

An enquiry on
Ignorance of Ecological costs
in Architecture Practice



Guided by Prof. Urvi Desai
B.Arch. Research Thesis
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Declaration

This work contains no material which has been accepted for the awards of any other degree or diploma in any University or other institutions and to the best of my knowledge does not contain any material previously published or written by another person except where due reference has been made in the text.

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Date: 24 November 2017

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THESIS TITLE: AN ENQUIRY ON IGNORANCE OF ECOLOGICAL COSTS IN ARCHITECTURE PRACTICE

APPROVAL

The following study is hereby approved as a creditable work on the approved subject carried out and presented in the manner, sufficiently satisfactory to warrant its acceptance as a pre-requisite to the degree of Bachelor of Architecture for which it has been submitted.

It is to be understood that by this approval, the undersigned does not endorse or approve the statements made, opinions expressed or conclusion drawn therein, but approves the study only for the purpose for which it has been submitted and satisfies him/her to the requirements laid down in the academic program.

Signature of the Guide
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Date: 24 November 2017

Acknowledgment First of all, I would like to express my gratitude towards CEPT University for providing the enabling environment that knowingly or unknowingly, directly or indirectly influenced the development of my thinking as an individual as well as an Architect.

The long journey of writing thesis had been very exciting and a very personal one. I would like to express my sincere gratitude to my mentor and thesis guide **Prof. Urvi Desai** for her remarkable opinion and constant support throughout the development of the thesis. The journey would have been much more challenging without her guidance and positivity. My respective thanks to **Prof. Vishwanath Kashi**, **Prof. Jigna Desai**, **Prof. Pratyush Shankar** and **Prof. Meghal Arya** for providing significant insights during this long journey.

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“Architecture is an important non-verbal medium for the communication of values about ways of life, aesthetic aspirations and, more generally, cultural ideologies. It always reflects the distribution of political and economic power within society”.

Architecture and Independence: the search for identity in India 1880-1980;
Desai Madhavi, Desai Miki, Lang Jon (1997)

Abstract Design is a very small part of the picture when one looks at the entire process of the act of building. But it possesses the power to bring impacts for generations to come. Staticity of the built form make its impacts resonate across the ages. These impacts, either good or bad, are beyond the static built environments and its presence is felt at macro scales like complex ecological systems.

This thesis takes the opportunity to look into the interdependency and relationships of architecture practices, building industries and the natural world. It attempts to identify forces experienced within as well as surrounding systems of Architecture practice that lead to the ignorance of Ecological Costs. This is carried out through Literature studies to examine the web of human systems as well as the natural systems, and therefore be able to identify factors at stake, to determine the Ecological costs. The literature study adopts the Bronfenbrenner's ecological theory model, and hence comprises derivation of deeper understanding and connecting the dots between diverse disciplines like *Physics, Social Sciences, Political science, Education, Religion, Ecology, Psychology, Economy and Architecture*. The close examination of these disciplines provided tremendous insights regarding extreme interdependency of human and natural systems and proved to be highly beneficial in the process. Literature study covers the factors at play in Macroscales whereas Case Studies examines at microscale. Inference from these literature studies suggests a significant presence of real estate and market driven forces in the production of Architecture. Hence, four case studies (situated in Vadodara and Ahmedabad) influenced by real estate and market driven forces are carried out through analytical methods. These studies complemented the inferences derived from literature studies.

The document could be easily misunderstood to be one more addition to the discussion of sustainability. But rather, this study is about system thinking and a holistic view of the Architecture profession with that of the natural as well as human world. This study considers *Ignorance of Ecological costs* as the symptom of a larger, much complex and a very serious problem at all the level of human society in recent times. Through this study, one can anticipate to be able to locate the root cause of these symptoms. This shall help to determine and understand the critical role of Architecture for bringing consciousness within society in order to achieve better emotional and physical well-being through built environments.

Key Words: System thinking, Ecology and Architecture, Ecological costs, Ecological ignorance, Built environments, Human habitat.

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Nature of Ignorance Analysis

1

Introduction

- 1.1 Hypothesis, Aim and Objectives
- 1.2 Methodology
- 1.3 Scopes and limitations
- 1.4 Organisation of thesis

“What we do to our landscapes, we ultimately do to ourselves”

Benjamin Vogt

1

Introduction

Built environments are the ‘Niche’ created by human species to carve space for themselves amongst a pool of species sharing that space in the same area. In ecological science, *Niche construction* is defined as the process of changes in the local environment and in the process altering environments of their own as well as another species, in order to shelter themselves themselves (*Semiotics Encyclopedia online, E.J. Pratt Library - Victoria University, 2001*). A nest is a niche for a bird, earth colonies for ants, and buildings are for Humans. In the world of ants, “a typical colony has an egg-laying queen and based on the division of labor the adult workers are divided into different groups. Being one of the social species, just like human division of labor; these workers are divided to do various tasks such as nest construction, maintenance, foraging, tending the queen and nest defense” (*Singh, 2006*).

If such an analogy is pictured for Human species, Architecture profession would be one of the subdivisions of the ‘Niche Construction’. The exponential growth of human population in recent times has wiped away the notion of human belongingness to the nature from the consciousness and hence been regarded as an external entity. So, this analogical vision, that draws parallels between human buildings and that of Ant’s colonies, is essential for introduction of this thesis as it develops imagery in the reader’s mind that the process of Architecture is as similar to that of making a nest or Ant colony.

Architecture is an integral part of Built Environment and the process of human niche creation. Majority of Archtiecture practices does not consider the importance of integrating ecological conscious practices as part of their design belief. Not only Architecture practices, but in general, there seems to be neglect of such values within Architecture fraternity as well as construction industry. This is eventually reflected into the way the living environment unfolds.

This thesis takes an opportunity to inquire the reason behind ignorance of Ecological costs in Architecture profession. The hypothesis is, that there is general ignorance of ecological awareness within education as well as practice. Through the literature studies and case studies undertaken in this document, the objective is to look for ecological ignorance through holistic lenses, system thinking approaches and study areas beyond Architecture profession in order to locate the reasons and nature of Ignorance.



1.1

Hypothesis There is an Ignorance of ecological costs in Architecture Practice.

Aim To find if there is any ignorance of ecological costs in (main stream) Architecture practice and the nature/causes of the ignorance, if any.

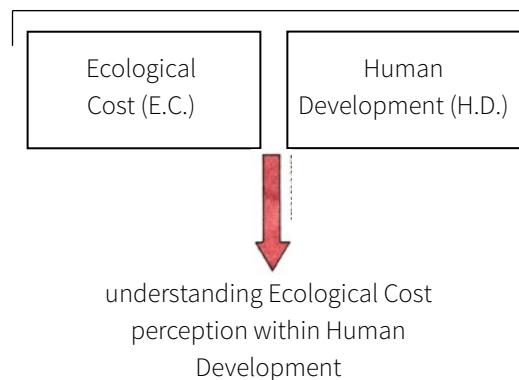
Objective

- Find what is ecology and how it relates to Built Environment.
- In what ways and how the intricate interdependency between human and nature has changed in recent past.
- To find out how Architecture practice orients itself around the recent changes in society and systems.

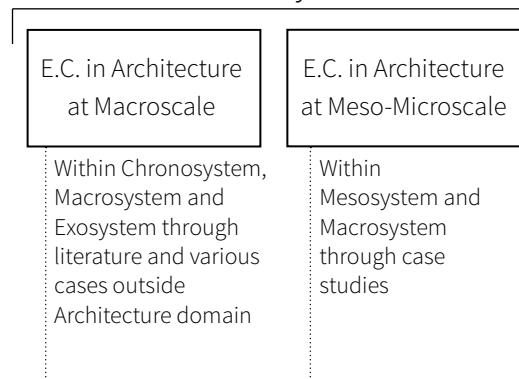
1.2

Methodology

Literature Study



Analysis



1.3

Scope & Limitations The holistic outlook to discussions and relationships between ecology and Architecture have been studied. The wide range of literature study provides different set of opinions, perspectives and ideologies formed over a period of time. To look for the factors that affects current form of (mainstream) Architecture practice, a sample study of four case projects are carried out. This sample study can be further developed and replicated to be able to locate the missing link between ecological awareness and current scenario of Architecture practices.

