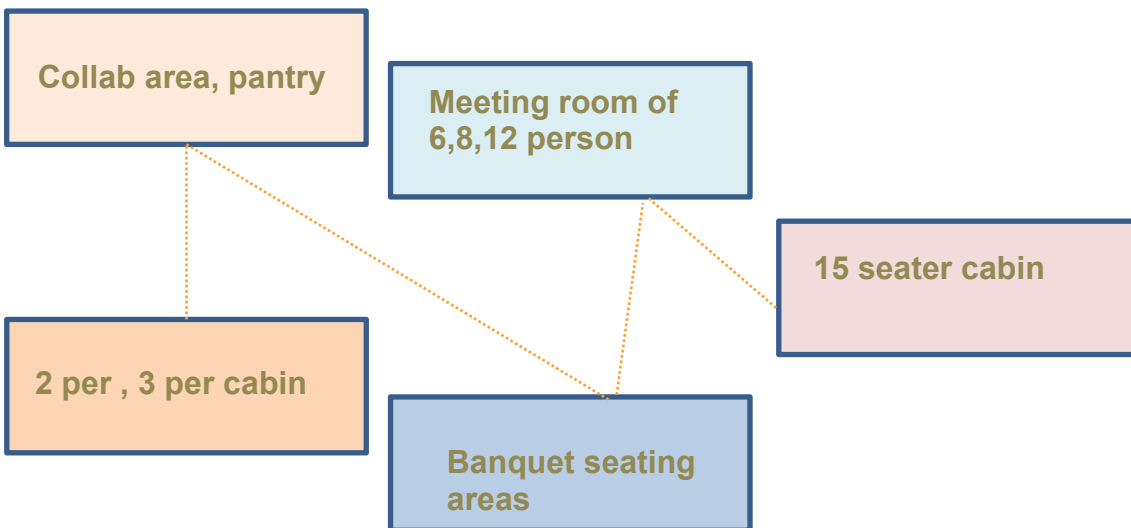
16 yr old building

- Not such common area and partition has been provided in the previous plan and Less collab area

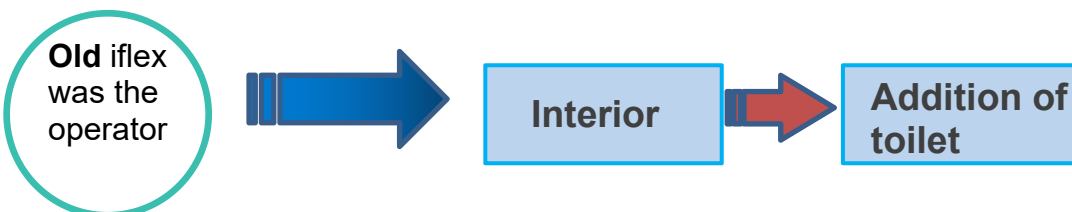


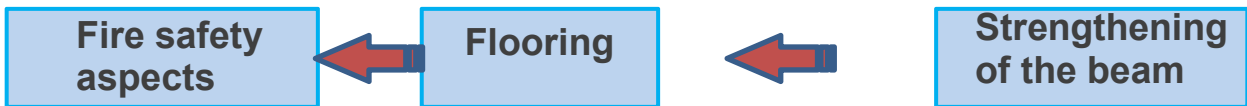
Division of spaces in old usage

➤ Division of spaces in new occupation



➤ Things that have been changed from old building:





➤ **Difficulties that are face during changing the space:**

1. CODES

● **TOILET:**

The building was constructed at 2005 , Initially the building was designed of less number of occupants than present and change of standards .These made to critical for the designers to in-corporate the standards

The old building has 2 WC For men and women and 2 urinals per floor

The sanitation requirement provided in the change of space TO CO-WORKING:

An average of 150 occupants per floor

As per code : For male, 1 per every 25 persons

For , female , 1 per every 15 persons

As per code , The number of wc for Male is compensated , BUT the number of wc for female is reduced by 1nos.

(This is due to the calculation of floating population)

● **PARKING :**

As per code the number of bike park per 400 square foot is 1 nos

As per CODE it requires 70-80 nos of bike park,

But available is only 40-50 bike park

And Have poorly a less Car parking facility of 5 nos

● **DEMOLITION:**

The demolition of existing structures(such as walls , fixed partitions) requires more time and costs



- **PLANNING:**

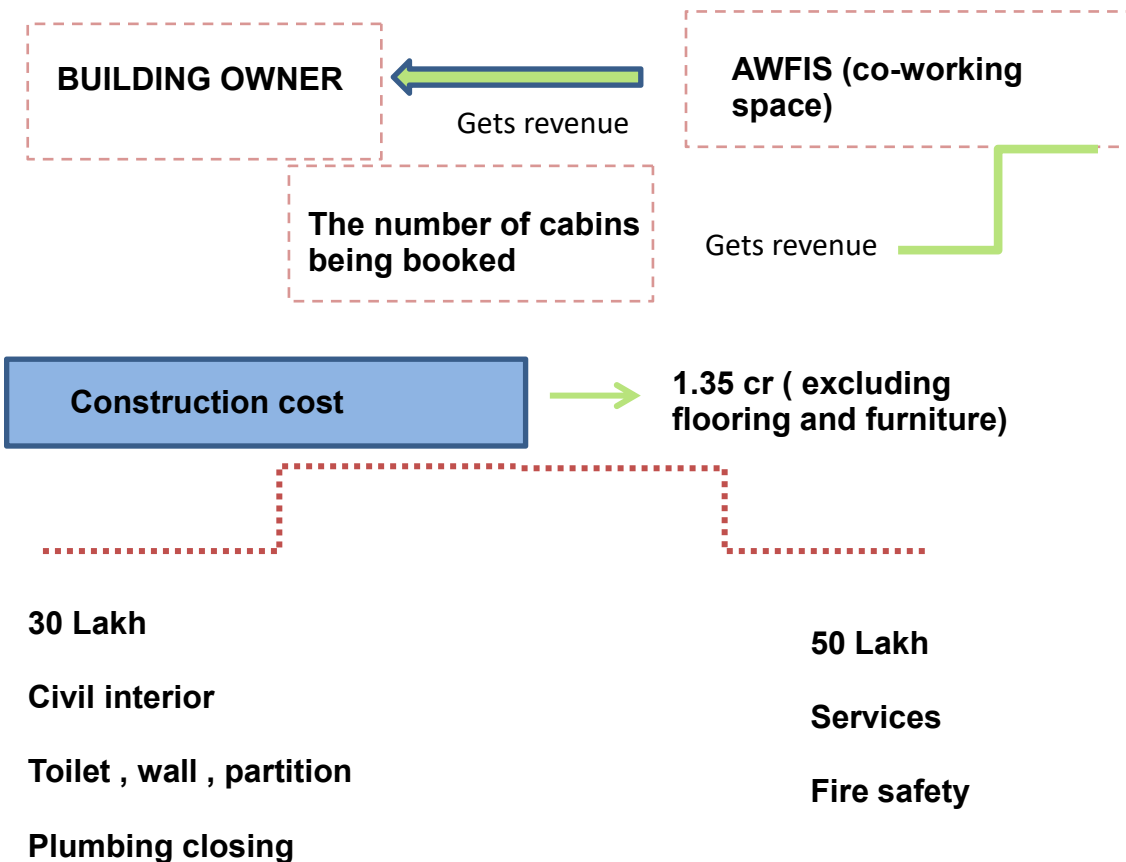
Since the building has a dimensions according to the previous user , changing the space requirement as per new user is a difficult process.

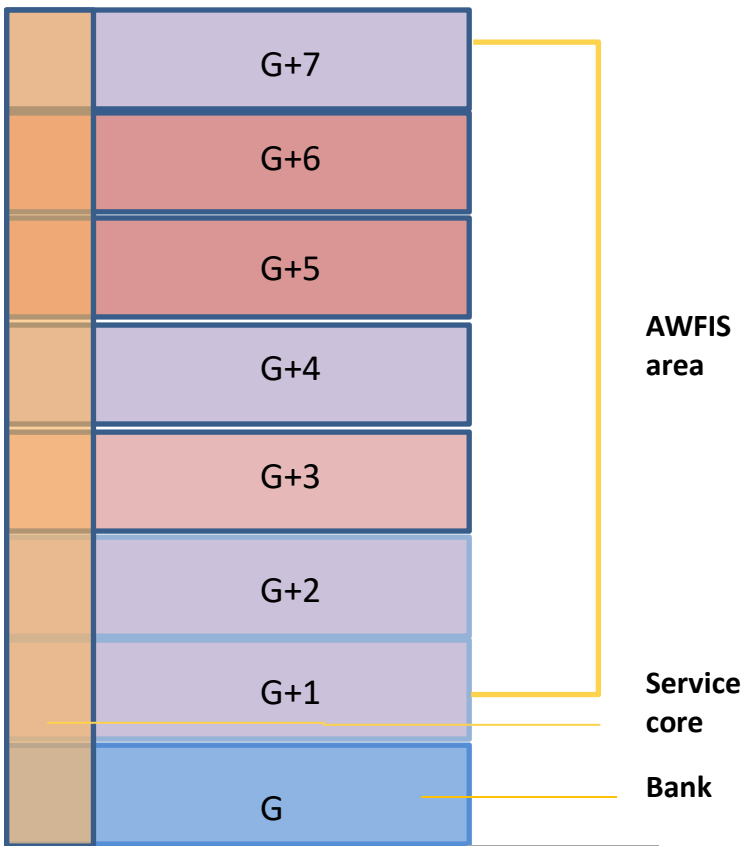
CASE STUDY - The ceiling height is planned low as previously ,now as of to fit the new services such as fire safety , and other ducting there is less space for false ceiling , hence forcefully the area was subjected to OPEN CEILING

Additional beam support in MS STEEL to distribute the load

Provision of service area for AHU etc Were difficult to occupy

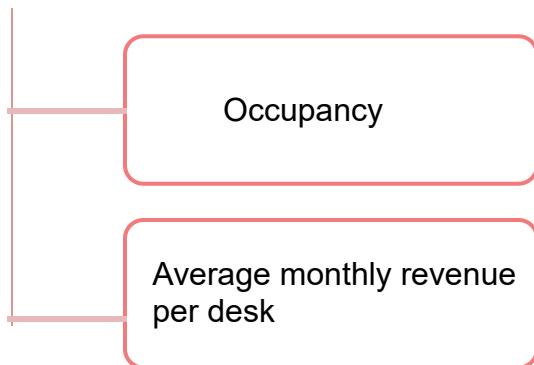
Cash flow pattern:





➤ **Revenue:**

REVENUE:



These two are the important factors that generate profit - DURING operational stage

➤ **OCCUPANCY :**

They calculate occupancy as in traditional:

% of LEASE OUT ARE

TOTAL LEASEABLE AREA



They calculate occupancy as in

Co-Working space :

TOTAL DESK AREA SOLD

TOTAL DESK AREA AVAILABLE

HOW , do they convert desk unit and area is by :

AVERAGE SQUARE FOOTAGE PER DESK



Which defines the space layout efficiency

Per employee personal space in offices across India is down from around 225 sq ft in 2009 to around 100-125 sq ft now, say experts (Source THE HINDU)

This made the AWFIS a high density layout of the co-working space and maximum space efficiency

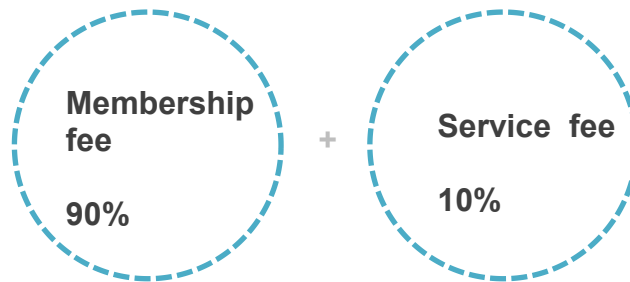
Rental operating model is followed in AWFIS , where the OWNER doesn't invest in refurbishment and other aspects of co-working space , he just earns the MONTHLY rental income.

Tab:3.2.2.2. Building area and efficiency

Rentable square foot(RSF) (it does not include staircase and lifts)	60,100 sqft
Usable Square foot (USF)	45,400 Sqft
Average square foot per desk	150 - 180 sqft
Building efficiency	80%
The building is designed for 75% of efficiency	

REVENUE :

Revenue Generation



Average monthly membership fee

Rs. 22,000

Average monthly service fee

Rs. 2200

The average monthly fee remains constant for two -3 years than might increase in 2% - 5%

UP-FRONT COST :

The overall cost consideration / the input of money to develop as co-working space by AWFIS are :

Fit-out cost

Other costs

FITOUT COST:

1. Construction cost
2. Sift cot
3. Hard cost
4. IT System
5. Move cost
6. FFE (Furniture , fixture and equipment)

CAPITAL EXPENDITURE :

The IT system contributes of about - 5% of the total capital expenditure

FFE contributes about - 18 % of the total costs

Fees contributes about - 3% of the total costs

OPERATING COSTS :

Building operating expense

Utility service , insurances , tax , services

Business operating expense

Daily expenses - printing , cleaning , administrative expenses

Marketing expense

Reason for LOST VALUE

Parking facilities - The amount of parking required for the space is not sufficient

Not provision of sufficient amenities

Dispute between the owners

How Its been CAPTURED

Provision of extra parking facilities in compensation of space near by

Captured value due to large demand drivers

Deriving the space according to the need of the occupiers

Provision of amenities required for the space

Creating a peaceful and workable and interactive ambience



Fig:3.2.2.3. AWFIS site photos

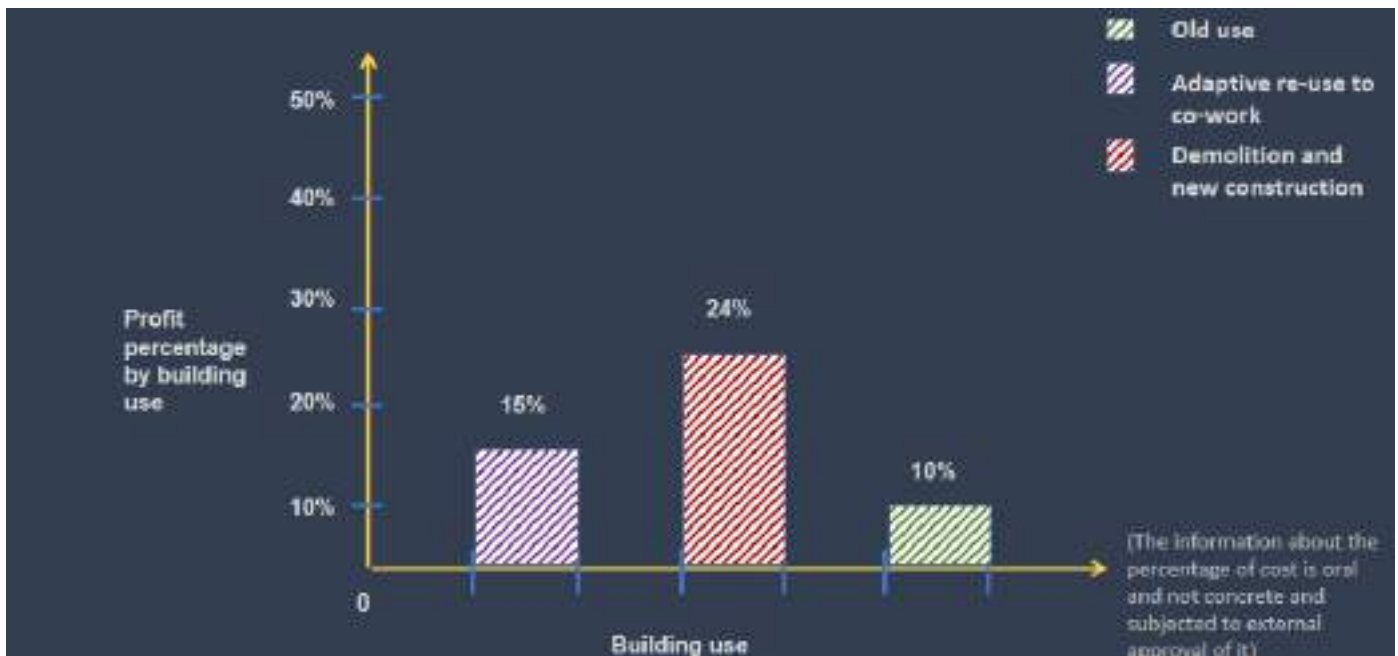


Fig:3.2.2.4. Profit percentage by building use



Fig:3.2.2.5. AWFIS site photos

3.2.3 CONTAINER BUILDING:

CLIENT PERSPECTIVE :

Tab:3.2.3.1. Various category of analysis from client perspective

CASE 1	CASE 2
1. Location JSV Office building and Cafe , at Medavakam main road, Chennai	1. Location CMRL Head quarters Site , Nandanam , Chennai
2. Purpose of use Office and Cafe	2. Purpose of use Purpose of use is Site office
3. Year Since 2014	3. Year Usage from 2016
4. Type of container 20 feet container 3 nos	4. Type of container 20 feet container 2 nos
5. Owning the container	5. Owning the container
6. Purpose of owning the container • Cost efficient , Relocatable to other site , if the future development is required at the present site • REDUCTION of wastage • Scrap value of the container is 15% - 20% • The amount of TIME required to fix is less • The amount of LABOUR required is less	6. Purpose of owning the container • Cost efficient • Relocatable to other site , if the work at the current site is over • Can be used for the other projects also(to increase the number of use)

CASE 1	CASE 2
7. Cost of Container The container cost is Rs. 75,0000 , per container to purchase. For 3 nos the cost is Rs 2,25,000	7. Cost of Container The container cost is Rs. 85,0000 , per container to purchase. For 2 nos the cost is Rs1,70,000
8. Other expenses • Cost of painting , coating for rusting , • Customised furnituring , • Heat insulation (glass wool and frame to reduce the transmission of heat) • , concealed wiring , flooring • Additional roof for reducing heat penetration • 10 Laksh for 3 containers(including transportation, plinth for resting the container , and lifting and fixing)	8. Other expenses • Prime cost , no extra coat for insulation • Flooring sheet • Open wiring • NO heat insulation stuffs • 2.5 Lakh for 2 containers
9. Maintenace • Less maintenace compared to the conventional , to get a good quality extenor , painting shall be done for EVERY 5 YEARS , inspection required	9. Maintenace • Less maintenace compared to the conventional
10. User experience • Compact and comfortable	10. User experience • Compact and comfortable and advantageous
11. Drawback • Ventilation would be a major drawback	11. Drawback • Ventilation

12. Time analysis Time required to fit the building was quite Lesser than conventional . It requires about one week to fit the container , The interior work takes of about 15 days to complete	12. Time analysis 1 day to fit the container , and 2 weeks for the interior works
13. Cost analysis There is a saving of about 10%-12% of the cost than conventional method , lower operating expenses	13. Cost analysis There is a saving of about 18% -25% of the cost than conventional method
	

3.2.4 CONTAINER STRUCTURES - MAKEWELL CONTAINER CARE - contractor perspective

INTERVIEW from Ms.Vanmathi

Located at Ennore - Container manufactures as office space , 1bhk,2bhk,3bhk homes , stores ,shops ,showrooms ,library , food court .