[redacted]

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- 1.4 Thesis is organized in 5 chapters**
- Organisation of the thesis**
- Chapter 1:** This is an introduction to the research and explains its aims as well as methods to explore the area of focus.
- Chapter 2:** This chapter is divided in two parts. Part one is an introductory section of the study to develop basic understanding of Ecology as a discipline and overlapping spheres between Ecology and Architecture. Also, the outline of ‘Ecological cost’ in context of this thesis is explored and an analytical framework is developed that is used to carry out the case studies.
- Chapter 3:** This chapter is divided in four parts. In part one, an overview of ecological stances taken by different group of people within India, i.e. the Architecture fraternity and Architecture profession in India. Part two explores peripheral forces from Exosystem sphere of Bronfenbrenner’s ecological model in order to find presence of ecological ignorance in those systems. Part three frames the analysis conclusion from the studies carried out in part one and two. Part four explores Mesosystem and Microsystem of Bronfenbrenner’s ecological model in order to find presence of ecological ignorance within Architecture practice.
- Chapter 4 :** In this chapter, examination of ecological ignorance with respect to Architecture profession is carried out through four case studies located in Vadodara and Ahmedabad. The inference from these studies are derived through Bronfenbrenner’s ecological model and Ecological cost wheel.
- Chapter 5 :** Inference from the study is derived.
- Bibliography and references**
- Appendix :** Sample questionnaire for the case study



2 Understanding the Background

2.1 What is Ecology?

2.1.1 Ecological Processes

2.1.2 Ecological Systems

2.1.3 Built environment as subset of ‘Ecology’

2.2 What is Ignorance?

2.3 Analytical Framework

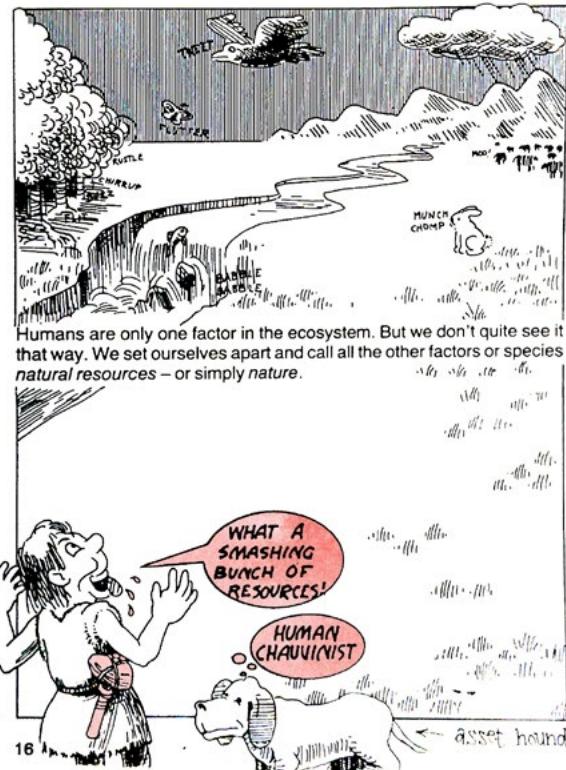
2.3.1 Human Ecological Development Model

2.3.2 Ecological Costs

2.3.3 Thesis Analysis Framework

The Ecosystem

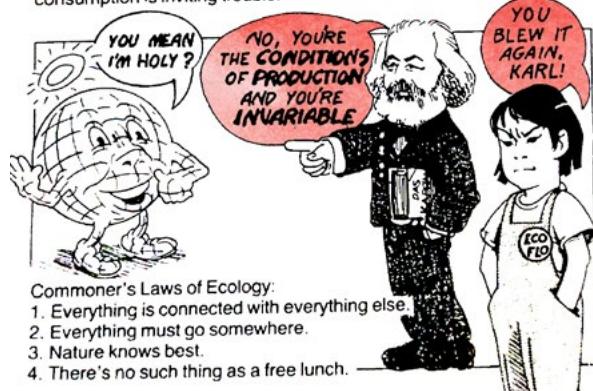
The ecosystem is the complex web linking animals, plants and other life forms in any particular environment, whether it's your windowbox or the whole biosphere. Everything hangs together in the ecosystem — alter one part and you alter the others. Sooner or later.



Human survival depends upon preserving the ecosystem. It's the boundary of existence, the framework of human activity. The ecosystem can do without us but we can't do without the ecosystem. As long as we live on Earth.



Viewing nature as no more than a bundle of resources for human consumption is inviting trouble.



- Commoner's Laws of Ecology:
1. Everything is connected with everything else.
 2. Everything must go somewhere.
 3. Nature knows best.
 4. There's no such thing as a free lunch.

Figure 1
Illustration of general perspective of ecosystem by human
Source // *Ecology for beginners*, Croall Stephen. pg16

2.1

Basics of Ecology

The literal Hindi translation of the word *Ecology* means ‘परिस्थिति विज्ञान’, which means the Science of Situation. Unlike *Environmental Science* i.e. ‘पर्यावरण विज्ञान’ , in which human is positioned outside the natural systems; this ‘Science of situation’, as per the name suggests, is a study of the forces acting within as well as outside the existing systems of a place in a given frame of time.

“Nature cannot be reduced to fundamental entities, like fundamental building blocks of matter, but has to be understood entirely through self-consistency. Things exist by virtue of their mutually consistent relationships, and all of physics has to follow uniquely from the requirements that its components be consistent with one another and with themselves (Capra,1989).”

The word ‘ecology’ rather than ‘environment’ in the title is carefully chosen. In recent times, the prefix ‘eco’ has become synonymous for eco-friendly living. This green fad, however, has to do more with conservation biology than that of ecology. Irrespective of their size and shape, all organisms need to interact with the neighbor species of their place, their neighborhood, and their environment in order to survive. “Ecology” is the scientific study of the interactions between organisms (including human) and their environment (the surrounding). The field is dedicated for improving our understanding of life processes, interactions, and adaptations; movements of material and energy through living communities; the abundance and distribution of organisms; successive development of ecosystems and biodiversity in the context of the environment.

In order to identify the Ignorance of Ecological cost in a profession like Architecture that deeply engages with the formation of human habitat, it becomes utmost important to understand the basics of ‘ecology’, what are the systems and processes bound to the frame of time and in what ways human intervene in these systems. **Therefore, in this section, the attempt is to develop a basic understanding of the science of ecology (for the reader), its intricate relation to human activities and in what ways it would be used to carry out the study.**

- 2.1.1 **Ecological Processes** The interaction within inanimate world are the lifeblood of living beings as it provides conditions that allow life to thrive upon it. Ecological processes are the physical, chemical and biological actions or events that link organisms and their environment (*Green Facts: facts on health and environment, 2001*). Processes like hydrology, nutrient cycles,

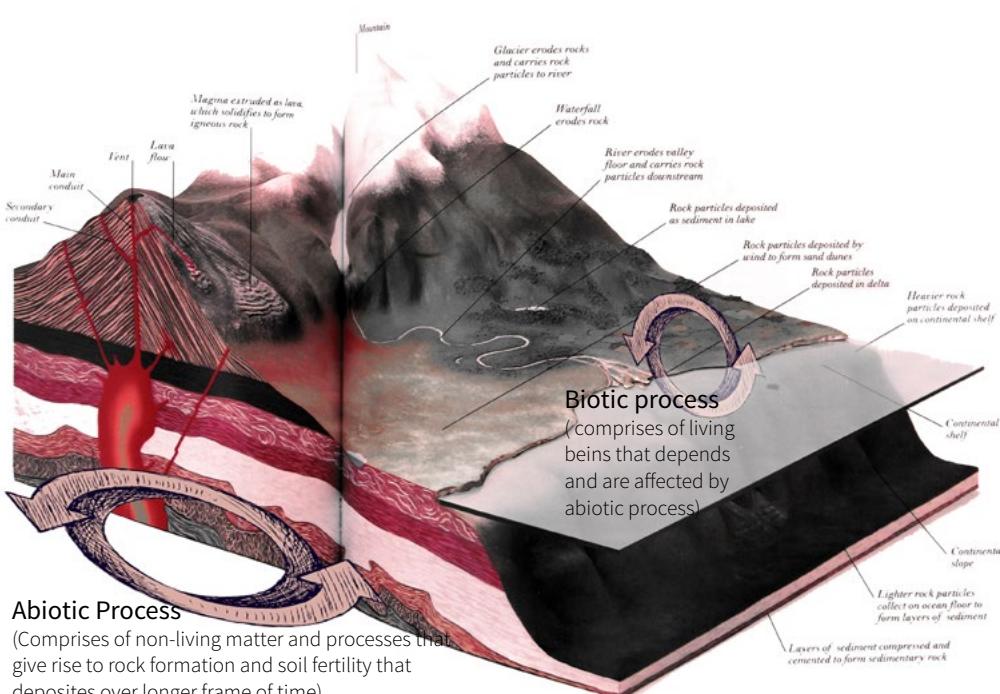


Figure 2

Ecological Processes, Biotic- Abiotic processes
Source // Ultimate Visual Dictionary, Evans Jo. pg 266 (modified)

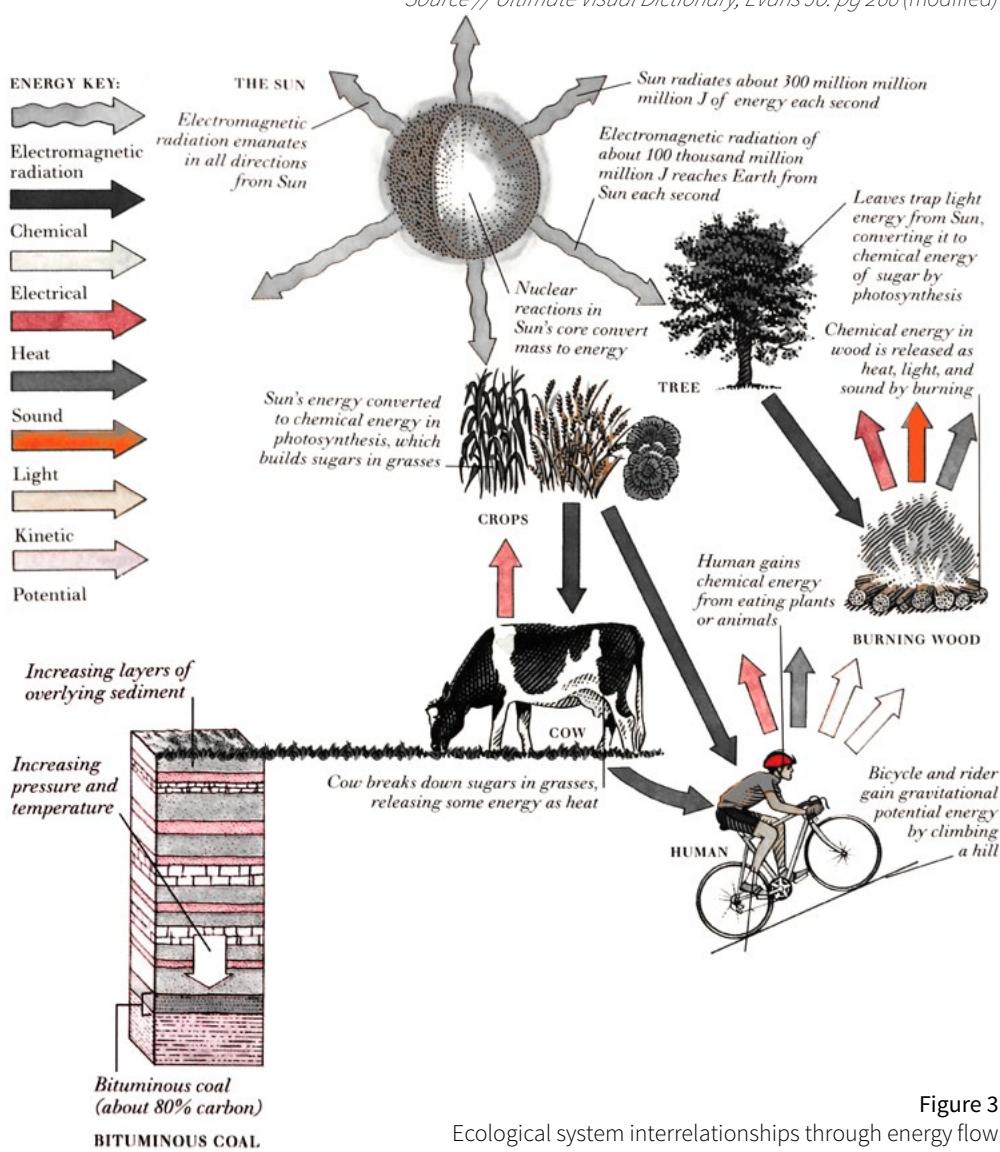


Figure 3

Ecological system interrelationships through energy flow
Source // Ultimate Visual Dictionary, Evans Jo. pg 315 (recreated)

biotic interactions, species population dynamics, and evolution determine the species composition, habitat structure and ecological health of every site and landscape (*US Environmental Protection Agency, 2014*).

These cycles tend to maintain balance through various abiotic conditions like weather and factor of time. But in recent years, scientists have discovered that these are subjected to irreversible changes due to unexpected alterations by invasive species and human interventions. Advancements in science and technology has made it possible to create new compounds that does not form naturally in the environment (out of which, few are extremely toxic). Its adverse effects on humans and other species has not been assessed and potentially trigger irreversible changes in the bio-systems. These actions are slow and steady whose intensity and impacts are difficult to determine. These compounds has been unconsciously or consciously released in Ecological processes. So, in the long run, these are responsible for determining the species composition of an area and the survival of human beings.

2.1.2

Ecological Systems Interspecies interactions exist usually because of the need for energy to sustain life. Under the discipline of ecology, it is recognized as energy transfer between two broad categories of Heterotrophs and Autotrophs. Heterotrophs comprise of species who depend on Autotrophs for energy. Only Autotrophs possess the ability to capture energy from the sun and convert it in a form that can be consumed by heterotrophs to gain energy.

In this web of energy transfer, popularly known as Food web, the keystone species plays critical role. A keystone species is recognized as a species which is connected to a disproportionately large number of other species in the food-web. This makes them capable of maintaining the organization and structure of the entire communities present around them. They have the ability to result in a range of dramatic cascading effects that alters tropic dynamics and other food web connections. (*Joern Fischer, 2006*).

Within this energy transfer structure, human species as a whole is recently positioned as *Hyper-keystone species* (*Yong, 2016*). He says “*we, hyper keystone species, are the influencer of influencers, the keystone species that disproportionately affects other keystone species, and the ur-stone that dictates the fate of every arch* (*Yong, 2016*)” .