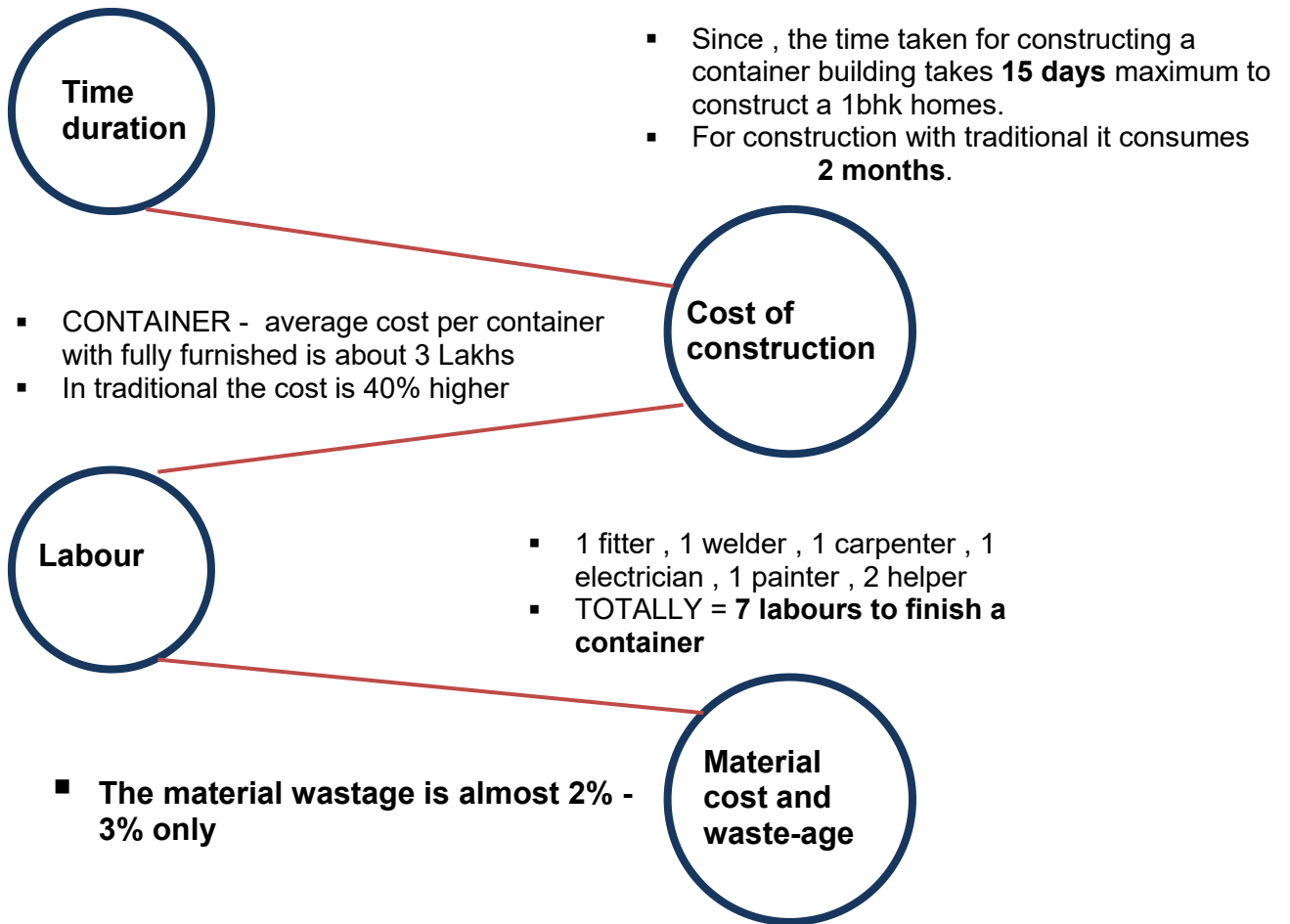
Containers are PRE-FABRICATED and PORTABLE buildings .

WHAT makes consumer to move from permanent to temporary structures ?

As per current scenario , the economy is moving towards compact and focusing on small scale and re-scaling the amount of interest.

DEMAND OF TEMPORARY STRUCTURES





DESIGN ASPECTS:

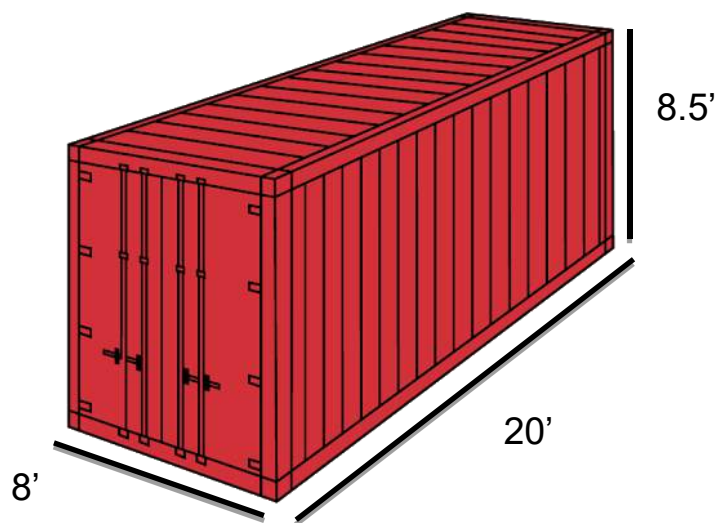


Fig:3.2.4.1.Container dimensions

The standard size of container available is 20'*8' and 40' * 8' in rare case 10' * 8'

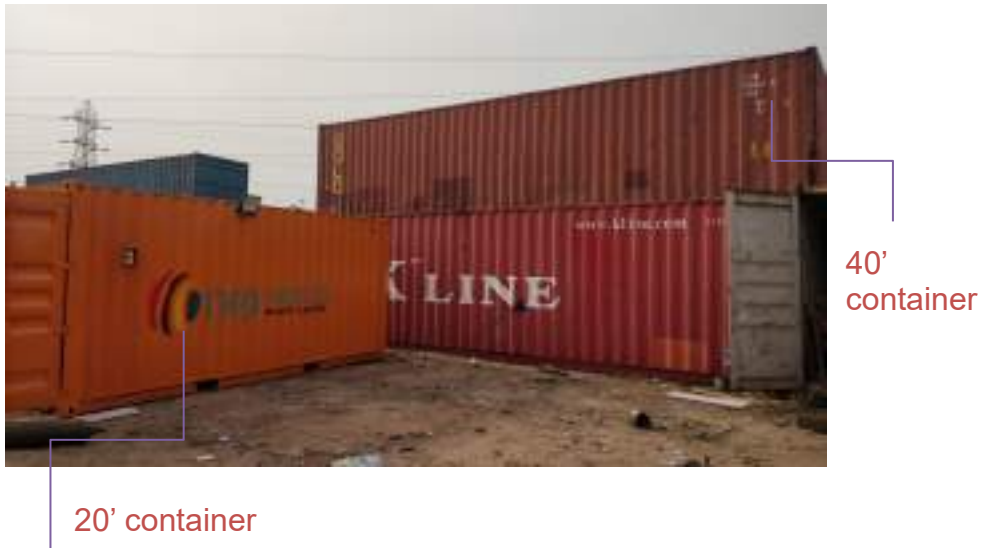
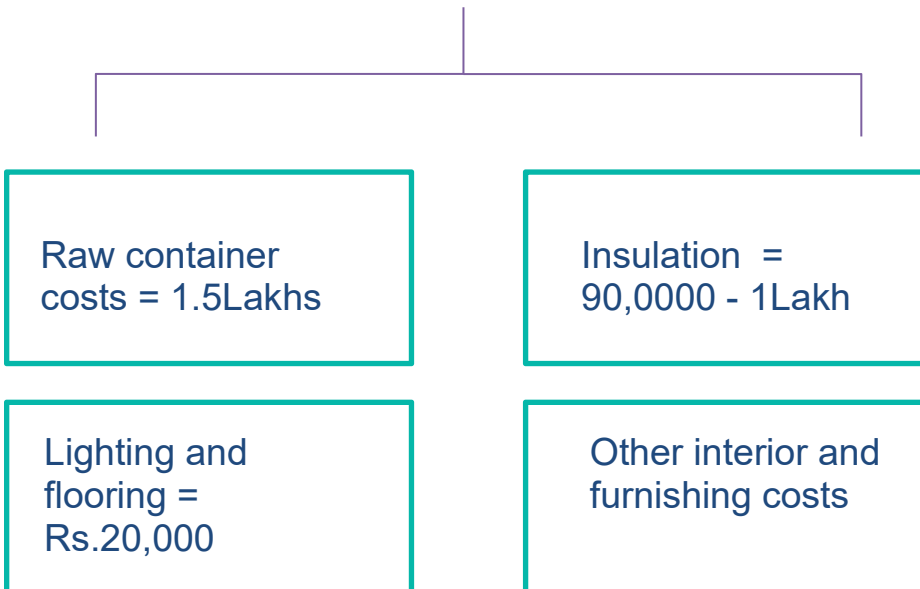


Fig:3.2.4.2.Type of container

COST :

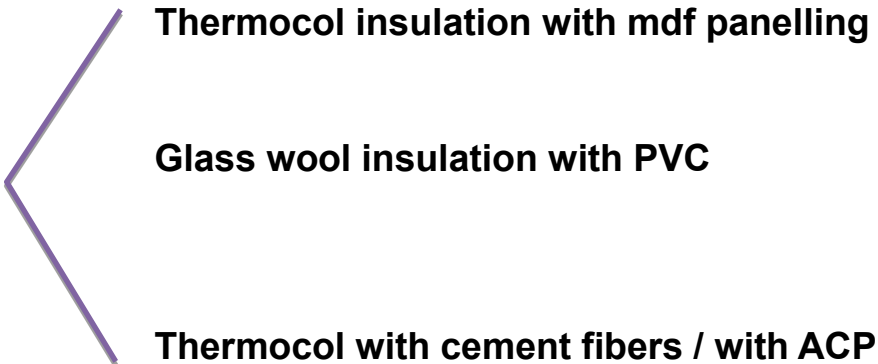
A fully furnished container of 20' = 3L - 3.5L

Its Rs.2000 / sq ft



HEAT INSULATION :

As analyzed from the consumers , the major factors that prevents them from using temporary structures is due to HEAT



AESTHATIC :

- Rigid aesthetic is another factor , where it makes it restrict to use.
- The container is being used in various spaces
- Clay cladding is done
- Epoxy paint = long durable

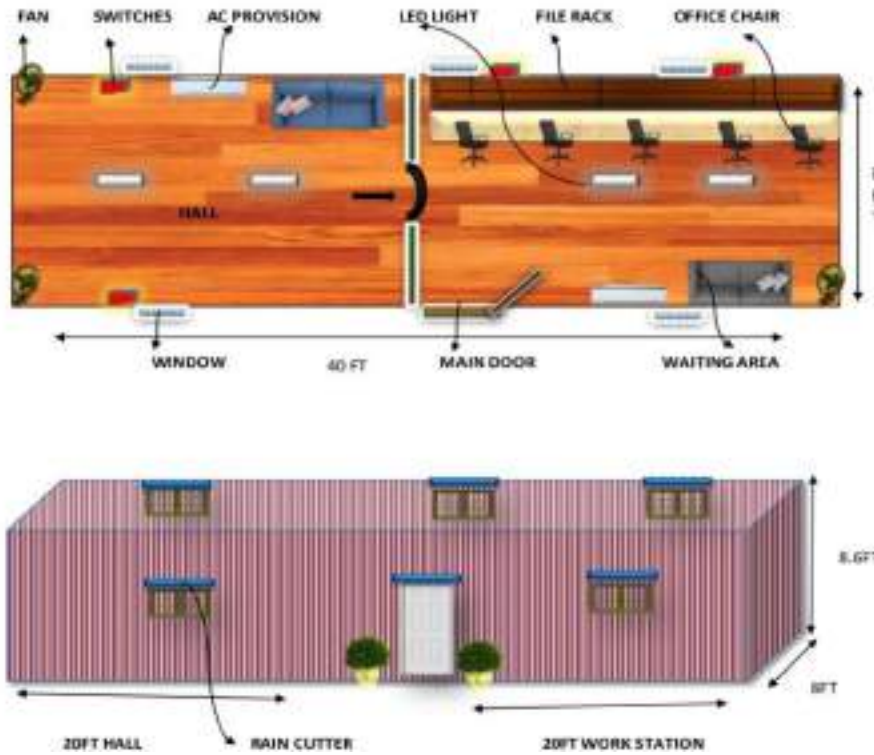


COST REDUCTION FACTORS :



REVENUE GENERATING FACTORS :

RE-SALE value of the container building is 30%-40%,
NO ISI code to be followed .



40'
workstation
for **INDIGO
AIR**

Services are
concealed

False ceiling height =
6inch

Fig:3.2.4.3.Container workstation plan

STAKEHOLDERS INVOLVED:

Re-relocatable building contractor

Design and construction stage

Land owner

Transportation and fixing

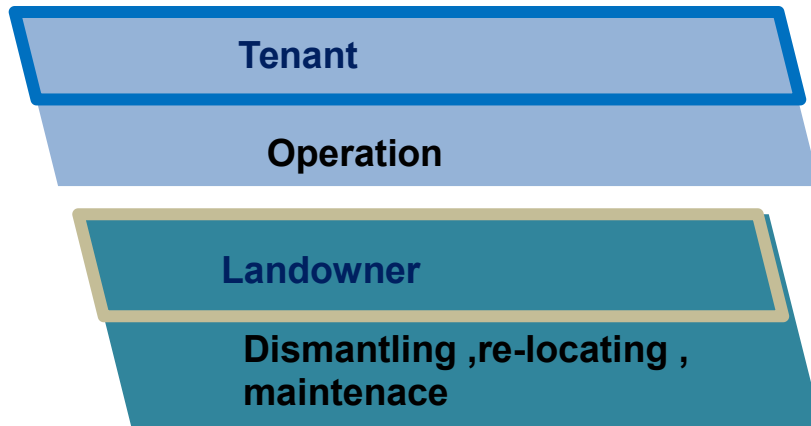


Fig:3.2.4.4.Container photos

INFERENCE



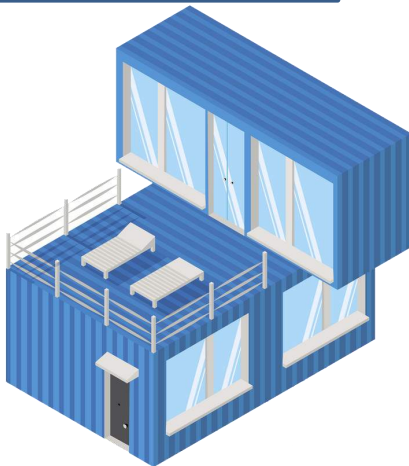
- The profit generated from the space after shifting to adaptive re-use co-working space is higher percentage than the Previous one but the occupancy rate is 50 percentage , due to the reason of unawareness of people about virtual office spaces and knowledge about co-working
- And other reason for less occupancy rate is Higher costs due to higher amenities
- But the rental income to the OWNER is constant without loss
- Prime location is an BENEFIT

AWFIS CO-WORK , NUNGAMBAKAM



- Since AWFIS is a newly startup company with 3 floors accessible for the occupants, the revenue generated is profitable as compared, and due to the increased return of investment, the other floors are being converted to CO-WORKING spaces. The construction and approval cost is less since the conversion is from OFFICE - CO-WORK OFFICE.
- The drawback in this space is deficient amount of parking, For solution to the parking additional space is identified.
- Maximum utilization of space - LOCATION IS A MAJOR FACTOR FOR PROFIT

CONTAINER BUILDING - JSV & CRN



- The usage of container building is cost efficient and the return value after the life span is also an advantage
 - Its suitable for LESS TIME, LABOUR
 - Profit generation
-
- Suitable for site offices since the nature of the building is not permanent
 - Provides profit, higher than the other scenario is due to the interior cost of it less
 - One time investment, can generate



MAKEWELL CONTAINERS

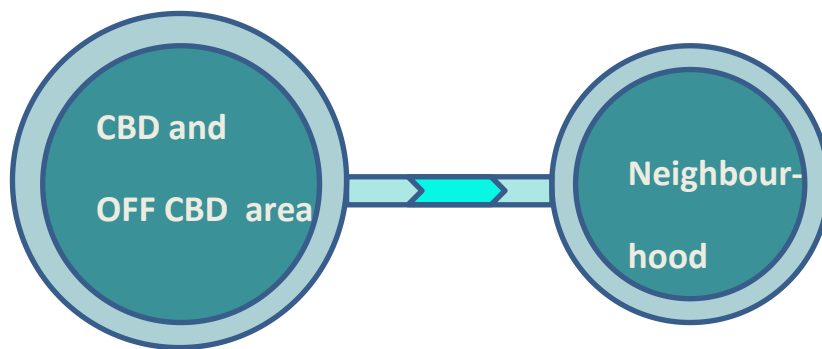
- Since the majority of the consumers aren't aware of the fact of this concept lead to the no usage of this method. During the year 2021 , shift in the economy lead the consumer to move to the modular aspect which contributes to circularity,**less operating expense**
- Since the container is cost efficient , dismantlement , relocatable it neither puts impact to the environment ,maintains CIRCULARITY in economy and improves the profitability

CHAPTER 4

LIVE STUDY

4.1. Site selection:

- The sites have been chosen in the off-cbd zones , where the current market is focused and developing due to the high concentration of IT / ITES sector and residential development in the south sector of Chennai.