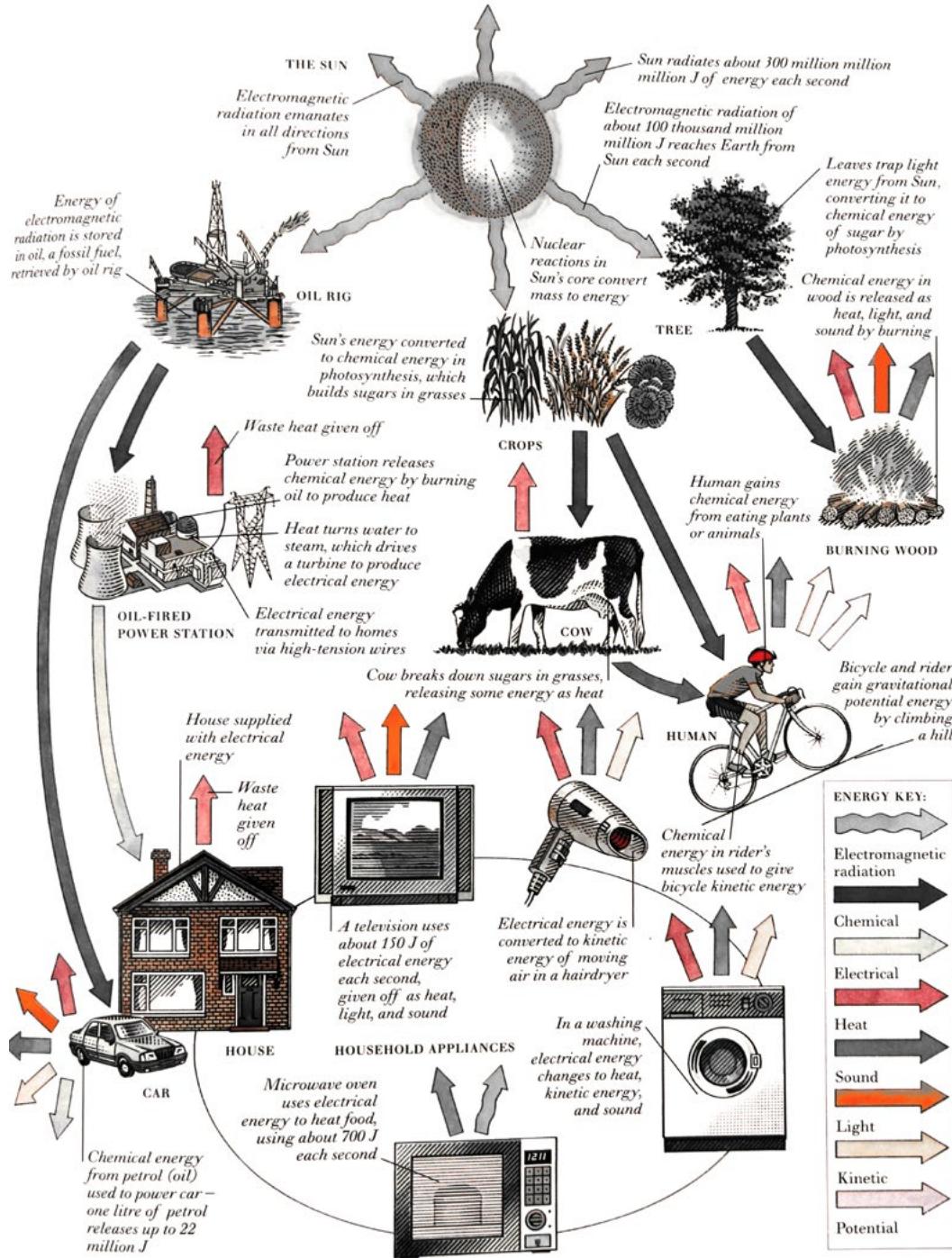


Figure 4
Energy and resource flow relationships between Human, Nature and built environment
Source // Ultimate Visual Dictionary, Evans Jo. pg 315

2.1.3

Built environment as a subset of ‘Ecology’ Ecology and Built environments, both are part of complex processes that contains numerous systems within itself. In order to simplify the study of interconnectedness between them; firstly, the participatory systems are explained in isolation and then dots of interdependency are connected. In nature, the processes followed by other species to form built environments are characterized under following categories.

Habitat// The natural environment in which an organism lives, or the physical environment that surrounds a species population (*Habitat, 2017*).

Niche// An ecological niche is described as how an organism or population responds to the distribution of resources and competitors; and how in turn alters those same factors (*James H.Brown, 2005*).

Niche construction// Niche construction is the process whereby organisms, through their activities and choices, modify their own and each other’s niches (*Dr. John Odling-Smee, 2013*).

Biome// refers to a community of living organisms that have same characteristics for the environment they exist in containing distinct biological communities. It is basically formed in response to a shared physical climate (*The World’s Biomes, 1996*).

These terminologies are not merely definitions but rather explain key features for human habitat formation and hence intricately connects to Architecture and built environment (fig.4). The journey for human started as a hunter-gatherers where resource competition between human and surrounding species were balanced. The advancement in technologies and ability to grow food initiated the process of gap between the two (human and surrounding species). **While in the earlier times, food was one of the main reason for intervention in nature; in present days, a large proportion of intervention is through the act of building industry (Green facts, 2001)**. This industry is one of the highest extractor as well as consumer of the resources, and one of the biggest reason for pollution as well. The process of human niche construction is modifying entire biome to the extent of irreversible changes in natural cycles. **For example, a ton of cement is made from 1.4 tons of limestone, 300 kilos of clay and 60 kilos of silica sand. In order to fetch these raw materials, a large chunk of forest land and hills/mountains with limestone deposition are cut down.** The replenishment of these resources and deposits take millions of years of ecological processes. Hence, it is critical to introspect the way Architects and Planners are engaged in the process of habitat creation, and the changes that they must anticipate.

“Making the decision to remain ignorant by committing to an ideology despite scientific proof is a dangerous mindset that can inhibit an individual from discovering the truth and therefore developing as an individual (Lee, 2015).”

In this quote, replacing the word *individual* with the word *Professionals* probably provides a better insight to look it from the lens of Architecture profession. The dictionary meaning of the word *Ignorance* means “being in the state of lack of knowledge”. In context of this thesis, Ignorance is referred to the lack of knowledge of Ecological systems within Architecture profession. This state has many roots in history albeit access to a vast pool of knowledge through the technological development of Internet and travel.

Psychologist (Peels, Blaauw, 2016) segregates the state of lack of knowledge i.e *ignorance* into three major categories:

Factual ignorance// refers to absence of knowledge of facts.

Objectual ignorance// refers to un-acquaintance (limited familiarity) with the actual object.

Technical ignorance// refers to absence of knowledge of how to do something that could actually be done. (Nikolaj, 2015)

This categorization is based on the kind of circumstances that shapes the nature of the state of ignorance. Just like a coin with two sides, this state of unawareness goes hand in hand with that of seeking knowledge. An intrinsic psychological behavior triggered by ignorance tend to make a person reject contrasting valid arguments or information without making them realize its importance or need of understanding. “It is impossible to be able to completely eliminate ignorance but reducing the gap between the state of knowledge and lack of it has potentially long-term positive effects (Bryan, 2009).”

In this chapter, the attempt is to be able to locate forces that dictates the nature of Architecture practice presently. This is carried with the help of the ecological cost wheel (fig.7) in which all the systems - Chronosystem, Macrosystem, Exosystem, Mesosystem, Microsystem - are studied briefly. Eventually, an attempt is made to locate the **root systems** that leads to ignorance and then find the nature of ignorance present in the profession that cripples possibility of positive actions.

2.2

What is Ignorance?

2.3 Analytical Framework

In this section, the analytical framework for the thesis is elaborated in brief.

There are two pillar parameters for the analysis of the study undertaken through literature as well as case study analysis. **First parameter** comprises the indepth study of the way human mind develops, behaviours that influence the choice of actions as an Individual as well as group. While second parameter is enrooted to determine the parameters for ecological cost and factors that can precisely encompass ecological impact during the act of building.

2.3.1

Human Ecological Development Model In this particular section, the attempt is to examine the systems that affect development of Human behavior and psyche in order to identify environments that determine collective beliefs, and eventually course of actions within building industry as well as other systems in place.

Human enjoys a powerful position compared to other species because of the ability to think, imagine, create essential tools and organize human society in a way that can possess power over the energy flow of nature (Yong, 2016). From various studies regarding development of Human psychology and behavior, the ‘Ecological system theory’ (*The ecology of Human Development*,1979) model proposed by **Urie Bronfenbrenner** found to be most appropriate for this thesis. This theory provides framework of relationships with individual’s context within communities and the wider society. Studying this particular framework provides deeper understanding regarding people and their environment in order to comprehend their interconnectedness. *Its ability to look at human development through various scales make this model appropriate for the thesis as it examines individual parts as well as connect them under holistic system view.* He divides the model under following five systems and examines how each systems plays critical role in human development.

Microsystem// refers to the institutions and groups that directly and most immediately impact the individual’s development, which **includes family, friends, education and neighborhood.**

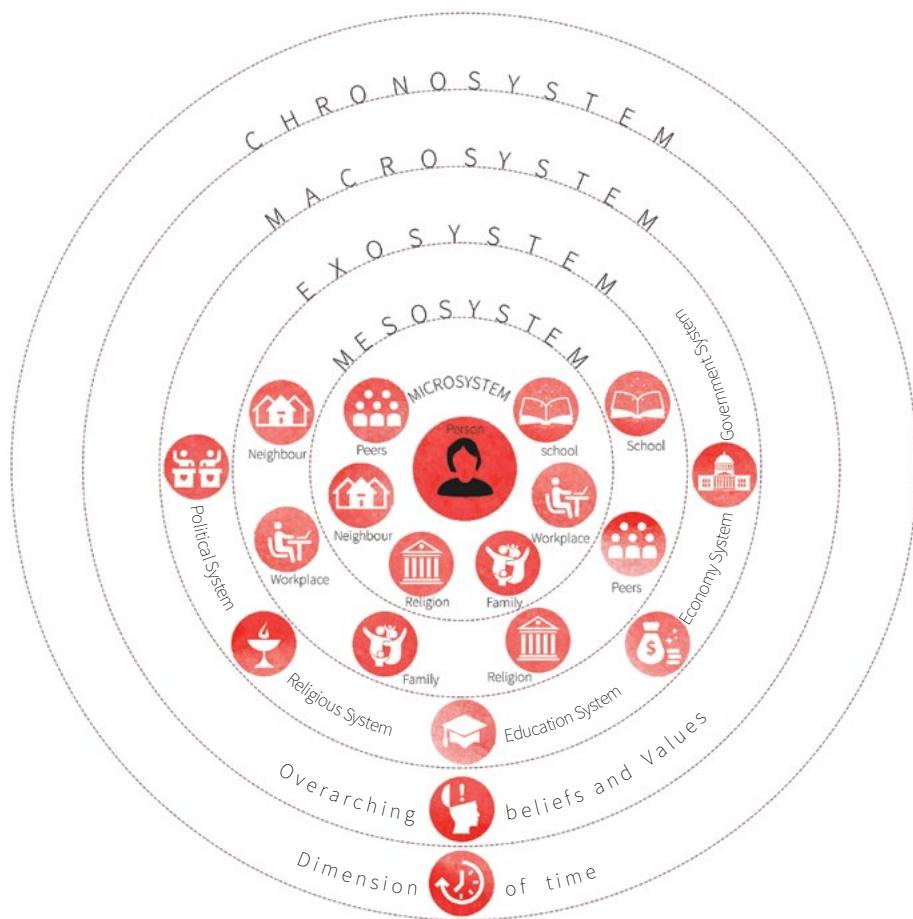
Mesosystem// refers to **interconnections within institutes**, groups of Microsystems and their relationships amongst themselves.

**Chronosystem**

The scale of time over a large area

**Macrosystem**

The scale of collective belief of people in an era

**Exosystem**

The scale of governing bodies of societies

**Mesosystem**

The scale of Systems within a Neighbourhood

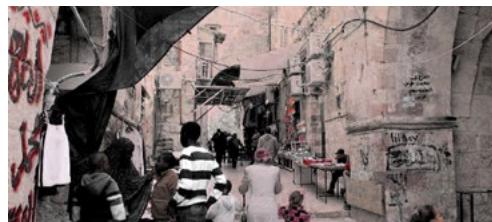


Figure 5
Bronfenbrenner's Human Ecological development model

Exosystem// involves links between individual's immediate context and the social **settings where individuals do not have an active role.** (eg. Industry, social services, neighbors, local politics, mass media, etc.)

Macrosystem// involves **larger beliefs, attitude, and ideologies of a person's context that shapes cultural and economical context of an individual or a group of people.** Here, cultural context refers to ethnicity, socioeconomic status, poverty etc.

Chronosystem// refers to **larger beliefs, attitude, and ideologies of a person's context over a period of time.** This includes environmental events and transitions over the socio-historical circumstances as well as life courses.

Although in present times this model needs an additional layer within microsystem to elaborate the influences from advanced in technology (TV, Internet, speed transport, and increased probability of exchange of ideas) on human learning curve. Yet the physical aspects largely remain static; especially, in the context like India where a large population still remain devoid of access to modern advancements in technology.

As shown in fig.5, each circle represents successive spheres of influence and a system of interacting groups of institutes that play an important role in formulating ideas and actions of the individual (either a person, group of people, or group of people engaged in same profession, in this case an Architect). Here, Chronosystem (i.e. factor of time) is an essential element of this model. “Because this model measures an individual’s development, these interactions occur on a measurable chronological scale. Time influences the systemic interactions within an individual’s lifespan as well as across generations, such as in the case of ‘family values’, a set of morals or beliefs that are passed down between generations and shape development. Successively, overall beliefs and values of a time - *Zeitgeist* - are most essential elements that shapes the orientation of administrative systems which eventually affects each individual belonging to that system (Madeline, 2017)”.

In ancient times, religious beliefs highly governed the way of life, especially in Indian subcontinent. These belief deeply incorporated nature and hence, its presence is also felt in Ancient Architecture. Also, the orientation of economic and political believes were similarly encompassed under belief of human as a part of nature. Quite often, this was evidently reflected in lifestyle, human attitude towards nature, socioeconomic structure and market mechanisms of ancient societies.

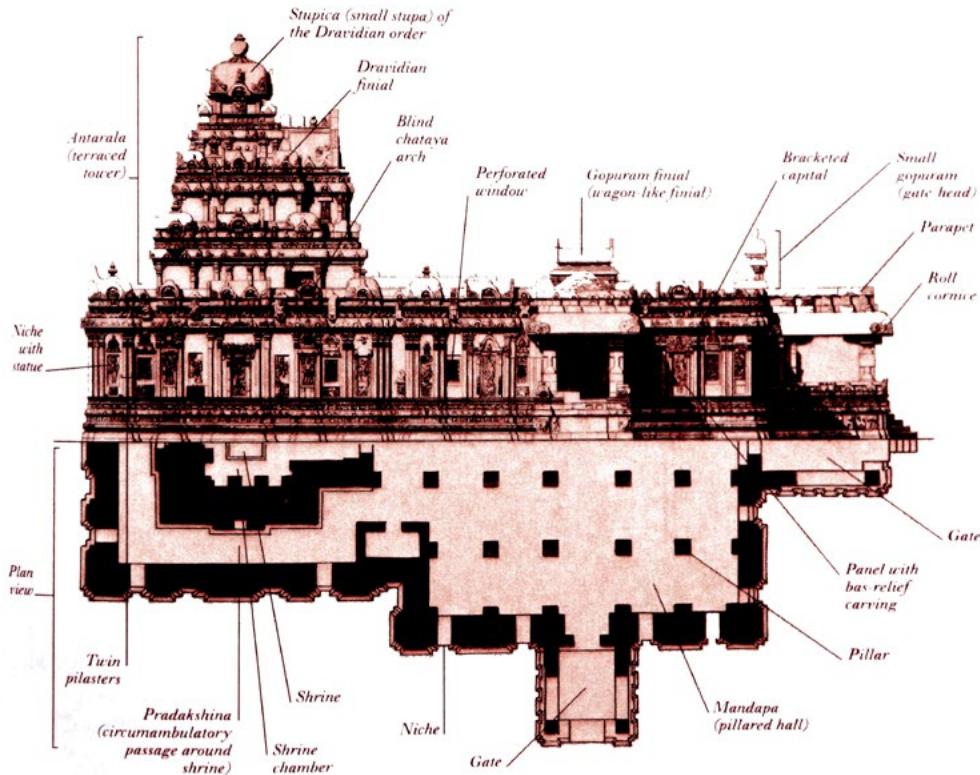


Figure6

Ancient Public spaces: Side view and plan view, Temple of Virupaksha, Pattadakal, India, c.746
 Source // Ultimate Visual Dictionary, Evans Jo. pg 491 (modified)

Until recently, ecologists and scientists treated humans as an externalities; hence economists tend to treat ecosystems as an externalities (O'Neill, 2000). If this statement is examined furthermore, one can comprehend that in present times, these religious beliefs are replaced by the belief in Science and Technology. The foundation of this belief lies in the idea that human beings are the most intelligent species and hence are above all, unaffected by the laws of nature (O'Neil, 2000) (Gadgil, Guha, 1992). Therefore, these systems are aligned as if the factor of nature doesn't exist and tend to believe that in case of extreme situations, science and techno-fix solutions will rescue the world.