- The process by which the site is being narrowed starts from CBD and non CBD area.
- From that based on the neighbourhood the appropriate site has been selected
- Then the potential building with lost value is been scrutinized .
- The area in the sub-urban has been selected for the live study.
- The urban core(cbd zones) has dense population and with an diverse mixed of used in the area , hence the building with lost value identified is very less and most of the time was not left UN-occupied.
- Due to urban sprawl the sub-urban areas are being developed and demand in the market is being increased .

- In rural the possibility of development is not viable due to basis of infrastructures



Fig:4.1.1.Various site for live study

Tab:4.1.1.Site selection based on various criteria

	CRITERIAS	SITE 1		SITE 2		SITE 3		SITE 4		SITE 5	
1	Location of the building	OMR , opposite to Saravana stores		Jawaharlal nehru road, opposite to the chennai silks		OMR , Adjacent to Sathyabama university		OMR ,Opposite to Turya hotel		Medavakkam main road , Opposite to NEXA showroom	
2	Typology	Commercial - Restaurant		Commercial - Restaurant		Industrial		Commercial - Restaurant		Industrial	
3	Plot Size	9,500Sqft		8,590 Sqft		85,890 Sqft		5,381 Sqft		13,500 Sqft	
4	Year of construction	2018		2017		1999		2018		1998	
5	Number of floors	Stilt +2		G+2		G		G+4		G+4	
6	Reason for lost value of the building	Less demand in restaurant		Due to managerial issues & No direct accesibility to the space		Legal issue and dispute between the Owner and Tenant (Due to less amount of interest Paid to Owner)		Less demand in restaurant due to COVID - 19		Shift of Industrial building to Outer skirts and Dispute for constructing 2 floors , without permission	
7	Accesibility	Located at Main road,Easily connected to main OMR		Gets connected to Velachery main road		Located at Main road,Easily connected to main OMR		Located at Main road,Easily connected to main OMR		Located at Main road,Easily connected to Pallavaram to thoraipakam 200' road	
8	Proximity to Bus Stop	200m		20 m		100m		500m		150m	
9	Proximity to Railways	9km		200m		13km		6 km		5km	
10	Proximity to airport	12.2 Km		5.3 Km		14.5km		9 Km		6km	
11	Abutting road width	100 feet		20 feet		100 feet		100 feet		60 feet	
12	Frontage	4 m		10 m		6m		4 m		8m	
13	Parking facilities	4 Car can be parked		16 Car can be parked		40 car park		5 Car park		25 car park	
14	Conditions Of building	Good condition		Good condition		Poor condition of the facade and possesion of many damages		Good condition		Good condition	
15	FSI	0.9		1.4		0.8		1.8		2.2	

18	Public interest/ Demand for reuse	Less demand for re-use of the building due to other vacant buildings are located just near by		Less demand for the building to be re-used		Moderate demand for the building to be re-used		Good demand for the building to be re-used		Good demand for the re-use of the building	
19	Aesthetic	Good aesthetic with glazing		Good aesthetic with glazing		Moderate aesthetic , with Poor aesthetic condition		Good aesthetic with glazing		Moderate aesthetic	
20	Degree of nature of building to be renovated for adaptive re-use	Requires less alterations		Requires less alterations		Requires More alterations		Requires less alterations		Requires less alterations	
21	Social impact	Retains the sense of place		Not much social impact		Adds value to the area		Value of the area gets maintained		Adds value to the area	
22	Current legal issues if any	No		Yes		Yes		No		No	



Good



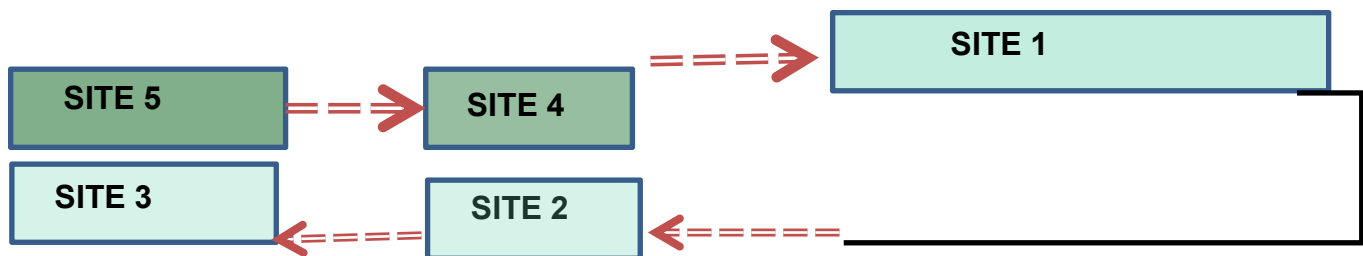
Average



Poor

These information are obtained from concerned owner and survey from Surrounding peoples

The order of site with highest good criteria are:



SITE 5 - Vijayshankar building

- Based on the selection criteria the site at MEDAVAKAM MAIN ROAD has been selected
- Since this site has good accessibility and also better demand among the people to use it.

4.2. Site Introduction :



- The site is located at OFF-CBD Zone
- It is located at medavakam main road , towards madipakam
- Its primarily a residential zone in south suburb area and surrounded by commercial zones also
- It is located at a distance of 480m from the 200' radial road of THORAIPAKKAM - PALLAVARAM Road

200 feet -radial road

Medavakam main road The abutting road
width is 100' road

4.2.1.DETAILS

Tab: 4.2.1.Site details

Ownership	Single ownership and privately owned property
Year of built	1998
Type of building	Industrial
No : of storey	G + 4
Plot area	13,500 Sq ft
Plot Coverage	50%
FSI	2.2
Gross floor area	32,500 Sq ft

The site is surrounded by commercial and residential zones



Abutting road
width 5m

This site comes under
kanchipuram district

4.2.2.PROXIMITY



A closer proximity to bus
stop of about 250 meter

A closer proximity airport
of 6km

At a distance of 5 km
proximity to metro
station of Nanganallur



- 10 meter and 100 meter proximity to restaurants
- 1km and 2km proximity to other necessary amenities

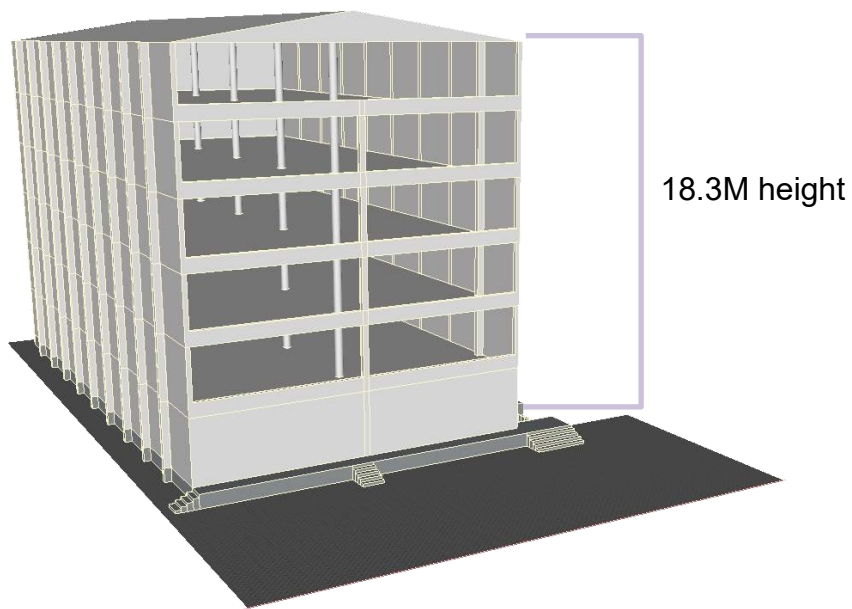


Fig:4.2.1.Building view

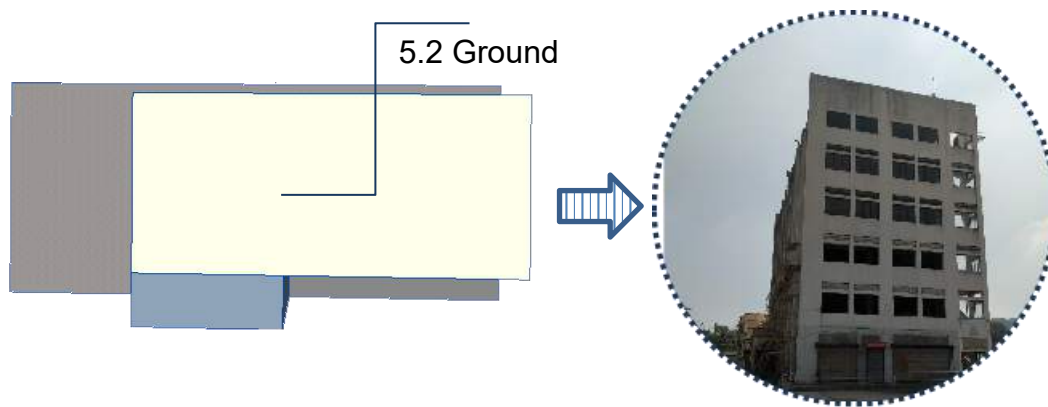


Fig:4.2.2.Area of the site

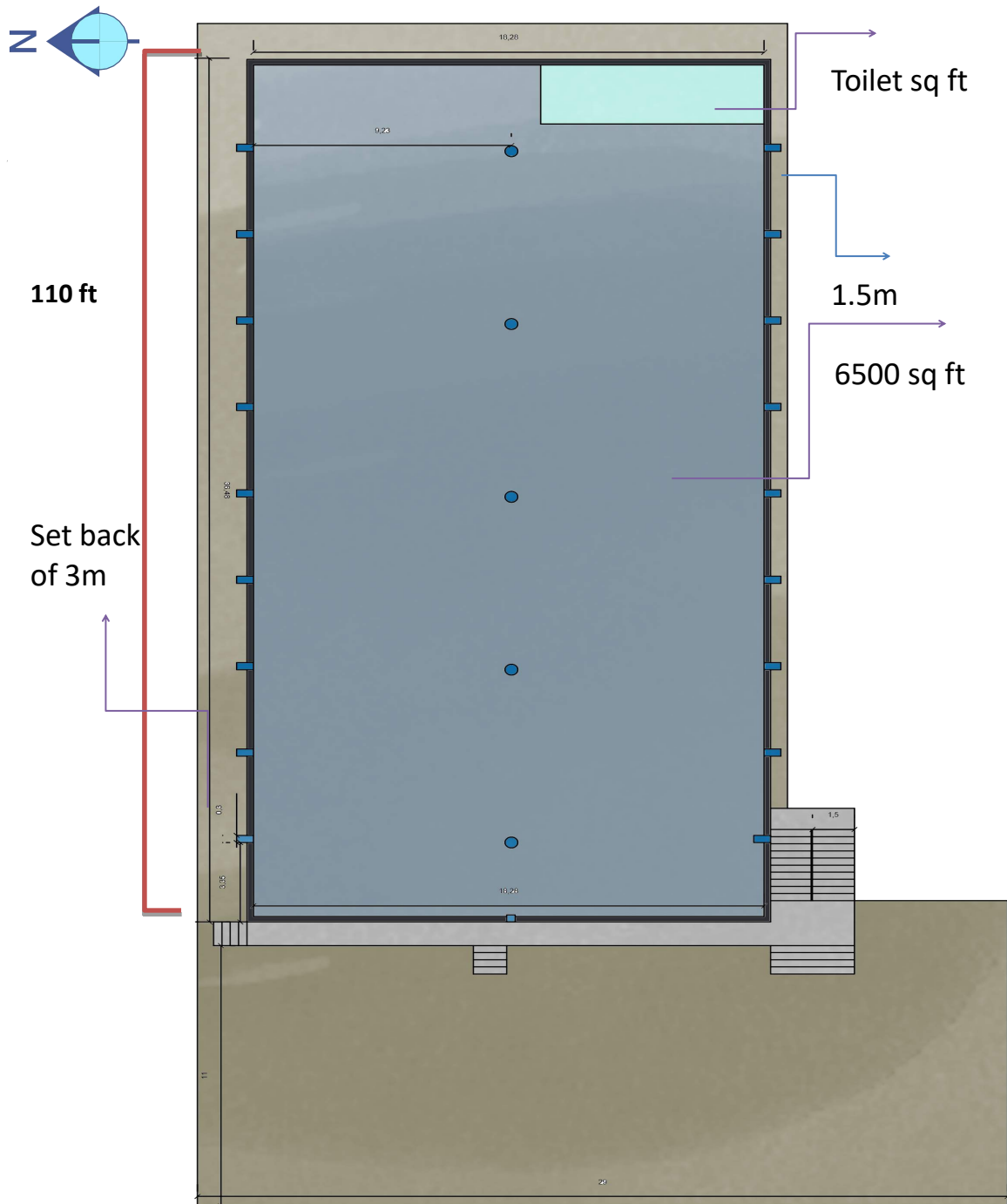


Fig:4.2.3.Site plan

4.2.3.SWOT Analysis

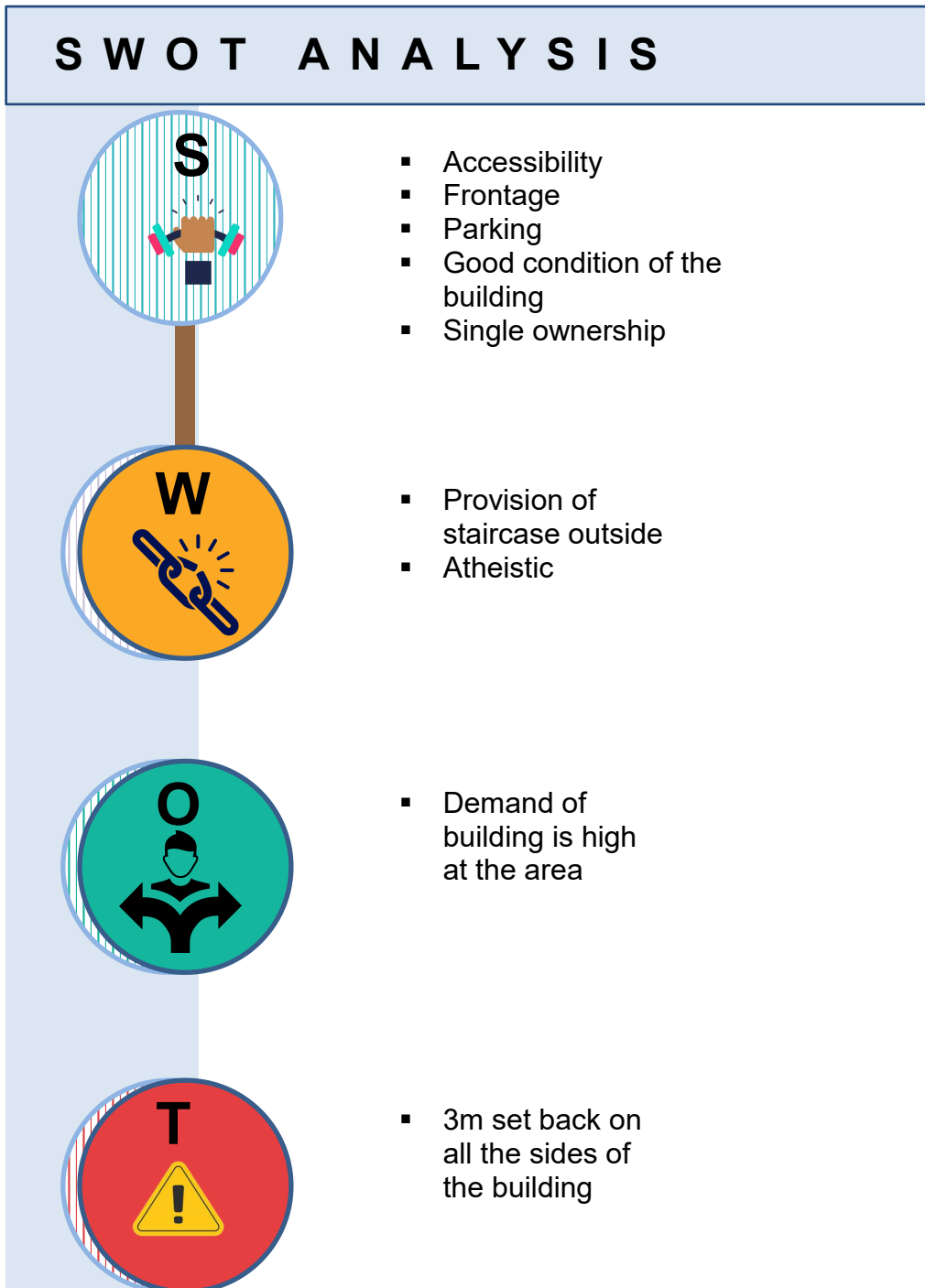
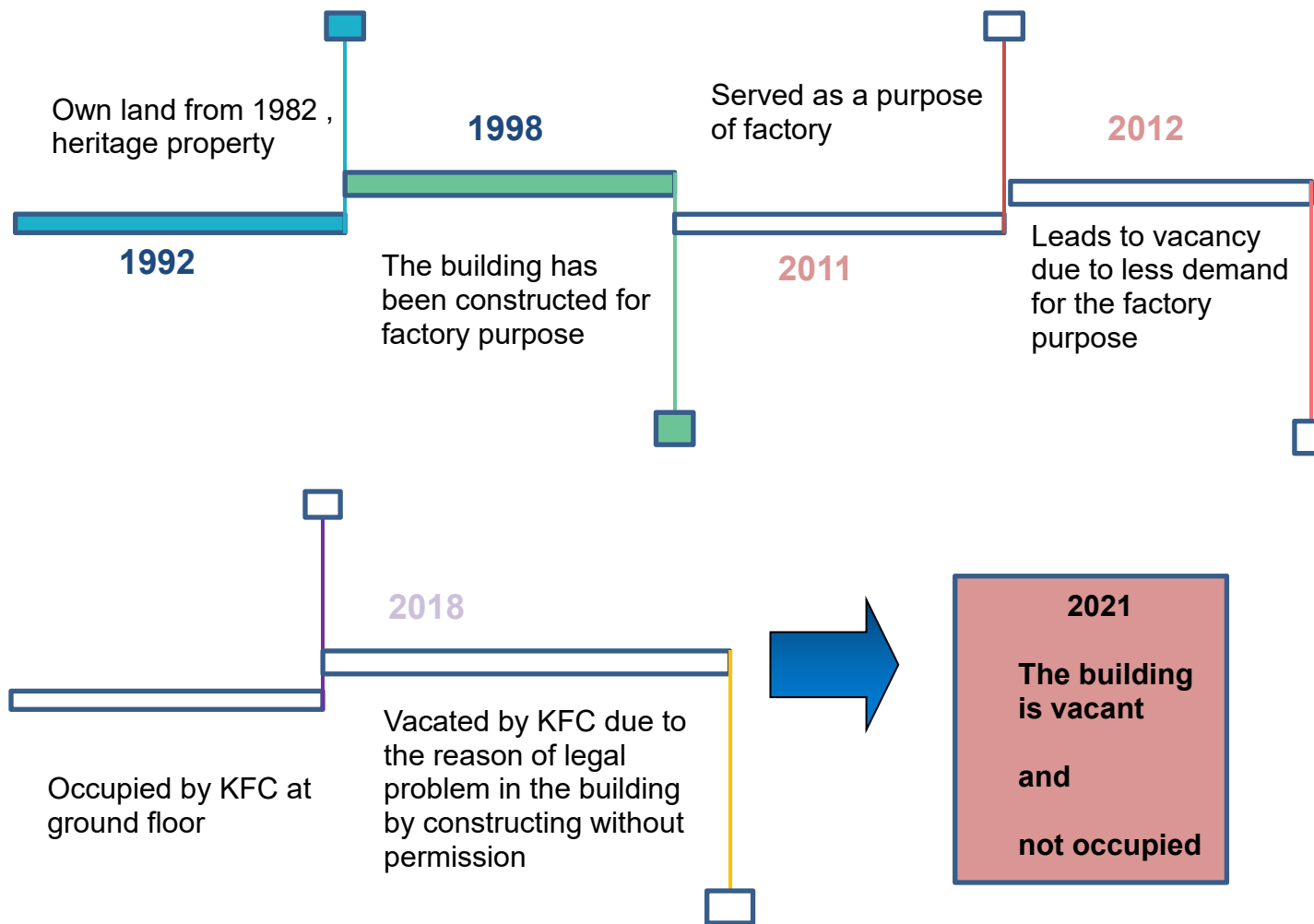


Fig:4.2.4.SWOT Analysis

4.2.4. Reason for the lost value of the building :



Primary reason

Initially they have attained permission for g+3 , BUT constructed for G+4 structure, so constructing without approval made the 4th floor vacant .

Primary reason

Due to increase in trends and technology the previous industrial building lead to obsolesce of the business , which made the tenant to vacate.

Secondary reason

Provision of lift was not provided , which made it difficult for upper floor movement when it was a industrial use.

Tertiary reason

The tertiary reason was , since it was a old building of age 23 years , the building facade was not pleasing and which doesn't attract the tenant , as per the current trend

AT CURRENT THERE IS NO LEGAL ISSUE

The building is constructed at 1998 , the FSI was 1.5 which allows only 3 floor. At that time , they have applied for additional FSI

The building has got approval for the FSI and at present no legal issue

At current , the FSI has been increased up-to 2 , And Premium FSI is allowable up-to 50% if the road width is 18m and above (Commercial non-high rise building)

4.2.5.Current condition of the building :



Fig:4.2.5: Current condition of the building



- The circular columns in ground floor, first floor and second floor has been changed to square columns with additional MS supports , in order to withstand the load.



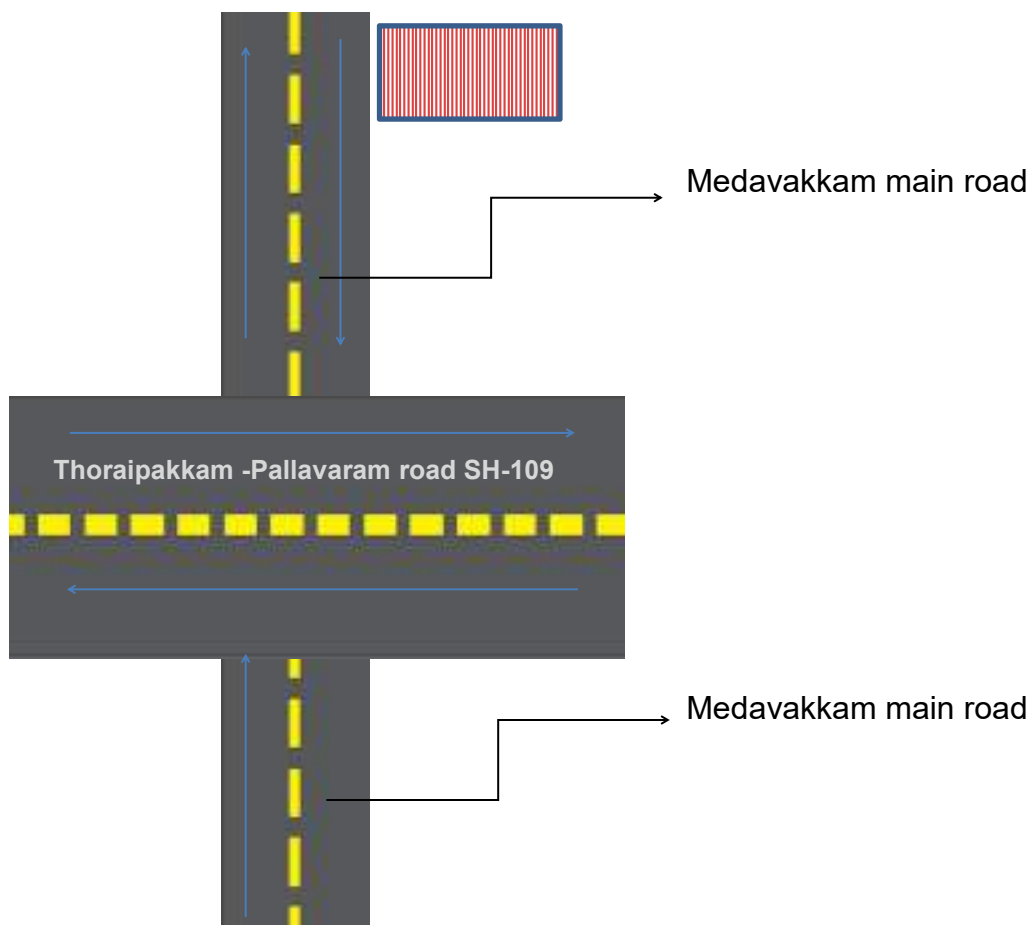
Toilet wall partition has been demolished in order to convert to a large open space.

4.3. Suitable typology

The building is identified suitable and feasible for re-use. There are different type of re-usability of the building such as residential , commercial , industrial , retail etc. which is being identified from analyzing real estate market , real estate consultants and analysis of each typology.

4.3.1.INTRODUCTION TO THE SITE:

Its primarily a residential locality , catering the needs of MIDDLE INCOME GROUP



➤ LIFESTYLE

- Keelkatalai is located at south Chennai, which is one of the promising real estate location in Chennai
- It attracts the professionals from IT parks and other business centers.
- They have diverse people residing there.

4.3.2.REAL ESTATE MARKET

- Keelkatalai is one of the fastest growing real estate market where the price ranges from Rs.4,700 to Rs. 5686 per square feet

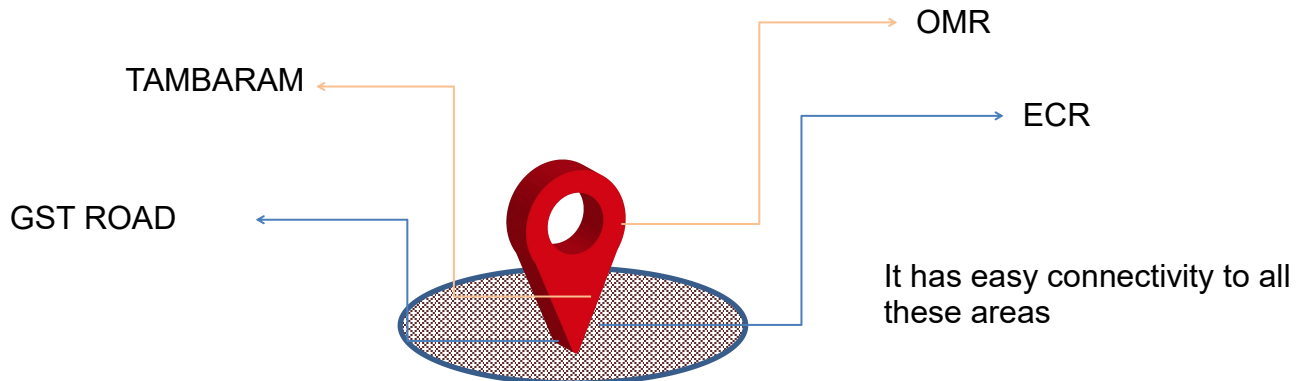
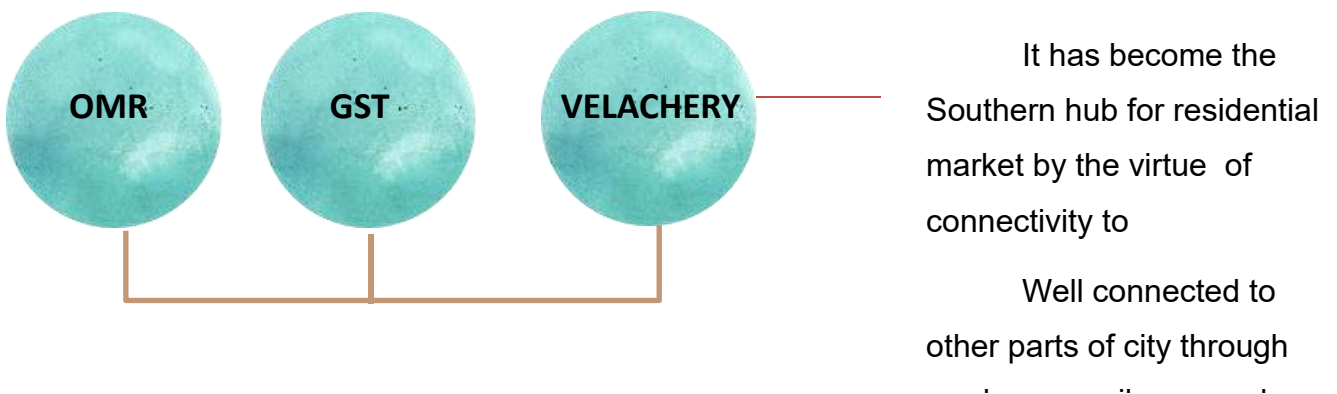
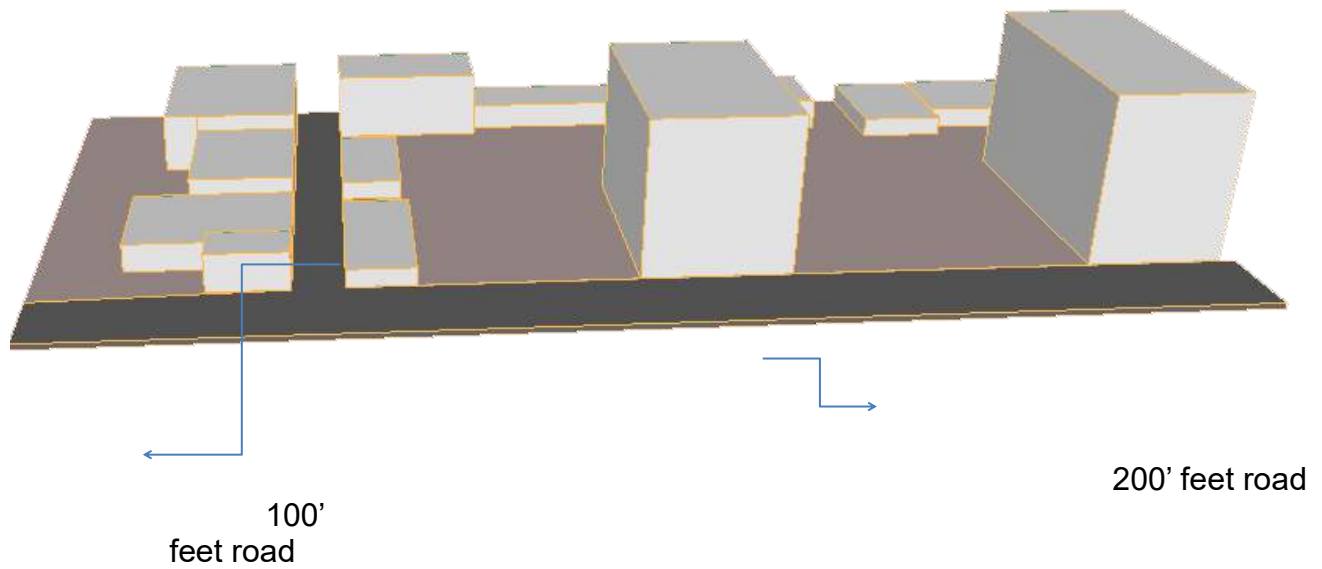


Fig:4.3.2.1.Connectivity from the site



- Major focus and growth in commercial and residential space , which is due to the commercialization of MEDAVAKKAM MAIN ROAD .
- **FUTURE DEVELOPMENT**
- With the upcoming metro station, the property values in Keelkattalai is likely to increase in the times to come.
- **NATURE OF THE BUILDING**
- This is due to the internal road width . The buildings in the 200' are constructed high rise , while the internal road which leads to KEELKATALAI has road width of 100' the height of the building is less,
- The maximum number of floors in that area ranges from G+5 - G+4 , majority of height

of the building is G+2 - G+1



It is located closely to the IT Zones(OMR, Thoraipakkam) and Industrial Zones(Tambaram , pallavaram)