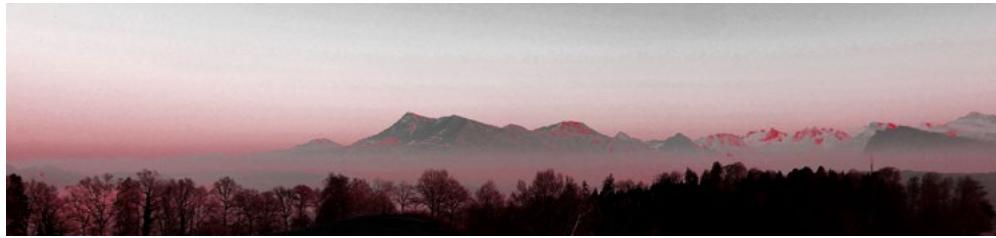
2.3.2

Ecological costs This particular section is to clarify the meaning and definition of ecological costs in the context of this thesis. Also through a brief understanding of an Ecology, attempt is made to develop a model that can be used as a parameter to check whether a project is carried in ecologically conscious manner or not. This model is adopted and modified after studying three specific models which are currently present and tried to bridge it with the elements that were absent or overlooked from those models.

General notion of the term cost means nothing more than a value written on a rectangular piece of paper and is instantly associated with the notion of "monetary value" of something. The in-depth understanding of the term cost has lost its meaning through the course of time. Hence, coining the word 'Ecological cost' has numerous possible inferences.

Theoretically, there are a few models and systems that tend to define and put a monetary value on an object. It includes careful calculations of its ability to replenish as well as potential harms to nature. The concepts like Life Cycle Cost Analysis (LCCA), Circular Economy, Ecological Economics, etc. examine the possible ways to incorporate "factor of nature" in the valuation of an object. For example, LCCA is a tool to determine the most 'cost-effective' option among different competing alternatives to purchase, own, operate, maintain and finally dispose off an object or process, when each is equally appropriate to be implemented on technical grounds (*Life-cycle cost analysis*, 2017).

This theory is assuming that LCCA is useful and is a practical approach for environmentally responsible investments. But LCCA fails to handle irreversible decisions, neglect items that have no owner - *the commons* - and does not consider the cost to future generations (Gluch, Baumannb, 2003) (Orr, 2014).



Outer Circle

Analysis of Ecological costs within Natural World



Inner Circle

Analysis of Ecological costs within Human World



Figure 7
Ecological Cost Wheel

On the other hand, the field of “Ecological economics” seems to provide better insight for the term “Ecological cost” and define it as “estimation of how to maintain stable environments before assessing the cost in dollar terms (*Ecological economics,2017*)”. But all these propositions merely explore the ways of distribution of resources and its coupling with present-day market mechanisms, especially within highly organized work force as that in western countries. Such a model seems to have limitations to be able to operate within unorganized labor force, like that in India.

It fundamentally neglects the basics of natural cycles and processes. Hence, the thesis takes an opportunity to inquire about the factors neglected in those models and hence eventually lead to ignorance of ecology at such huge proportions which are capable of inducing irreversible changes in the ecosystem.

The concept of ‘Ecological cost’ largely encompass the belief that any kind of intervention done during the process of construction should allow maintenance of ecological systems and respect the pace for stable Biome formation. To bring more clarity to the concept of ecological cost, the most suitable explanation for the word **cost** is “something that is given, needed, or lost in order to get a particular thing (Manser, 2001)”. In the context of the thesis; ‘A particular thing’ in this definition refers to architecture services and the quest is to look for **what is given, what is needed and what is lost in order to achieve these services.**

Hence, placing the costs in a way that consider both the cycles human made as well as natural systems is more sensible measure to find whether an act of building or habitat creation has carried ecologically conscious practice or there was an ignorance. Therefore, an ecological cost model has been derived based on science of ecology and process of construction. As per in figxxx. the inner circle represents processes for making built environments in the human made world whereas the outer circle represents that of natural world. Both the circles contain factors that determine type of practices carried out under a project.