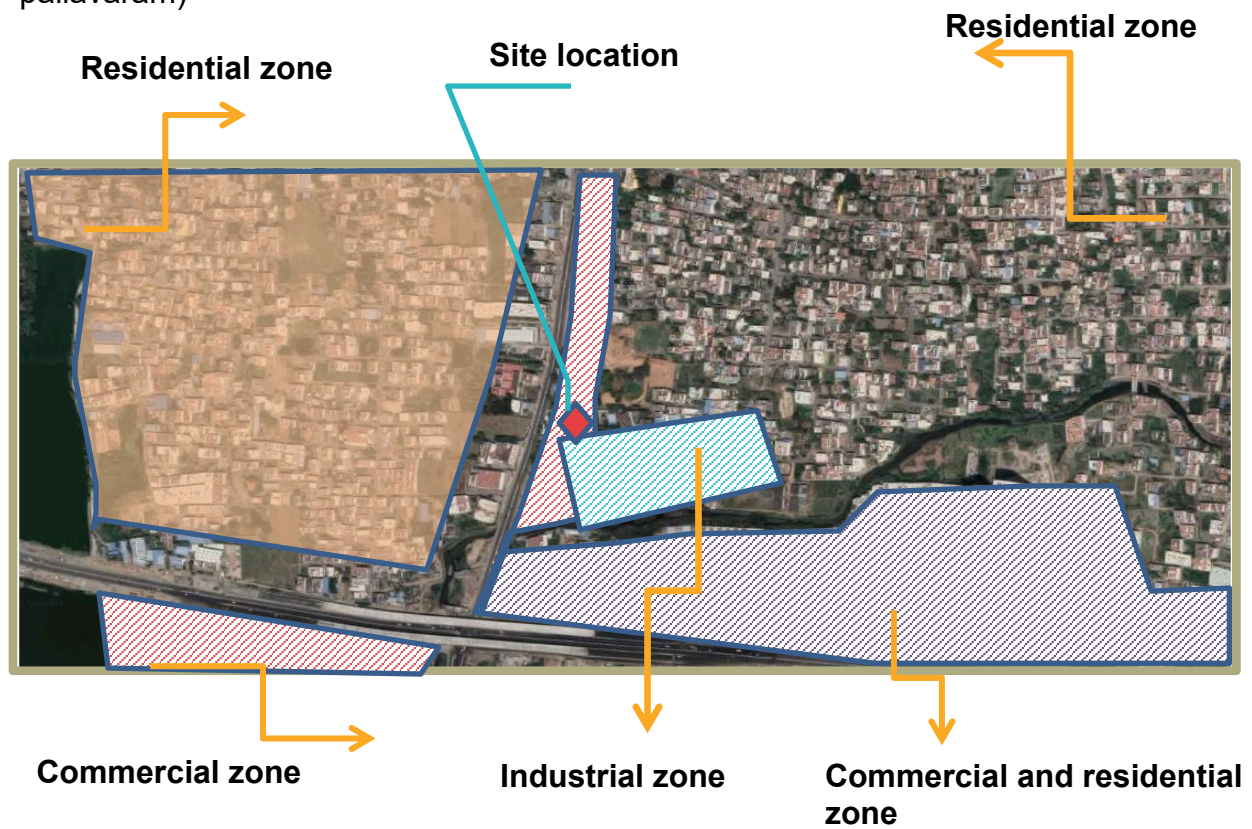


Fig:4.3.2.2.Demography of keelkatalai

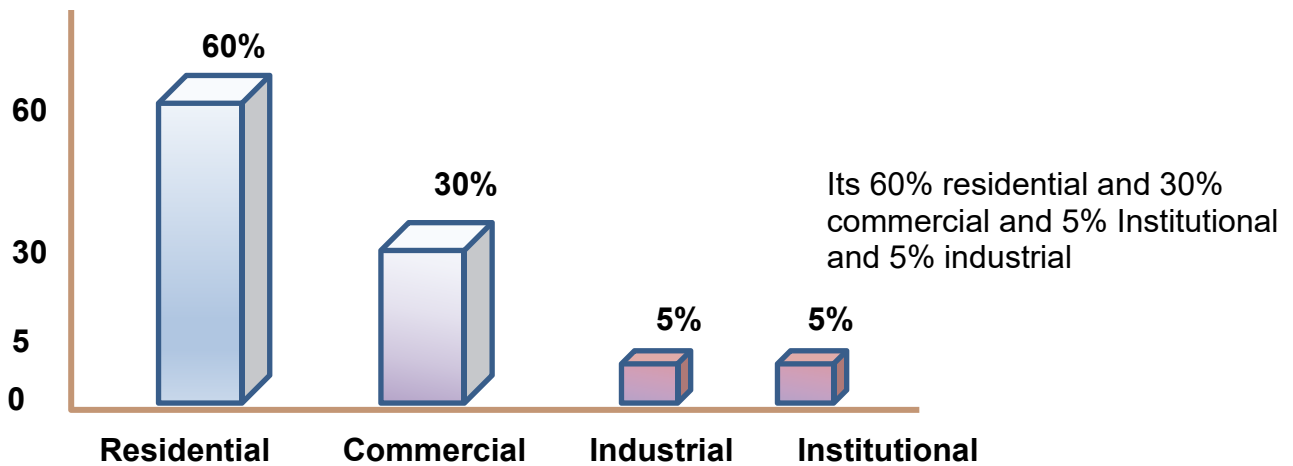


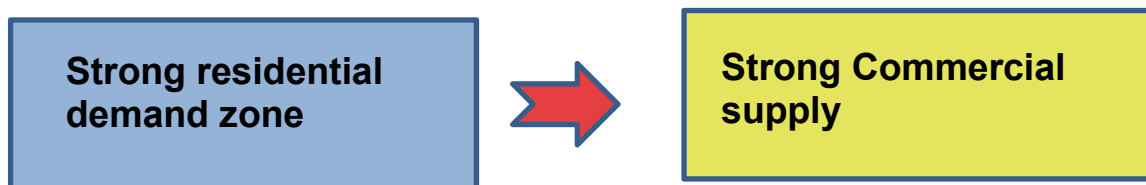
Fig:4.3.2.3.Percentage of typology of building

Its 60% residential and 30% commercial and 5% Institutional and 5% industrial

4.3.3.Real estate market :

(Source :THE HINDU , Feb 12 - 2021)

- Chennai has developed with a rich cultural heritage with modern technologies leads to development of IT spaces . Which fuels the demand of mid and low-rise homes - with affordable price
- Keelkatalai has good connectivity to these MPR and PTR road ,which are the drivers for residential demand and leads to robust road network and development of social infrastructure.



And it has future demand potential due to the  Development of business park in that area

➤ PEEK INTO KEELKATALAI AND MADIPAKKAM

PTR is showing a positive prospective for both residential and commercial zones with attractive rental rates and capital value.

With the strong IT development , increase the residential and other services like educational , hospitals and other civic amenities has the possibility to develop.

- All these demand leads to the development of social infrastructure , which is developing in that currently leads to Construction of 2 way flyover at Keelkatalai junction and development of upcoming metro stations
- **The space between - 20,000 - 40,000sqft are the major attraction of profit generation in that area**

As identified from the study it is observed that Housing and residential have more demand.

4.3.4.As per survey from real estate consultant :

ANNA SALAI , GST, OMR AND POONAMALLE ROAD are the lifeline roads for Chennai. Where the major accessibility and development has happened



Fig:4.3.4.1.Real estate market development in Chennai

- After the major roads have been developed , it has been occupied fully , then the connecting roads which are connected perpendicularly are being developed.
- Like wise other major area has been developed - guindy, nanganallur road etc.

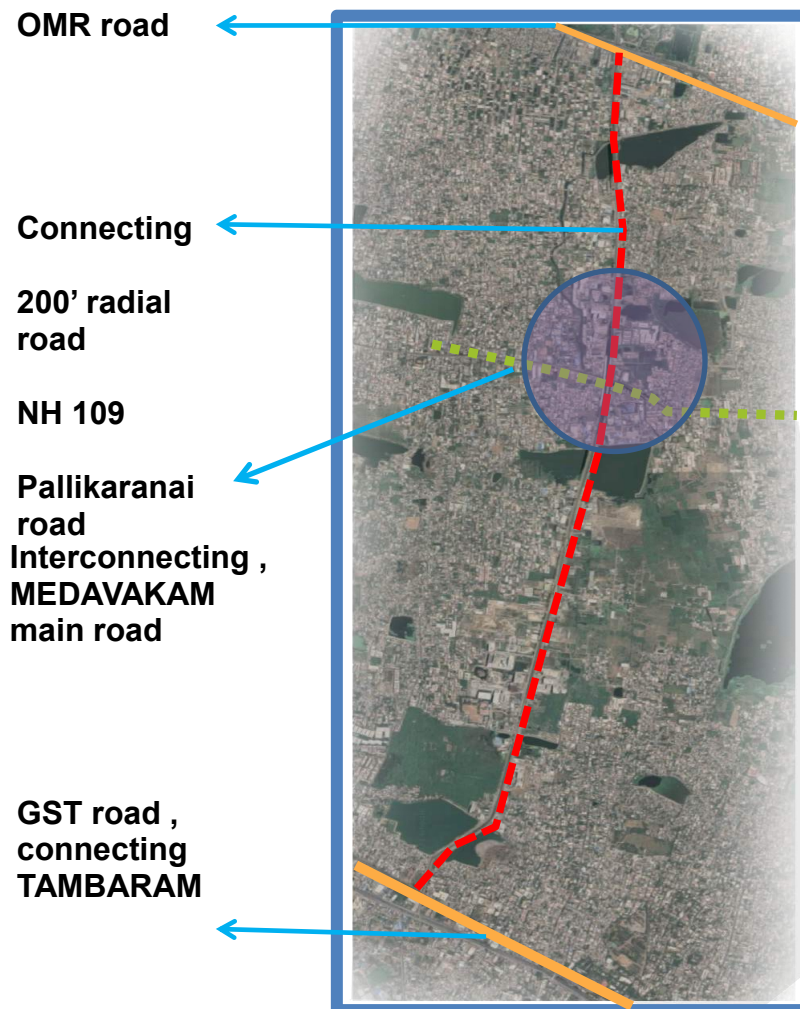


Fig:4.3.4.2.Current real estate development in Thoraipakkam

- Now the major development happens and being focused on the THORAIPAKAM TO PALLAVARAM CONNECTING ROAD.
- The area in and around 6KM of this infrastructure will be developed and will become the main concentration of the city for the next 5-7 years and future commercial development spot

Hence , by re-using the building to COMMERCIAL OFFICE SPACE has a success rate of 85% .

4.3.5.ANALYSING EACH TYPOLOGY

In this various typologies of building are analyzed based on different cafeterias to define the suitable typology;(these in formations are obtained from live survey(48 nos of people) , interview among architects(8 architects) , contractors (10 builders)

4.3.5.1.RESIDENTIAL:

- The site is surrounded by residential ranges from low rise -mid rise structure
- Providing residential typology in a residential predominant zone has the less possibility of success .
- And the plot is located at main road , which is being developed commercially , providing residential is less opportunistic



Fig:4.3.5.1.Demand for residential in Keelkatalai

DEMAND

- The demand for residential is quite moderate in that area due to current pandemic scenario

DESIGN ASPECT

- Space utilization will be less and poor . As per design wise , adapting the building to a residential
- has more impact in ventilation to the house , providing services , and since the column are present at the center it has more difficulties in designing the space.

RENOVATION

- It requires more permanent partition of walls , and demolition for providing sunken slabs and service lines would be difficult

As per survey

- As per survey it is observed that , people above the age group of 50-60yrs wanted the space as an residential with minimum number of units and increased amenities .Only 5 % of the people opted for it.

FUTURE SCOPE

- The scope is less for residential building because , there are other buildings with good amenities and space efficiency and adaptive re-use of a building people has low possibility to prefer it .

4.3.5.2.EDUCATIONAL:

Any residential predominant zone development will have basic other amenities , among the major amenities is educational building. It has good and well reputed schools and colleges are available within closer proximity.

SCHOOLS :

1km -Holy family metric school

2km - proximity prince matric school

2.2 km - Sai-cbse school

3km - San academy

5km - vels academy

TUTION CENTERS :

0.5km - NEET Training center

Within 1km radius - other small scale tutu ions center are provided

COLLEGES :

3 km - Quiade milleth college

5km - Vels college

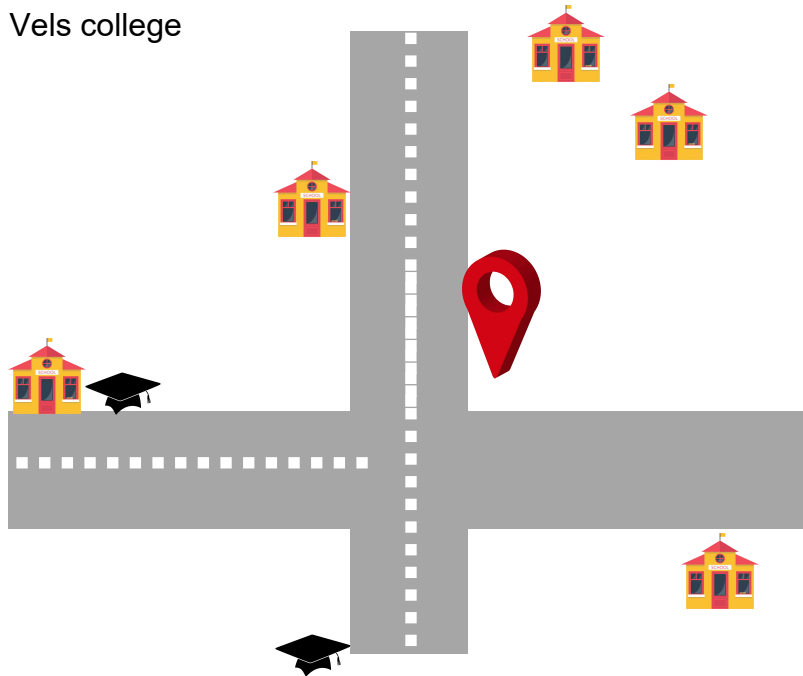


Fig:4.3.5.2.Various educational building in Keelkatalai

DEMAND

- The demand for educational building is less , since they have been provided with good facilities of schools and colleges already.

RENOVATION/ADAPTATION

- The degree of adoption and demolition will be more in order to provide corridor space, and should have permanent partitions

LEGAL REQUIREMENTS

- The front set back is satisfied ,which is 6m, but side setback provided are 3m on one

side and 1.2 on other sides , the adaptive building doesn't require setbacks , but the setback is considered for educational building , And the staircase shall be internal . And minimum area requirement for school shall be 2000 sqm , which is not satisfied here.

DESIGN ASPECT

- The provision of staircase shall be internal , which requires more space utilization and ventilation facilities on both sides would be difficult .Space utilization would be less if circulation spaces are given.

AS PER SURVEY AND FUTURE SCOPE

- It is observed from the survey that people has no requirement of educational building and has less future scope.

4.3.5.3.ASSEMBLY:

These include social gathering spaces such as Theaters , assembly halls, restaurants , auditoriums etc.

➤ THEATERS

This area has few theaters surrounded by :

1. KUMARAN THEATER - Proximity of 2km
2. VETRI THEATER - Proximity of 4km
3. GRANDMALL INOX - Proximity of 5km

DEMAND

The demand for theater is very less

RENOVATION/ADAPTATION

- This requires more demolition because , to construct a theater the ceiling height should be 30' and only complete demolition would be suitable for theater

DESIGN ASPECT

- The minimum dimension for movie theater is 30m and 12m , but the ceiling height is 30' , only till G+2 can be used other floors can be used only for storage .Space

efficiency will be poor. Cost of demolition would be high and requires more space if good amount of circulations are provided

AS PER SURVEY

As per survey it requires very less demand among the people and has less future scope

➤ This building is NOT suitable for mandapam , due to the less space and Has good Mandapams with 1km Proximity (Jeyachandran mandapam and vijayraja etc)

➤ BANQUETS:

There are few banquet hall nearby the site:

1.5km radius - TR mini hall
 - Sivasakthi hall

Within 3km radius - Ambiga hall
 - Aarna Mahal

DESIGN ASPECT

- The building is very space efficient for banquet hall , but the center columns is a major drawback to use as banquet hall.
- But only TWO FLOORS can be used for banquet halls .

DEMAND

- The demand for the space is very less.

ADAPTATION

- Since 4 columns are at the center , the demolition of column will be the only way to use it . And providing additional support.

AS PER SURVEY

- There is no demand for banquet halls and doesn't have any future scope

CAR PARK

Average car park requirement is 40 which cannot be satisfied , and Only two floors can be occupied , but the parking for other floors cannot be satisfied . (the parking requirement was 1 park for every 200sqft)

4.3.5.4.HOSPITAL:

The site is surrounded by good healthcare facilities with a very closer proximity.

HOSPITALS NEAR BY :

1.2 km - GRACE multi speciality hospital

1.5Km - Apollo hospital enterprisers LTD

2 Km - Kathik hospital , Lifeline hospital , Anjakha Hospital

4.5Km - Kamatchi Multi speciality hospital.

And other small scale hospitals in and around 1km

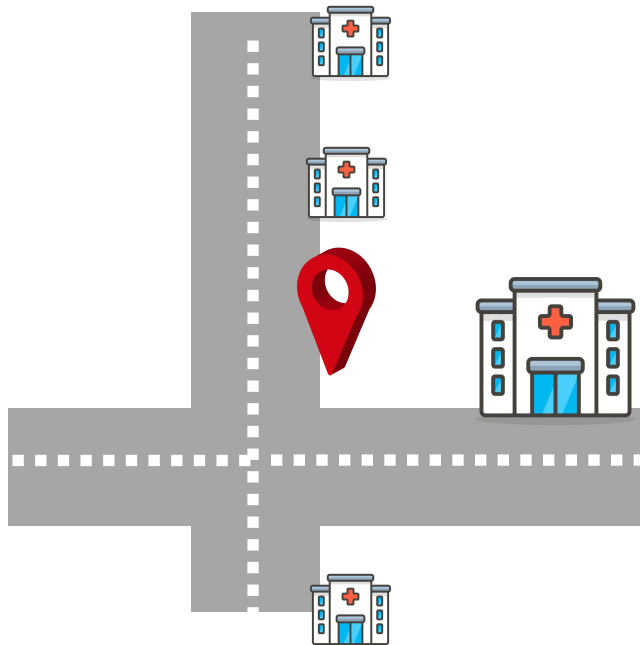


Fig:4.3.5.4.Hospitals located in Keelkatalai

DEMAND

- The demand for hospital is very less.

RENOVATION/ADAPTATION

- The building requires complete demolition and re-construction Any hospital should have an corridor width of 2.4 which acquires lots of space. and Provision of services would be very difficult and provision of stricture lift requires demolition of more space

DESIGN ASPECT

- Design wise space provisions for toilets and fire staircase would be difficult .And service designing would be difficult tasks.

AS PER SURVEY AND FUTURE SCOPE

- As per survey , the people has no demand for hospitals since they have well structured hospitals near them . The future scope is considered less , if it was a large scale building for hospital it would be efficient .

4.3.5.5.HOTELS / LODGES:

Near by hotels:

At a proximity of 2km - OYO Rooms

At a proximity of 2.2km - Zone by the PARK (4 Star hotel)

At a proximity of 3.5km - Silver key executive stays

DEMAND

- The demand for HOTELS is less due to the availability other hotels and budget friendly hotels near the 200' road itself, since the IT ZONES are located

REQUIREMENTS

- The maximum ground coverage should be 40% for HOTELS , but this Site has ground coverage of 50%

ADAPTATION

- It requires more adaptation by provision of large permanent partition walls .

- Corridor space provision
- Demolition of outdoor staircase
- There are provision of large windows which should be altered

DESIGN ASPECT

- The design aspect is moreover like residential , provision of services like utilities , laundry , kitchens acquires large space and the space for rooms would be compact . and Toilet service provision will be difficult.
- Requires 25 car park which can be satisfied

AS PER SURVEY AND FUTURE SCOPE

- There is no demand for hotels /lodges among people since its a residential zone , the requirement is nil and There are many hotels near IT zones , they are preferring it rather than away from it. And has less future scope

4.3.5.6.RESTAURANT:

There are many restaurants near by :

500m proximity - 1km Proximity - A2B , Sangeetha , DOMINOS , KFC , and other small scale hotels

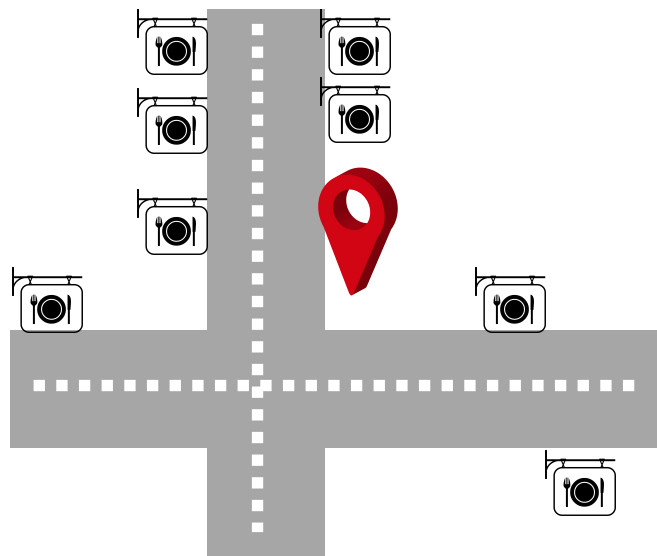


Fig:4.3.5.6.Restaurants located at Keelkatalai

DEMAND

- The demand for restaurant is moderate , since its been a residential are the demand for restaurant would always be there , but there are sufficient restaurants available.

ADAPTATIONS

- Requires less adaptations and demolition will be less, but the restaurant would be feasible for only two floors

REQUIREMENTS

- The amount of car park required is 1 for every 50 sqm and 1 bike park for every 25 sqm ,It requires 40 bike park and 22 car park which is satisfied.his is for only two floors , the car park for other floors cant be satisfied.

DESIGN ASPECTS

- Space efficiency will be more , the requirement for loading and unloading bay would be difficult

AS PER SURVEY

The demand is moderate (30 %) but the future scope of the project would be less

4.3.5.7.RECREATIONAL :

- PARK - This area doesn't have more park facilities but the lake road walkways.
- GROUND - Only few grounds are available in this area , where it cannot be satisfied by the site .
- SPORTS FACILITIES - The sports facilities such as badminton requires complete demolition of two floors ,And there are sufficient badminton courts near by.
- Major attraction in that area is Keelkattalai Lake, Madipakkam Lake.

DEMAND

- There is less demand for recreational spaces.

AS PER SURVEY

- The demand is moderate (30 %) but the future scope of the project would be less

4.3.5.8.RETAIL :

There are many retails such as departmental stores , clothing , electronic retails , etc
Many retails are available within the proximity of 1km itself.

DEMAND

- There is moderate demand for retail because availability of all retails within closer proximity

ADAPTATIONS

- Very suitable for adaptive re-use , requires less modification and demolition

REQUIREMENTS

- Since it is above 50 sqm , the car park requirement is 1 car park for every 50sqm. It requires 30 car park and 60 bike park , which is quite difficult to satisfy. (but can be satisfied with hydraulic car park)

AS PER SURVEY

- 20 % of people opted for RETAIL space , but the future scope would be really less

4.3.5.9.OFFICE :

DEMAND

- This area has insufficient office space , especially at the MAIN ROAD with easy accessibility and car park.

ADAPTATION

- It requires very minimal adaptation and demolition and space efficiency would be more

REQUIREMENTS

- 1 car park required for every 50 sqm and 1 two wheeler for every 25sqm. The amount of car park required is 44 nos and 75 bike park which can be satisfied by provision of mechanical car park

AS PER SURVEY AND FUTURE SCOPE

- As per survey , 40% of people have opted for office space and good future scope as per the current real estate market

4.3.5.10.WAREHOUSE :

DEMAND

- The space got vacant due to the less demand in warehouse.Hence there is no demand for warehouse and storage spaces

ADAPTATION

- This space is more suitable for ware house and satisfies the parking facilities which is been previously adopted by the industries

AS PER SURVEY

- It has no demand for warehouse and no future scope and less efficient since its been developing zone

Tab:4.3.5.1.Suitable Typology

SUITABLE TYPOLOGY								
	TYPOLOGY	AVAILABILITY	DEMAND	DESIGN ASPECT	ADAPTATION	REQUIREMENTS	AS PER SURVEY	FUTURE SCOPE
1	Residential							
2	Educational							
3	Hospital							
4	Theaters							
5	Banquet							
6	Marriage hall							
7	Hotels /lodges							
8	Restaurant							
9	Recreational							
10	Retail							
11	Office							
12	Hostels							
13	Warehouse							
		Poor		Good		Average		

As per the above study and survey from Real estate consultants ,real estate markets and From the residents , i came up with a suitable building typology to re-use the building , which is a **COMMERCIAL OFFICE SPACE**.

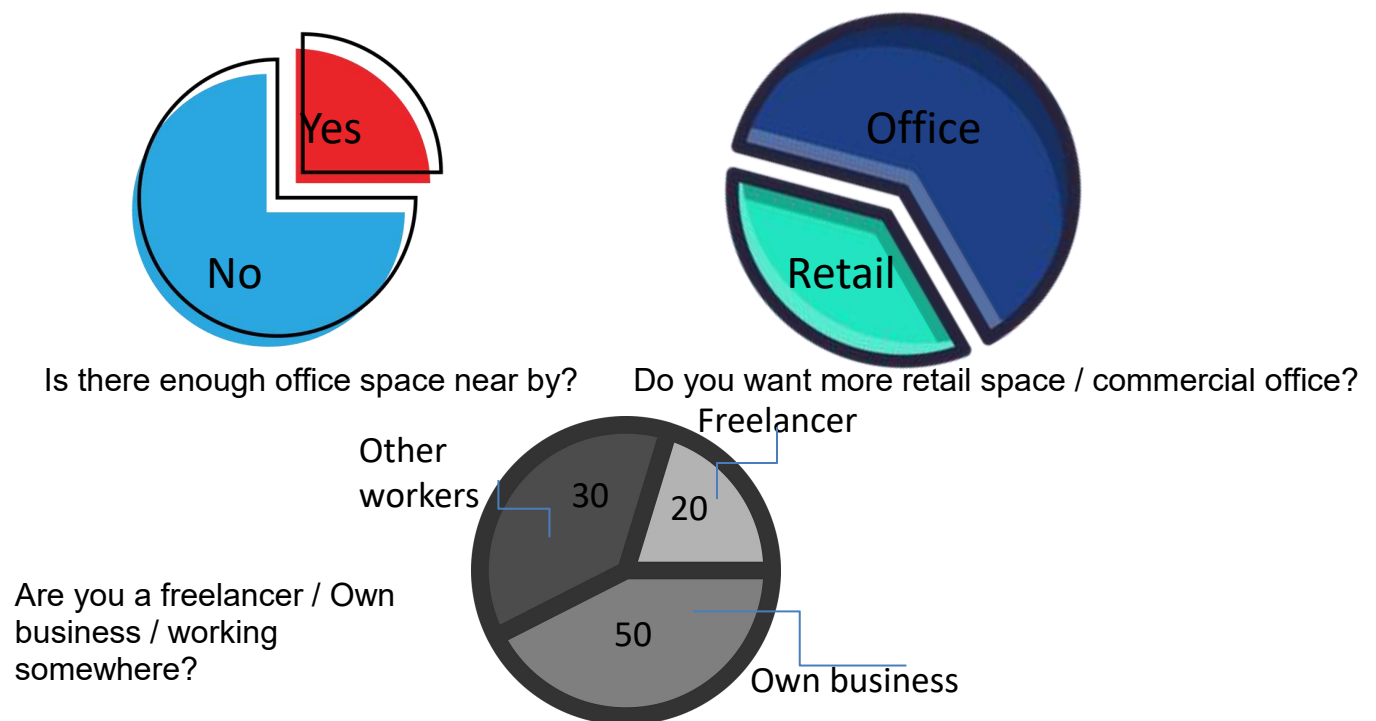


Fig:4.3.5.Surveys to identify suitable typology

As per the report from JLL and CBRE and analyzing the current market trend in Real estate, it is observed that small scale offices has the capacity to sustain in the market and large office spaces tends to leave the space vacant.

Tab:4.3.5.2. Traditional office space occupancy

Traditional office space	Occupancy %
DG Square (Thoraipakkam main road)	40%
KG Pinnacle (Adambakkam)	55%
Fayola Towers (Velachery)	60%
Chaitanya imperial (Teynampet)	45%
Wabag House (Thoraipakkam main road)	55%
MPL Tower (Velachery road)	50%

Based on the survey of traditional and co-working space occupancy , it is observed that the occupancy rate increases from traditional to co-working space.

Tab:4.3.5.3.Co-working office space occupancy:

Co-working space	Occupancy %
Workafella (Teynampet)	70%
Awfis (Annasalai)	75%
Karya space (Nungambakkam)	88%
Culture work (Velcahery)	70%
A-space (Velcahery, railway station)	85%
Workafella (Nungambakkam)	80%

- Hence , higher occupancy rate produces higher return as profit.
- Hence rather than traditional office space , flexible space has the more occupancy rate and where it attracts the freelancers.

TRADITIONAL OFFICE SPACE



FLEXIBLE OFFICE SPACE

- And there has been emerging flexible office spaces near Velachery , with near by accessibility to the main velachery.(A -SPACE share office spaces , WOCO spaces)
- It is observed from the survey that there is insufficient office spaces in Keelkatalai and near by areas - (Madipakkam , Nanganallur , Medavakkam) and maximum percentage of people are own business and upcoming freelancers , which can makes flexible spaces as suitable typology

4.3.6.Feasibility of Flexible office space :

Off-site factors

1. Accessibility:

- The building is located at the frontage of the road of 11 m frontage ,It gets connected to the connecting road of OMR and GST which is easily accessible for the public infrastructure. The frontage road is 100' which is suitable for commercial zone. It has 360 degree access to the infrastructure

2. Public transport accessibility:

- It gets connected to the connecting road of OMR and GST which is easily accessible for the public infrastructure. The frontage road is 100' which is suitable for commercial zone. § Near by access to METRO and AIRPORT

3. Site surroundings :

- The structure has side walk access .Surrounded by all commercial and residential buildings .Strong business and residential mix in the area.

4. Health issues :

- Since there is no factories and hospitals near by it is free from health issues and other risk ailments.

On-site factors

1. Large open spaces:

- The amount of partition provision is less in the building with column at the corner and few central columns which makes it as a large space to utilize

2. Structural condition:

- The structural condition of the building is very adequate to adaptive re-use for other purpose.The amount of damage , cracks are very less

3. Plot size:

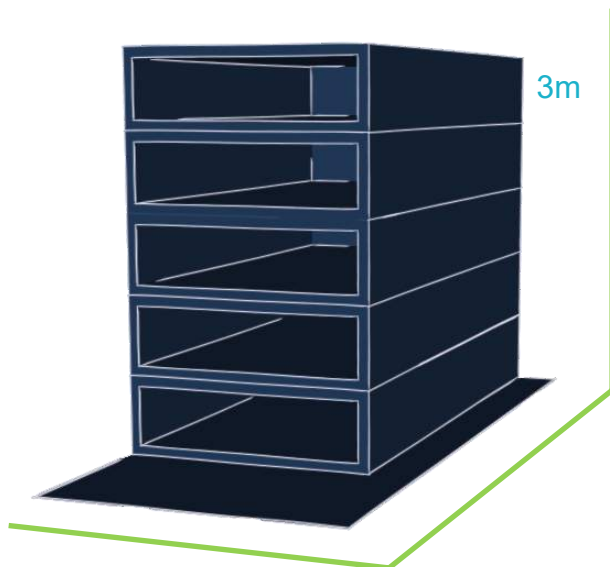
- For the commercial project to be viable it should be 2-3 grounds minimum .The site has area of about 5.2 ground

4. Car parking facilities:

- The total car parking required as per DCR is 1 car park for every 50 sq m and 1 Bike park for every 25 sq m.
- The total car parking space available there is 330 sq m .
- It can accommodate 22 car park.
- By provision of mechanical car parking the total 44 car park is satisfied.
- It requires 90 bike park which is satisfied

5. Floor to floor height:

- Most of the industrial building have larger heights which made it inefficient for adaptive re-use.
- This structure has a clear height of each floor of about 3 meter which can be modified into the typology , without much renovation



Based on the above analysis , i came up with the more feasible typology - FLEXIBLE OFFICE SPACE which I going to further study the further feasibility.

(For this conclusion all the information's are gathered from the people , live survey , contractors, architects, investors, real estate consultants)

4.3.7.Various Drivers made it to re-use the building are:



Environmental drivers

This building has many potential to re-use rather than demolish.

Preventing the materials from landfill , since the material cannot be re-used .

Re-using the structure reduces the disturbance to the near by surrounding

The Amount of energy spent is less considering demolition and re-development

Reduction in urban sprawl of the city



Social drivers

This building has not exceeded the its useful life ,

Can avoid long term vacancy

Developing the value of the locale .

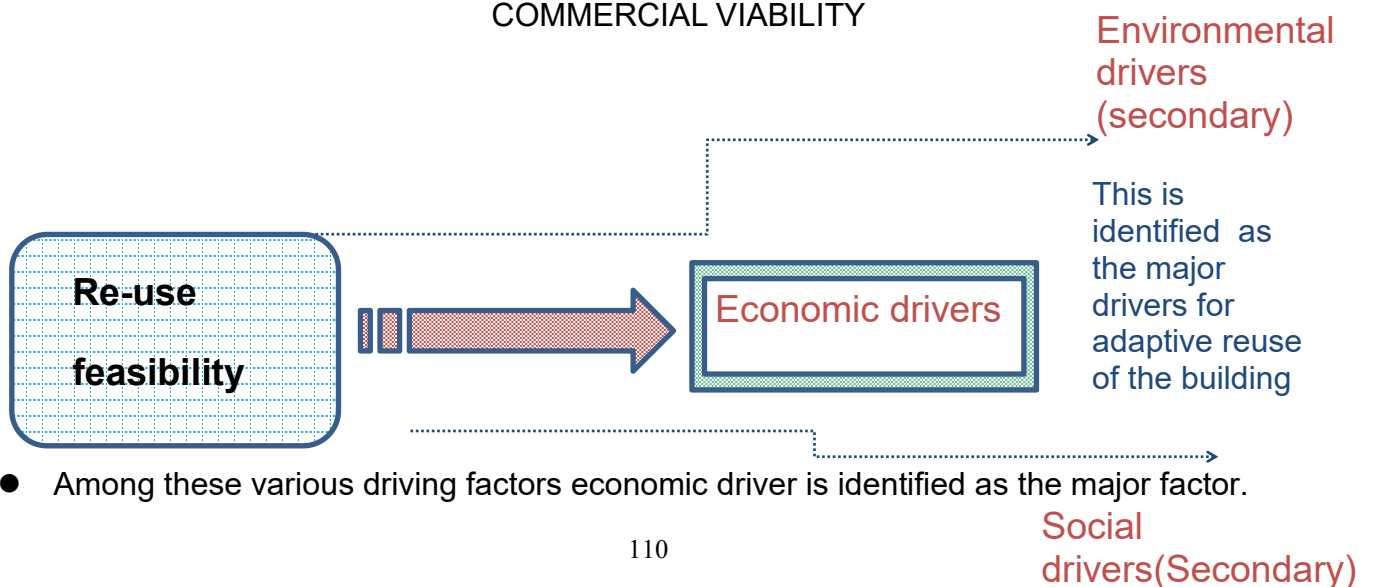


Economic drivers

Since the building has not many partitions and does not require complicated demolition - leads to less cost of renovation

MARKET VALUE - the building is located at main road with minimum proximity to amenities make it more viable to re-use it and keeps the market value high

COMMERCIAL VIABILITY



- Hence Financial feasibility is further studied to identify it.