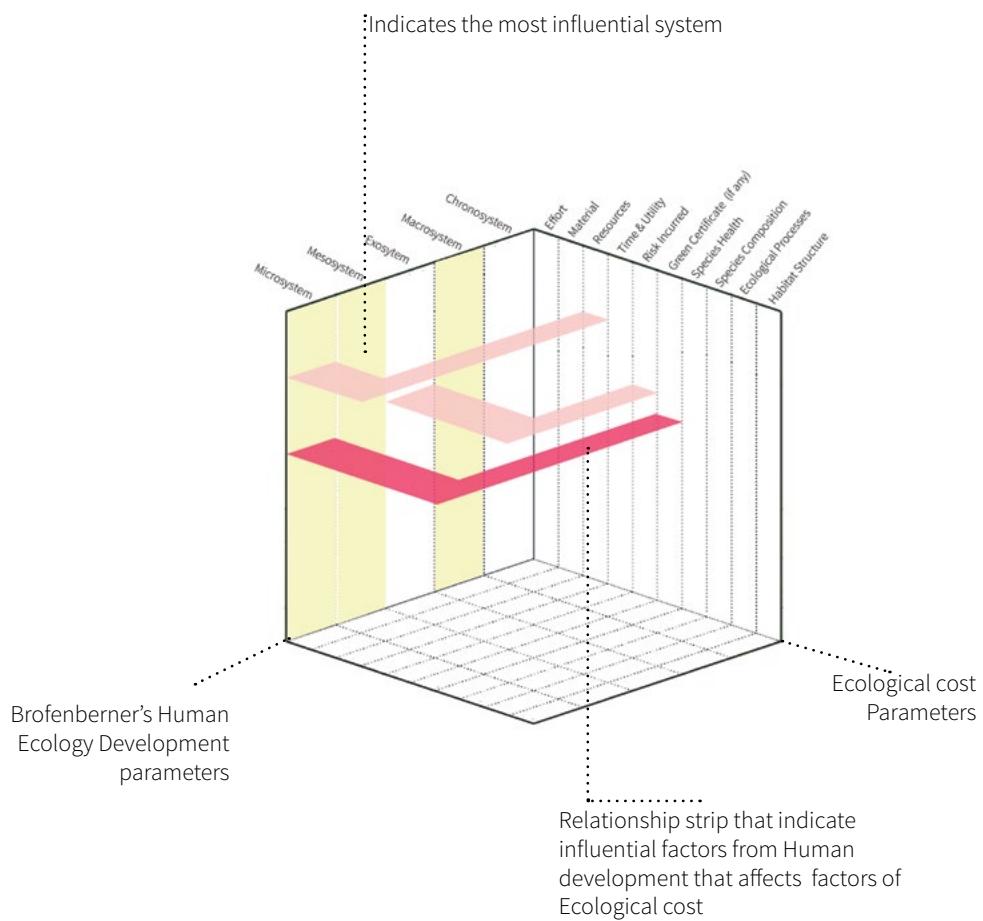


Figure 8
Relationship between Human ecological development and Ecological Cost

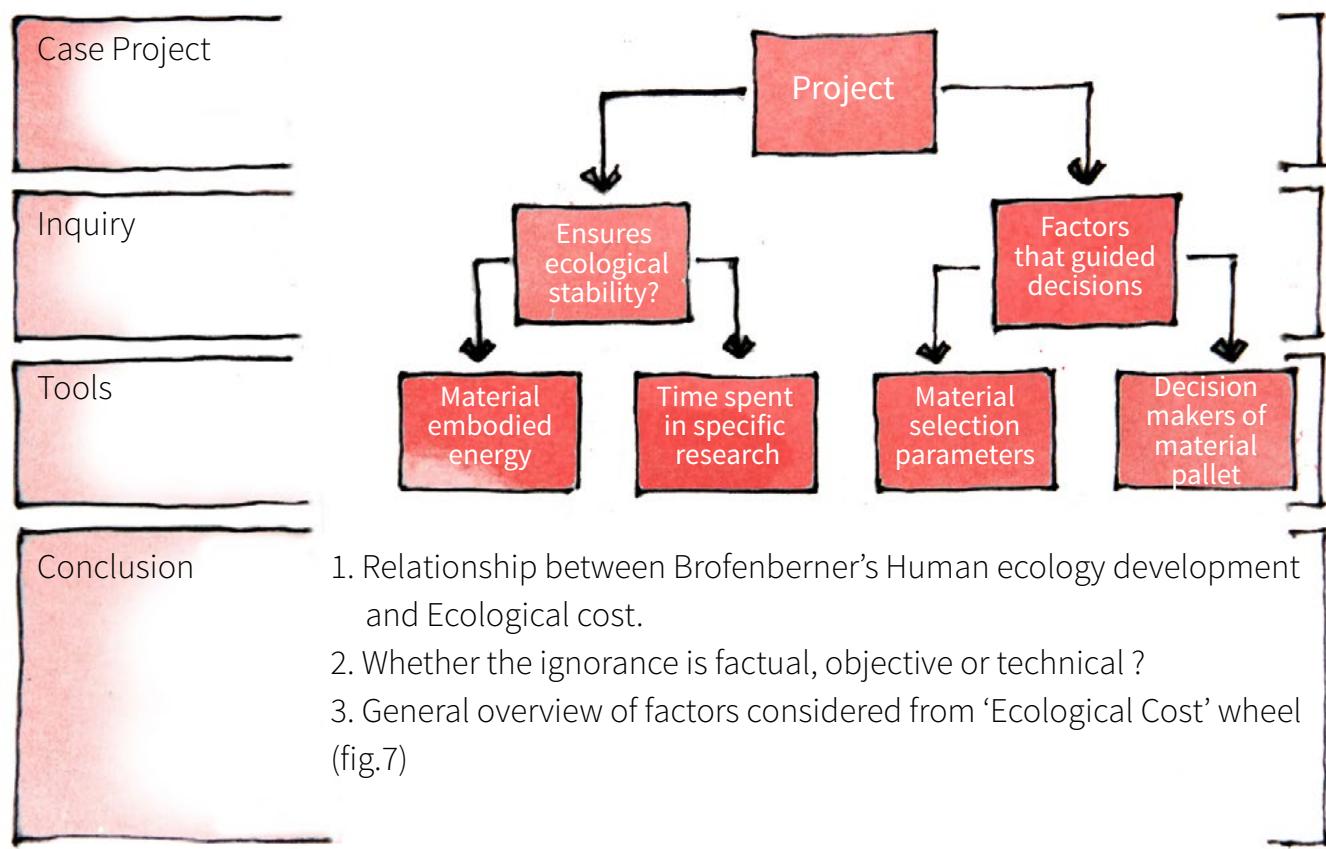
	Ecological costs	Factual	Objective	Technical
Human made world	Effort		●	
	Material		●	
	Resources	●		
	Time and Utility		●	
	Risk Incurred	●		
	Green Certificate (if any)	●		
Natural world	Species Health		●	
	Species Composition		●	
	Ecological Process		●	
	Hydrological cycle			●
	Nutrition cycle		●	
	Biotic interaction		●	
	Habitat Structure		●	

Figure 9
Nature of Ignorance

This model allows to analyze the project through the lens of amount of effort, materials, resources, acquired green certification (if any), time and utilities consumed and risk incurred while respecting water cycles, nutrient cycles, biotic relationships and surrounding species compositions in order to produce and deliver Architecture services and built environments. (Refer fig. 7). Based on this model, the types of costs in consideration are fundamentally different from either of the above-mentioned concepts. This model would be used as a tool to determine the nature of architecture practice of undertaken case studies and elaborate explanation is outlined in section 3.4.1

2.3.3 Thesis analysis framework	<p>The analysis for the thesis is divided into two major parts.</p> <p>In first part, attempt is made to first explore the presence of Ecological ignorance within Chronosystem, Macrosystem and Microsystem (Brofenbrenner's Human Ecology Development model) . After that, it is dissected to understand the reasons behind it.</p>
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In second part, further more exploration is carried out through four major case studies. This case studies are carried out in order to find ignorance within Mesosystem and Microsystem. The study is conducted as per follow.



3

Locating the Problem

3.1 General Stances: Analysis of Chronosystem & Macrosystem

- 3.1.1 In context of Indian Demography
- 3.1.2 Analysis: Within Architecture Profession
- 3.1.3 Anaysis: Within Architecture in India

3.2 Radaring ignorance in Exosystem

- 3.2.1 Within Political system and Governance
 - 3.2.1.1 *Funding distribution Analysis*
 - 3.2.1.2 *State of Millenium Development Goals (MDGs) and Sustainable Development Goals (SDGs)*
- 3.2.2 Within Economic System
- 3.2.3 Within Education System

3.3 Analysis Conclusion of Chronosystem, Macrosystem and Exosystem

3.4 Radaring ignorance in Mesosystem and Microsystem

- 3.4.1 Parameters to determin Ignorance
 - 3.4.1.1 *Sample Selection*
 - 3.4.1.2 *Data Collection method*
 - 3.4.1.3 *Data Analysis method*

Ecological Impact//

"Gatherer societies, with their low population densities, low per capita resource demands, cycles of materials closed on limited spatial scales, and a number of practices that promote sustainable resource use, necessarily have a low level of impact upon the environment. Over long intervals, however, even this can add up to substantial changes(Madhav Gadgil, Ramchandra Guha, 1992)."

Impacts and changes on **Chronological** scale (refer fig.10)

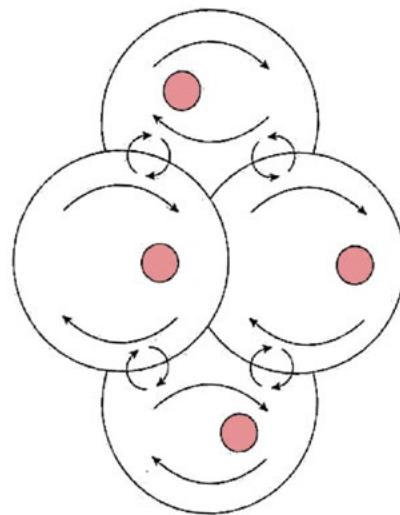


Figure 10

Material flows in hunter-gatherer society

Source//*This fissured land, Gadgil M. Guha M.* pg 16

Ecological impact//

"Indeed, agricultural societies which newly colonize lands held by the gatherers have had a dramatic ecological impact even in the short run- transforming landscape, exterminating certain species and depleting others, introducing weedy species, and so on. On the other hand, agricultural societies in approximate equilibrium with their environment - dominated by 'local production for local use' - have only moderate levels of impact in transforming landscapes and bringing about gradual changes in the composition of biological communities (Madhav Gadgil, Ramchandra Guha, 1992)."

Impacts and changes on **Macrosystem** and **exosystem** level(refer fig.11)

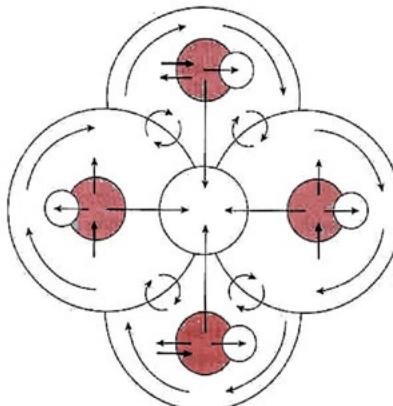


Figure 11

Material flows in Agrarian society

Source//*This fissured land, Gadgil M. Guha M.* pg 29

Ecological impact//

"Industrial societies, unlike gatherer or agricultural societies, are no longer directly dependent on the natural resources of their immediate vicinity. While enormously enlarging our knowledge about specific physical and chemical process, the impacts includes radical modifications of the landscape, a gradual depletion of forests, drastic reduction in (or extinction of) populations, a wholesale poisoning of biosphere and modification of bio-geochemical cycles (Madhav Gadgil, Ramchandra Guha, 1992)."