CHAPTER 5

FINANCIAL ANALYSIS

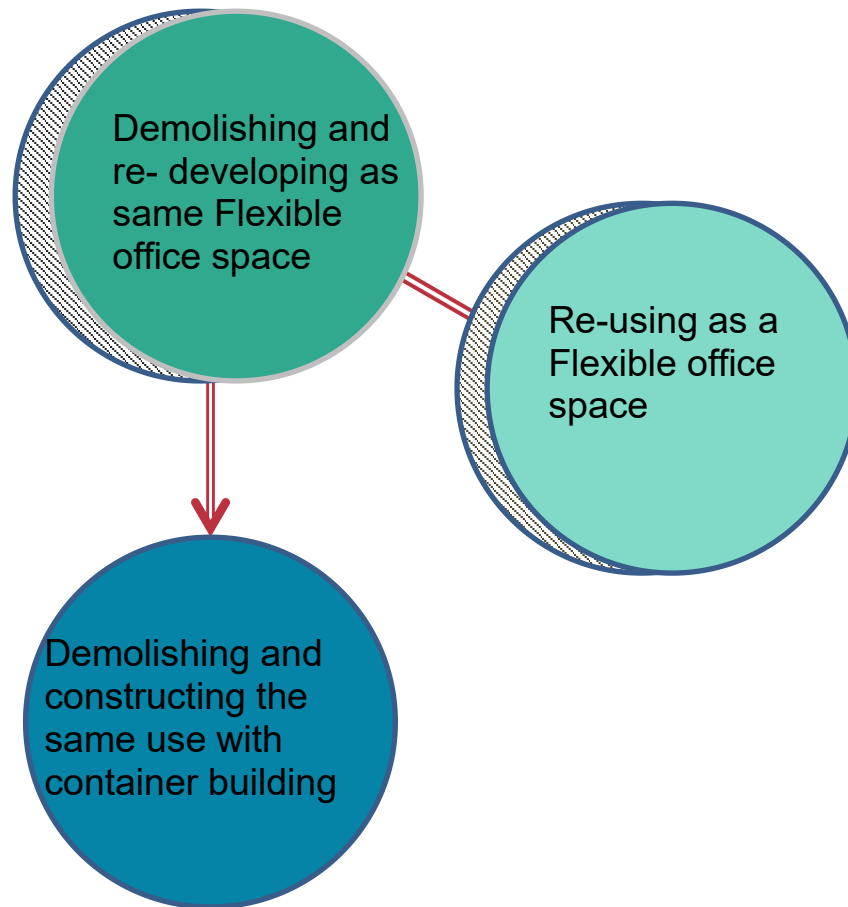


Fig:5.Scenarios for comparison

5.1. Facilities provided :

Based on the survey , among the people what kind of spaces they need and live case study analysis identifying the major rental driving facilities are provided:

Hot desk

This renting the desks , provides a revenue generation of about 36% , which focuses on the entrepreneurs and freelancers

Meeting rooms

Renting of the meeting rooms provides revenue generation of 10% of revenue. As per the survey from the freelancers and other clients , the need of renting of meeting room is high

5 -6 seater private cabins

These has the revenue generation capacity of 25 %

Event facilities

These has the revenue generation capacity of 10%

- Pantry
- Internet facilities
- Printers
- 24/7 access to the space
- Security
- Access control
- Micro-library
- Wellness room
- Lounge spaces

5.2. Site details :

Model type :

Owner operating model considering the owner is developing the structure , where the revenue generation is high rather than getting monthly rent from the tenant

Land cost :

Inherited property

Plot size :

13,500 sq feet

Building area :

6500 sq ft per floor - G+4 = 32,500 sq ft

Rent able area sq ft (RSF) :(without including staircase and lift)

6400 Sq ft (600 sq m) Which includes all the common spaces , such as Pantry (2.5 sq m) , Lounge (15 sq m) , Library (5 sq m) , Wellness room (6 sq m) , Printer (3.5 sq m) .

FSI :

2.2

Usable area sq ft (RSF) :

5170 Sq ft (480 sq m)

Total usable area = 25,800 sq ft

Where it doesn't includes the common space

- Considering , 80 sq ft as average square footage per desk It can occupy 65 occupants per floor.As an average it can occupy 280 occupants .
- (To proceed further with the COST BENEFIT ANALYSIS - i have taken non-discounted method for calculation due to certain limitations in the information availability)

5.3. Development costs :**Tab:5.3.Development for All scenarios:**

DEVELOPMENT COST / UPFRONT COSTS			
SCENARIO 1 (Demolition and new construction) Conventional Construction			
S.No	Various Categories	Cost in (Rs)	Remarks
1	Cost of demolition	Rs.2,60,00,000	Considering ,the demolition cost is Rs.800/sqft
2	HARD COSTS - Cost of new construction (Core and shell development)	Rs.5,85,00,000	Considering ,the New construction cost is Rs.1800/sqft
3	HARD COSTS - Cost of Setting up a flexible space	Rs.6,80,00,000	Considering, the cost is Rs.2000/sqft and mechanical car park(hydraulic car park) cost is 1.5L per parking ,totally require 20 nos
	It includes the cost of interior design , Painting work, Furnitures , Plumbing and other works - Services contributes - 30% of the costs -Finishing work contributes 20 % of the costs -Interior works contributes 50 % of the costs		

4	SOFT COSTS - Cost indirectly related to construction	Rs.25,02,500	Architectural designing = Rs.30/sqft Structural designing = Rs. 7/Sqft Services (MEP) = Rs. 15 /Sqft Other costs = Rs. 5/sqft Legal fees for approval = Rs.20/sqft
5	EQUIPMENTS COSTS	Rs.7,00,000	Pantry equipments , Lockers , LCD Projectors , Printers, server facilities
	TOTAL	Rs. 15,30,02,500	
SCENARIO 2 (Re-using as a FLEXIBLE SPACE)			
1	HARD COSTS - Cost of Setting up a flexible space	Rs. 6,50,00,000 + additional cost for demolition =Rs.6,90,00,000	The average cost is assumed as Rs.2000 per sqft. mechanical car park(hydraulic car park) cost is 1.5L per parking ,totally require 20 nos
2	SOFT COSTS - Cost indirectly related to construction	Rs.15,27,500	Architect fees = Rs. 30/sqft Structural consultants = Rs. 3/Sqft Services = Rs. 15/Sqft Other costs = Rs. 5/Sqft
3	EQUIPMENTS COSTS	Rs.7,00,000	Pantry equipments , Lockers , LCD Projectors , Printers etc
	TOTAL	Rs. 6,85,27,500	

SCENARIO 3 (Demolition and construction as a flexible space using container)			
1	Cost of demolition	Rs.2,60,00,000	Considering ,the demolition cost is Rs.800/sqft
2	Cost of contruction using container	Rs. 2,25,00,000	It requires 15 containers per floor So totally requires75 containers One container cost with complete interior = Rs.3,00,000
	A 10' * 20' container can occupy about 5 people . To occupy 65 people per floor , it takes about 13 containers for work spaces , for other amenities it requires 2 containers		
3	Other costs	RS.11,25,000	Levelling , Plinth ,
4	EQUIPMENTS COSTS	Rs.7,00,000	Pantry equipments , Lockers , LCD Projectors , Printers etc
	TOTAL	5,03,25,000	

5.4. Revenue components :

The major source of revenue components are the membership fee and services fee . They are charged either per day / week /month but most commonly it is charged per month (where it includes utilities , internet , cleaning services , other services with limited credits) .The amount of fee various depend upon the service it contains and the use of the space.

Tab:5.4.1.Revenue components and facilities provided

PLANS	WORKPLACE	ACCES S TIME	FACILITIES INCLUDED
Hot desks (Single desks)	In which they work in a common open area. Each day the space is first come first serve	24/7	WiFi access , pantry ,Front desk services, Printer access with limited number of prints (of 5 -10 copies) above that

	No fixed place of work		should be paid, Utilities and cleaning costs are included. Limited meeting room access (10 hrs / month) above that is pay and use. Cabinets and lockers are not included
Dedicated desks (4 - 3 seater)	Work in a dedicated desk with chair and lockable cabinets	24/7	WiFi access , pantry ,Front desk services, Printer access with limited number of prints (of 50 copies) above that should be paid, Utilities and cleaning costs are included. Limited meeting room access (10 hrs / month) above that is pay and use. Cabinets and lockers are included , office stationary , call and mail handling
Private cabins (6 - 5 seater)	Work in a private lockable office with dedicated cabinets. Fixed location of work	24/7	Wifi access , pantry ,Front desk services, Printer access with limited number of prints with extra credits than others Utilities and cleaning costs are included. Unlimited meeting room access Cabinets and lockers are included , office stationary , call and mail handling + pay for extra use based on head count

Other services / facilities	Events and meeting rooms	Limited period	Events and meeting rooms are pay and use , above the usage of credit periods. And only meeting room can be booked with all internet and utility facilities for particular hour
-----------------------------	--------------------------	----------------	--

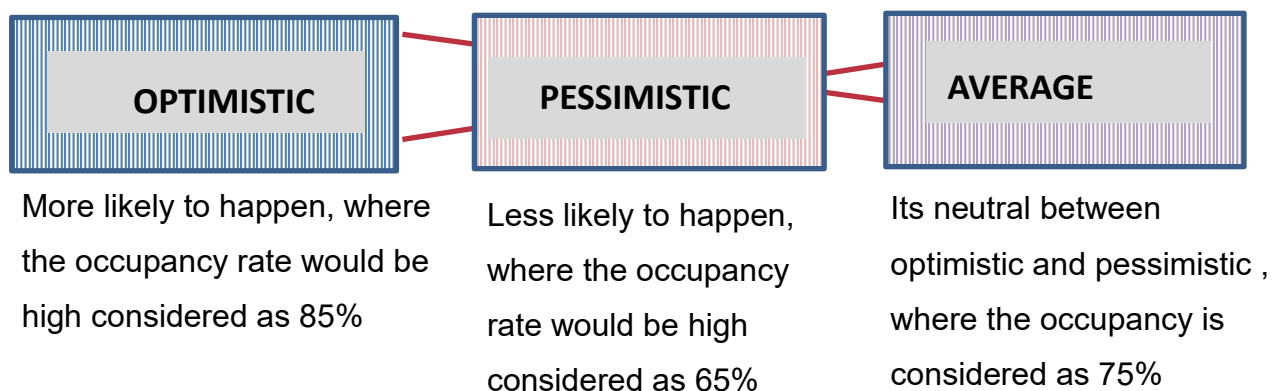
Tab:5.4.2.Cost of each spaces:

Karya space (Nungambakam)	Rs. 7600 / Month (HOT DESKS) Rs. 34,400/Month (PRIVATE CABINS) Rs . 17,500 /Month (Dedicated desks) WiFi , cafe ,Printers , wellness room ,Cabinets , lockers,House keeping ,reception , Car parking and bike parking ,AC
WOCO space (T.Nagar)	Rs. 7000 / Month (HOT DESKS) Rs. 20,000/Month (PRIVATE CABINS) Rs . 11,000/Month (Dedicated desks) WiFi , cafe ,Printers , wellness room ,Cabinets , lockers,House keeping ,reception , Car parking and bike parking,AC ,Library
AWFIS (Nungambakam)	Rs. 11,000 / Month (HOT DESKS) Rs. 32,000/Month (PRIVATE CABINS) Rs . 20,000/Month (Dedicated desks) Collaboration zone , pantry , printers , AC , car and bike park , WIFI Access , reception , Security , Projector , courier
Conclo office sapce (Perungudi)	Rs. 8,000 / Month (HOT DESKS) Rs. 40,000 / Month (PRIVATE CABINS) Rs . 12,000 / Month (Dedicated desks) WiFi, powerbakup , car parking , housekeeping, Pantry , AC, Reception , projector, security , Lockers,Computers(on request)
Karya space (Mylapore)	Rs. 7,600 / Month (HOT DESKS) Rs. 34,000 / Month (PRIVATE CABINS) Rs . 17,200 / Month (Dedicated desks) Pantry , Parking , washroom , printers , courier, Reception , drinking water , Customer support , AC , Cleaning , Reception ,Cafeteria

As analyzed The cost of spaces are : HOT DESK :Rs.Rs. 7,500/Month(1 per),DEDICATED DESKS:Rs.12,000/Month(2-3 per) ,PRIVATE CABINS:Rs.30,000/Month(5-6 per)

5.5.Cash flow analysis :

Since the occupancy rate wont be same during all the period of time , three scenarios are considered:



5.5.1.OPTIMISTIC SCENARIO:

Tab:5.5.1.Optimistic scenarios cash flow analysis

CASH FLOW ANALYSIS		
January -March - OPTIMISTIC SCENARIO		
Considering the occupancy as 85%		
TOTAL OCCUPANCY - 300 nos		OCCUPANCY AT 85% = 240 nos
1	Hot desk occupancy = 40 nos	
2	Dedicated desk occupancy =(2-3 seater) 23 nos	
3	Private cabins occupancy = (6 - 5 Seater) 17 Nos	
THE AVERAGE COST FOR EACH TYPE OF OCCUPANCY PER MONTH:		
1	Hot desk	Rs. 7,500 / Month
2	Dedicated desk	Rs. 15,000 / Month
3	Private cabins	Rs. 38,500 / Month

REVENUE		
1	Hot desk	Rs. 3,00,000
2	Dedicated desk	Rs. 3,45,000
3	Private cabins	Rs.6,54,500
4	Meeting room and events and space utilities	Rs.93,600
	TOTAL	Rs. 13,93,100

COSTS / EXPENSES		
1	Staffs	Rs. 84,000/Month
	Considering 2 staffs for reception (Rs.15,000) ,Other staffs 2 (Rs.12,000) and one manager (Rs.20,000) and watchman (Rs.10,000)	
2	Cleaning services	Rs.21,000 /Month
	Considering 3 nos of workers of salary , Rs7,000	
3	Beverages	Rs.25,000
4	Utility service costs	Rs.4,56,220

	Consists of electricity - Where it takes an average of about 1.5 unit / sqft for 32,500 sqft = 48,750 unit is required, One unit cost for commercial is Rs.13. For the occupancy of 85% Its been calculated = Rs.4,52,000 Sewage Charge - Rs.2420/month Water supply it costs Rs. 1800 /Month	
5	Paid advertising	Rs.8000 /Month
6	Office utilities	Rs.8,000
7	Internet services	Rs.35,000
8	Other miscellaneous	Rs.10,000
	TOTAL	Rs. 6,47,220

5.5.2.PESSIMISTIC SCENARIO:

Tab.5.5.2:Pessimistic cash flow analysis

CASH FLOW ANALYSIS		
April - June - PESSIMISTIC SCENARIO		
Considering the occupancy as 65 %		
TOTAL OCCUPANCY - 300 nos		OCCUPANCY AT 65% = 195 nos
1	Hot desk occupancy = 35 nos	
2	Dedicated desk occupancy = (4 - 3 seater) 21 nos	
3	Private cabins occupancy = (6 - 5 Seater) 16 Nos	
THE AVERAGE COST FOR EACH TYPE OF OCCUPANCY PER MONTH:		
1	Hot desk	Rs. 7,500 / Month
2	Dedicated desk	Rs. 15,000 / Month
3	Private cabins	Rs. 38,500 / Month
REVENUE		
1	Hot desk	Rs. 2,62,500
2	Dedicated desk	Rs. 3,15,000
3	Private cabins	Rs.6,16,000
4	Meeting room and events and space utilities	Rs.77,700
	TOTAL	Rs.12,71,200
COSTS / EXPENSES		
1	Staffs	Rs. 84,000/Month
	Considering 2 staffs for reception (Rs.15,000) ,Other staffs 2 (Rs.12,000) and one manager (Rs.20,000) and watchman (Rs.10,000)	
2	Cleaning services	Rs.21,000 /Month
	Considering 3 nos of workers of salary , Rs7,000	
3	Beverages	Rs.20,000
4	Utility service costs	Rs.3,75,820

	Consists of electricity - Where it takes an average of about 1.5 unit / sqft for 32,500 sqft = 48,750 unit is required, One unit cost for commercial is Rs.13. For the occupancy of 85% Its been calculated = Rs.3,71,600 Sewage Charge - Rs.2420/month Water supply it costs Rs. 1800 /Month	
5	Paid advertising	Rs.12,000 /Month
6	Office utilities	Rs.8,000
7	Internet services	Rs35,000
8	Other miscellaneous	Rs.10,000
	TOTAL	Rs. 5,65,820

(All these information are gathered from reference with practising architects and contractors and co-working manager)

5.5.3.AVERAGE SCENARIO:

Tab:5.5.3.Average cash flow analysis

CASH FLOW ANALYSIS		
July - September - AVERAGE SCENARIO		
Considering the occupancy as 75 %		
TOTAL OCCUPANCY - 300 nos		OCCUPANCY AT 65% = 225 nos
1	Hot desk occupancy = 40 nos	
2	Dedicated desk occupancy = (4 - 3 seater) 21 nos	
3	Private cabins occupancy = (6 - 5 Seater) 16 Nos	
THE AVERAGE COST FOR EACH TYPE OF OCCUPANCY PER MONTH:		
1	Hot desk	Rs. 7500 / Month
2	Dedicated desk	Rs. 15,000 / Month
3	Private cabins	Rs. 38,500 / Month

REVENUE		
1	Hot desk	Rs. 3,00,000
2	Dedicated desk	Rs. 3,15,000
3	Private cabins	Rs.6,16,000
4	Meeting room and events and space utilities	Rs.88,400
	TOTAL	Rs. 13,19,400
COSTS / EXPENSES		
1	Staffs	Rs. 84,000/Month
	Considering 2 staffs for reception (Rs.15,000) ,Other staffs 2 (Rs.12,000) and one manager (Rs.20,000) and watchman (Rs.10,000)	
2	Cleaning services	Rs.21,000 /Month
	Considering 3 nos of workers of salary , Rs7,000	
3	Beverages	Rs.22,000
4	Utility service costs	Rs.4,11,020
	Consists of electricity - Where it takes an average of about 1.5 unit / sqft for 32,500 sqft = 48,750 unit is required, One unit cost for commercial is Rs.13. For the occupancy of 85% Its been calculated = Rs.4,06,800 Rs.2420/month Sewage Charge - Rs. 1800 /Month Water supply it costs	
5	Paid advertising	Rs.10,000 /Month
6	Office utilities	Rs.8,000
7	Internet services	Rs.35,000
8	Other miscellaneous	Rs.10,000
	TOTAL	Rs. 6,01,020

5.5. Cash flow analysis per year :

Based on the revenue and costs that are identified for different scenarios the cash flow analysis for a years is done .Considering A year has 2 optimistic and 1 pessimistic and 1 average scenario.

Tab:5.6.Cash flow analysis per year

CASH FLOW ANALYSIS												
In Rs.	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
CASH IN	13,93,100	13,93,100	13,93,100	12,71,200	12,71,200	12,71,200	13,19,400	13,19,400	13,19,400	13,93,100	13,93,100	13,93,100
CASH OUT	6,47,220	6,47,220	6,47,220	5,65,820	5,65,820	5,65,820	6,01,020	6,01,020	6,01,020	6,47,220	6,47,220	6,47,220
NET CASH FLOW	7,45,880	7,45,880	7,45,880	7,05,380	7,05,380	7,05,380	7,18,380	7,18,380	7,18,380	7,45,880	7,45,880	7,45,880
TOTAL INCOME PER YEAR	Rs. 87,46,560 / YEAR											

5.6. Payback period :

Payback period is the amount of time does it take to recover the amount of investment made.Lesser payback period more feasible the models



$$\text{PAY BACK PERIOD} = \frac{\text{INITIAL INVESTMENT MADE}}{\text{NET ANNUAL CASH FLOW}}$$

Since , to calculate the pay back period , the cash flow for the 10 years have been identified , since the cash flow varies every year and not constant.

Tab:5.7.1.Cumulative net cash flow

	YEAR 1	YEAR2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Scenario	O	O	O	O	O	N	P	P	P	N
Occupancy %	77%	90%	90%	85%	85%	80%	70%	70%	70%	60%
Average occupancy numbers(Total number of occupancy x 200)	213	252	252	250	238	224	156	156	156	225
Revenue										
Fee growth %	0%	8%	8%	8%	8%	3%	-5%	3%	3%	3%
Expenses										
Expenses growth rate %	0%	6%	6%	6%	6%	6%	6%	6%	6%	6%
(NOTE - The percentage of growth is being identified from a research paper - (A study of co-working operating model) (and i). Office real estate report of 2021 and Building operating expenses and business operating expense is identified and including expenses considered negligible										
REVENUE	Rs. 1,81,30,490	Rs. 2,09,91,896	Rs. 2,09,11,389	Rs. 1,93,80,511	Rs. 1,92,82,904	Rs. 1,71,95,099	Rs. 1,55,77,014	Rs. 1,52,88,210	Rs. 1,52,81,679	Rs. 1,70,73,762
COSTS (EXPENSES)	Rs. 73,87,840	Rs. 96,46,841	Rs. 91,67,831	Rs. 91,73,680	Rs. 86,94,607	Rs. 81,27,043	Rs. 71,33,078	Rs. 70,61,063	Rs. 70,98,119	Rs. 66,31,360
NET CASH FLOW	Rs. 87,46,560	Rs. 1,08,34,555	Rs. 1,11,43,578	Rs. 1,01,94,433	Rs. 1,05,88,297	Rs. 90,68,056	Rs. 84,43,936	Rs. 77,25,146	Rs. 81,83,551	Rs. 90,41,460
Cumulative Revenue	Rs. 1,75,31,350									
Cumulative Costs	Rs. 81,43,880									
Cumulative Net cash flow	Rs. 93,87,467									

(NOTE : The occupancy scenario and growth percentage of expenses and revenue has been referred from a research paper - A study of co-working operating model and CBRE and JLL office real estate report 2021 , and few details have been identified from Awfis co-working space near annasalai)

Tab:5.7.2.Payback period

PAY BACK PERIOD		
SCENARIO 1	Development cost	Rs. 15,27,02,500
	PAYBACK PERIOD	15,30,02,500/ 93,87,667
		16.2 YEARS
SCENARIO 2	Development cost	6,82,27,500
	PAYBACK PERIOD	6,85,27,500/ 93,87,667
		6.2 YEARS
SCENARIO 3	Development cost	4,91,12,500
	PAYBACK PERIOD	4,91,12,500 / 93,87,667
		5.2 YEARS

5.7. Benefit to cost ratio :

It defines the relationship between the benefits and the costs , If the benefit is higher than the costs it would provide value for the project and vice versa

Tab:5.8.Benefit to cost ratio

BENEFIT COST RATIO	
FORMULA	Present value of all benefits / present value of all costs
Benefits	1,61,30,400
Costs	73,83,840
BCR	1,61,30,400 / 73,83,840
	2.18
When , the BCR is GREATER THAN 1 the project is viable and the NET PRESENT VALUE of the project will exceed 0	

5.8. Net present Value :

It is done to analyse the profitability of the project

Tab:5.9.NPV

NET PRESENT VALUE	
FORMULA	Summation of all expected benefits-Summation of all expected costs
Benefits	1,61,30,400
Costs	73,83,840
NPV	1,61,30,400 - 73,83,840
	Rs. 87,46,56060 / YEAR

5.9. Internal rate of return :

It is used to analyse the profitability of the potential investment - A good IRR is 13% for 10 years

Tab:5.6.IRR

IRR		
CALCULATING IRR FOR 1 YEAR		
PROFITABILITY MEASURE		
Formula	Net profit / cost of investment x 100	
SCENARIO 1	60,55,560/ 15,27,02,500	4%
SCENARIO 2	60,55,560 / 6,82,27,500	9%
SCENARIO 3	60,55,560 / 4,91,12,500	12%

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1. Analysis from payback period and IRR

It is observed that SCENARIO 1 has the higher development cost which is 2.5 times greater than the SCENARIO 2 and 4.2 times greater than SCENARIO 3.

PAYBACK PERIOD -

The payback period is less for SCENARIO 3 and SCENARIO 2, but in case of SCENARIO 1 the pay back period is very high which makes it inefficient SCENARIO for decision making

BENEFIT COST RATIO -

This benefit to cost ratio value is greater than which makes the model viable in decision

INTERNAL RETURN RATE -

The IRR is high for SCENARIO 3 and for SCENARIO 2, But it is as per minimal rate SCENARIO 3 is more than 13%

From all these results, it is concluded that, the circular models - Adaptive re-use, flexible spaces and relocatable buildings are **COST EFFECTIVE, RETAINS THE CULTURAL VALUE OF THE AREA, ADDS VALUE TO THE BUILDING, AND HAS A GREATER FINANCIAL STABILITY & RETURNS AND PREVENTION OF DEMOLITION REDUCES WASTE AND POLLUTION AND WASTAGE OF MATERIALS.**

- Rather than traditional linear model, demolition of space and adopting to traditional office space than flexible leads to less profitable scenario and generates less value.
- A holistic, blended approach to circular economy principles on a project will be the

most effective way of maximizing the benefits

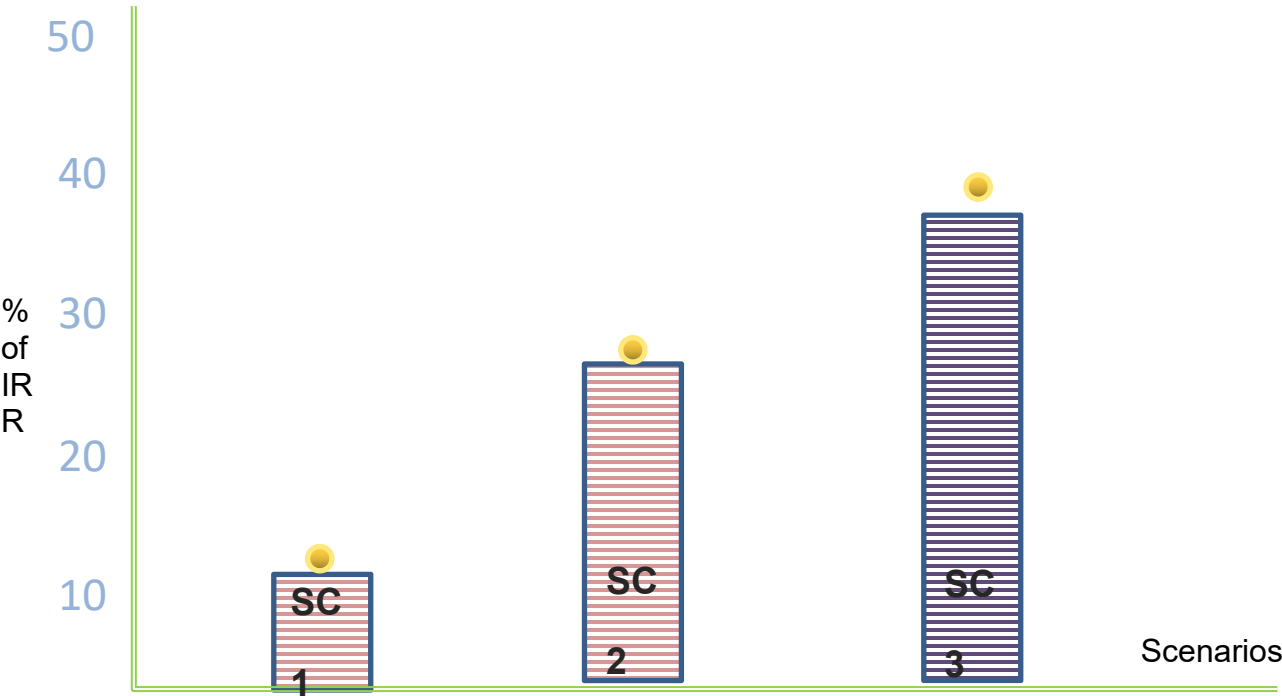


Fig:6.1.IRR of three scenarios

- The IRR value for 10 years should be minimum of 13% , which is considered as viable.
- The IRR for scenario 2 is 2.5 times higher than scenario 1

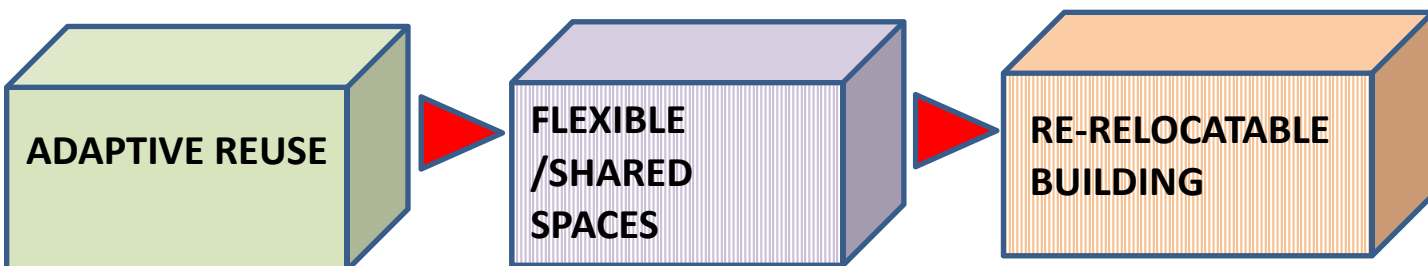
Tab:6.1.Description of each model



	Adaptive assets	Relocatable building	Flexible spaces
--	-----------------	----------------------	-----------------

Description	Building that adapts to alternative use	Buildings which can be re-used and has resale value	Where the tenants occupy the underutilized space
Lost value captured through	Pre mature demolition	Easy construction and low cost	Using under utilized space
Financial returns	The financial return was two times greater	The financial return was Four times greater	The financial return was Two times greater

6.2. Feasible Among these circular model

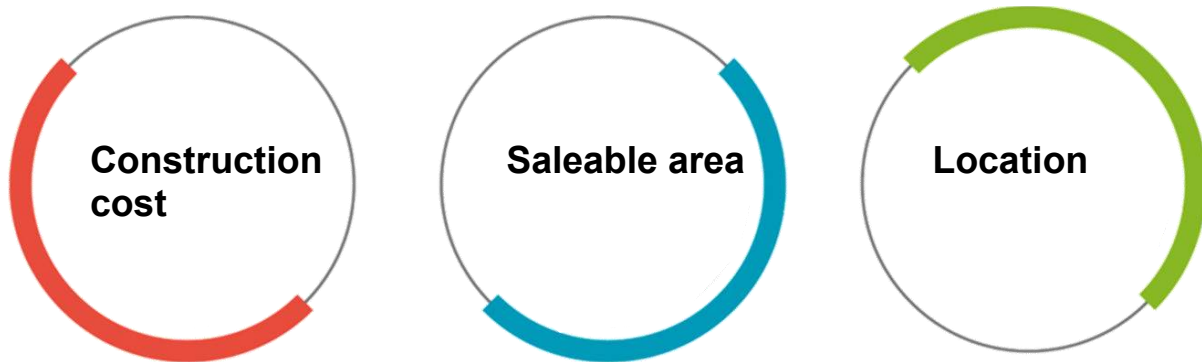


Adaptive re-use and Flexible/shared spaces are considered the effective way of potential return with less impact to the environment .

Relocatable building is more profitable and has potential return but will be efficient in a vacant land rather than demolition.

And there is no doubt that adaptive re-use is a better decision to enhance the value of the building , and which is towards sustainable economic development.

6.3. The other factors that affect the final outcome of the models:



- These models also depends upon the amount of investment made and loan amount , if the monthly interest rate is high the pay payback period tends to be longer

6.4.NON-MONETARY BENEFITS :

Tab:6.4.Non-Monetary benefits

Environmental benefits	Because residues are seen as valuable and they are absorbed as much as possible in order to be reused in the process. Less cause of pollution Reducing landfills
Resource saving	When compared to linear model , the circular model has a large amount of material savings up-to 70% in saving materials from demolishing . And Usage of used containers considered as a new development in the value chain Higher utilization
Social benefits	Social connectivity among the people Keeping materials in a closed loop

- In this circular sphere, profit opportunities may come from playing in new markets, cutting costs off with waste and energy reductions and the assurance of continuity of supply.
- Old buildings contribute to the significance and identity of the urban fabric, hence by maintain g these buildings would maintain the identity and smart growth essential for sustainable development.
- For these modes , the other focus should be on CHANGING BEHAVIOURS .
- Adaptable Assets reduces demolition activity, improving air quality from reduced dust and traffic
- And providing tax incentives for adaptive re-use will make an impact in the society.

6.5.RECCOMENDATIONS :

- The combination of two or more business models would be more profitable.In this case the electricity bill was the major cost generation factor , so by ADAPTIVE REUSE + FLEXIBLE SPACES + RENEWABLE SOURCE OF ENERGY , the expenses will be reduced will increase my net cash flow and add towards sustainability
- And usage of used materials which reduces the materials costs , which inturn reduces the development cost .

References

- 1) A G Pfeifer (2017) “ Barrier and enablers to circular business models “ , submitted to real estate development Netherlands” , Netherlands , April , Pg - 8 - 20
- 2) Archana Datta, (2019) , Accelerating Indias circular economy shift “ A report by FICCI , January , Pg - 12 - 15
- 3) Antti Peltokorpi , Riikka Kyrö (2019), “Embodying circularity through usable relocatable modular buildings “ ,Submitted to school of engineering ,Finland , January , Pg - 6- 13
- 4) Devni Acharya (2020) .”From principles to practises - Realising the value of circular economy in real estate sector “Matthew Cox, Arup , UK , April , Pg - 10 - 54
- 5) David Thelen, Mike van Acoleyen, Wouter Hurman, Tom Thomaes (2018),”Scaling the circular built environment “ Nicolas Raspail, Alexandru Grigoras (Circle Economy),November ,Pg - 10 - 30
- 6) Ellen Marathur foundation (2016), “Circularity in the built environment “ , Publication by ellen marathur foundations , India , April , Pg - 6 - 25
- 7) Janis Zvirgzdins (2019) ,” Circular economy in built environment and real estate industry”,Submitted to Institute of civil engineering and real estate economic, Riga,May , Pg - 2 - 10
- 8) Nart Stas, (2007),” Economics of adaptive reuse of old buildings - A financial feasibility study and analysis”,A thesis presented to the university of Waterloo , Canada , Pg - 4 - 150
- 9) Shweta Kakkar , “Co-working re-shaping Indian working spaces “ , Niharika Bisaria , 2019 , Pg - 3 - 7

- 10) Wenzhi shai (2017) "A study of the co-working operating model", Submitted to the Program in Real Estate Development in Conjunction with the Center for Real Estate in Partial Fulfillment of the Requirements for the Degree of Master of Science in Real Estate, India, February, Pg-11-64
- 11) Circular economy are leading to better real estate investments, <https://www.arup.com/perspectives/the-circle-expands-circular-economy-ideas-are-leading-to-better-real-estate-investments>, March, 20.
- 12) Real estate market in Madipakkam, <https://housing.com/news/madipakkam-property-market-overview/>, April, 24
- 13) The Hindu - Chennai emerging real estate hot spot, <https://www.thehindu.com/real-estate/chennais-emerging-real-estate-hotspots/article33818555.ece>, April 25.
- 14) Co-working space revenue, <https://www.coworkingresources.org/overview/revenue#profits-and-losses>, April, 17
- 15) Biggest challenges faced by co-working spaces, <https://inc42.com/features/what-are-the-biggest-challenges-faced-by-coworking-spaces/>, March, 20
- 16) Co working the hidden treasure for investors, <https://www.entrepreneur.com/article/344159>, April 11
- 17) Why real estate needs circular economy in its business models, <https://industrywired.com/why-real-estate-needs-circular-economy-model-in-its-business/>, March 27
- 18) Cost benefits major draw for co-working space, <https://economictimes.indiatimes.com/jobs/cost-benefits-major-draw-for-co-working-spaces/articleshow/58231345.cms>, March 16
- 19) Circular economy, <https://youmatter.world/en/definition/definitions-circular-economy-meaning-definition-benefits-barriers/>, March 12

20) Mr.Ram(2021, April 5) Personal Interview , Real estate consultant

21) Mr. Hari (2021 ,April 11) Personal Interview

22) Ar.Arun (2021 ,April 16) Personal Interview

23) Ar.Aran (2021 , April 15 , April 5) Personal Interview

24) Mr. Kumar (2021 , April 21) Personal Interview

25) Mrs. Vanmathi (2021 , March 25) , Personal Interview

26) Mr. Radhakrishnan (2021 , April , 17) Personal Interview

27) Mr. Narayani (2021 , April 5 and April 6) Personal Interview

28) Among the residents of Keelkatalai (April , 22)

29) Mr. Rakesh kumar (2021 , April 21) , Personal Interview