Impacts and changes across **Macrosystem**, **exosystem**, **Mesosystem**, **Microsystem** level(refer fig.12)

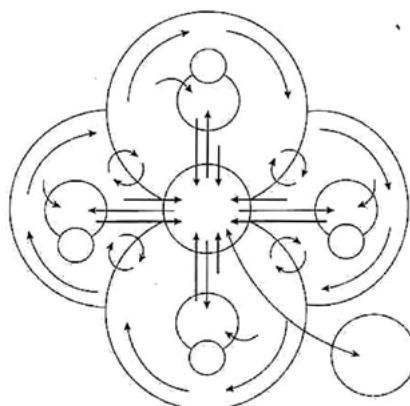


Figure 12

Material flows in Industrial society

Source//*This fissured land, Gadgil M. Guha M.* pg 36

3.1

General Stances: The key quest within this section is to find the reason behind general stances of the people with respect to ecology. This has been undertaken through three broad categories - the stances of People in general (within Indian), the stances within Architecture profession and its praxis (within India as well as whole fraternity). It is extremely important to examine opinions and aspirations of these various groups in order to provide a macro level picture of where Architecture profession stands in this resource based economic system structure which tends to bring along the inherent characteristics of that category.

3.1.1

In context of Indian Demography In Past two decades, India experienced vibrant environmental movements such as Chipko Andoland, Narmada Agitation to numerous other resource based conflicts. These movements are one of the indicator of presence of ecological dis-balance and its sever impact on few sections of the population. The fore-frontier of these movements are village dwellers, tribal communities and forest dwellers rather than concerned state authorities (*Guha,Gadgil,1995*). This indicates conflict of interest between various groups of people and their differing stances with respect to ecology.

In order to further investigate the cause for differing stances with respect to ecology; understanding the modes of resource use is a helpful tool because it determines the manner in which human interven in the nature. As per the study of Habitats in Human History (*Guha,Gadgil, 1992*); through out the human history, one can distill four distinct modes of resource use : **Gathering** (including shifting cultivation), **Nomadic pastoralism**, **Settled cultivation** and **Industry** (refer fig.10,11,12). The author has furthermore examined the distinctive characteristics of each through aspects of **technology, economy, social organization, ideology** and **ecological impact** of each mode of resource use (refer table 1,2). In their study, they found that “In assessing the ecological impact of different modes, one is struck by two paradoxes, which is illustrated here with forest use. Spatially, hunter-gatherers live *in* the forest, agriculturists live adjacent to but with *striking distant* to the forest, and urban-industrial men live *away* from the forest. Paradoxically, the more the spatial separation from the forest, the greater the impact on its ecology, and further removed the actors from the consequences of this impact! The same conditions operate with regard to other resources, such as water. (*Guha, Gadgil, 1992*)”.

	Gathering (including shifting cultivation)	Nomadic pastoralism	Settled cultivation	Industry (including fossil-fuel-based agriculture)
Land transformation	Little, some regression of patches of forest to successional stages or grassland	Some extension of grasslands, deserts	Forests, grasslands extensively converted to fields	Large-scale deforestation, desertification, built-up habitats
Habitat diversity	Enhanced	Somewhat reduced	Reduced	Substantially reduced
Biodiversity	Little affected	Some effect	Moderate effect	Considerable impact
Resource populations	Occasionally over harvested	May overgraze some grasslands and overharvest some prey populations	May overgraze some grasslands and overharvest some prey populations	Many resource populations overharvested
Occurrences				
poisonous to life				
Modification of biogeochemical cycles	Very little	Very little	Little	Substantial
Modification of climate	Highly unlikely	Highly unlikely	Unlikely	Quite likely

Table 1

The nature of the ecological impact in societies predominantly following one of the four major modes of resource use.

Source // This fissured land, Gadgil M. Guha M. pg 55,56

	<i>In equilibrium with resource base</i>	<i>Resource base expanding</i>	<i>Resource base shrinking</i>
<i>Fluidity of social groups</i>	Low	High	Often considerable
<i>Extent to which group interests prevail over individual interests</i>	Group interests quite significant	Individual interests more important	Group interests may crumble
<i>Perception of man-nature relationship</i>	Man as steward of nature	Man as conqueror of nature	Man helpless
<i>Extent to which sustainable resource use prevails</i>	Quite often	Rarely	Rarely
<i>Level of ecological impact</i>	Low to moderate	High	High

Table 2

Features of social organisation, ideology and ecological impact in societies in relation to changes in their resource base

Source // *This fissured land*, Gadgil M, Guha M, pg56

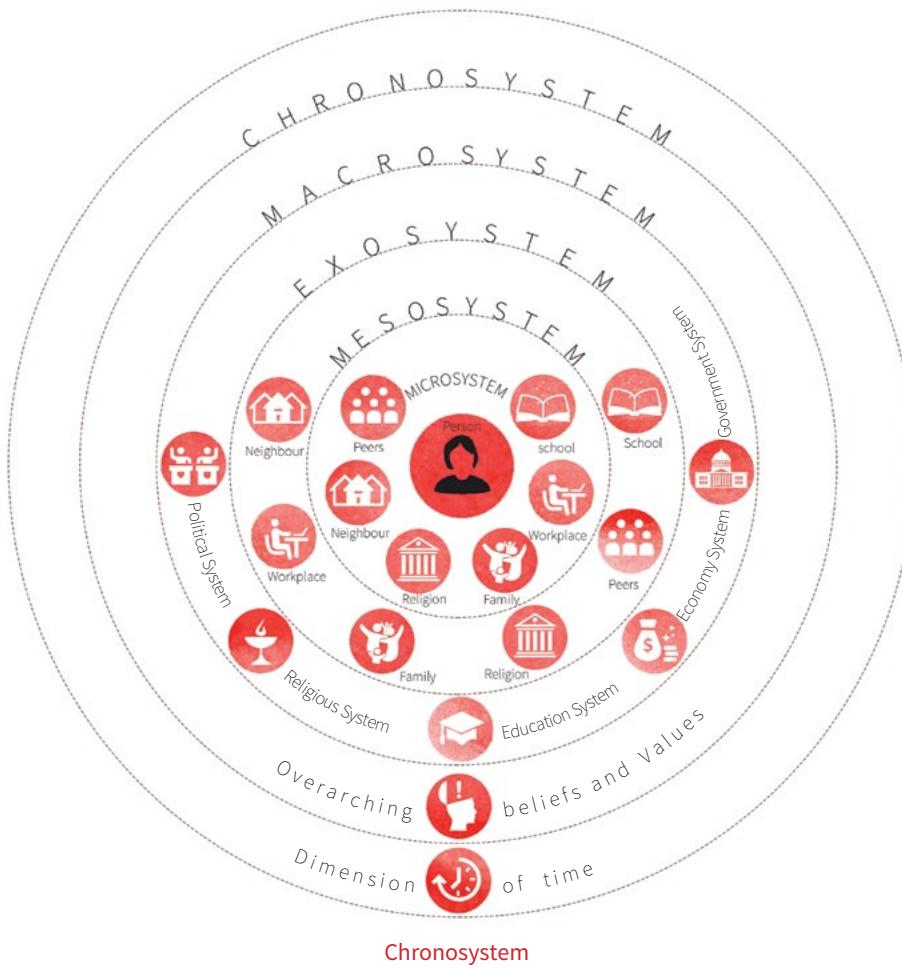
Based on their study, the overall picture rendered under the resource based conflicts within India (and hence their stance with respect to ecology) can be seen as the battle between population engaged in Industrial mode of production vs gatherers, nomads and settled cultivators.

This also signifies that the notion of ecology is built through the kind of occupation people are engaged in. In India, the economy is largely divided into three sectors – Primary sector (raw material fetchers and collectors), Secondary sector (transformer of raw materials) and Tertiary sector (supplying services to consumers and businesses). These three play a huge role in determining resource consumption capability of a person (Guha, Gadgil, 1995).

As a whole, Architecture is a subpart of the Indian Construction and building industry. The profession of Architecture belongs to service sector and in present times, it tends to serve a very limited section of the population. Hereby, it is important to note that construction industry is the second largest industry in India after agriculture and accounts for about 11% of India's GDP making a significant contribution to the Indian economy and employment (*Indian Construction Industry*, 2017). With increase in Architecture's contribution to the mainstream building industry, it becomes part and parcel of the system that behaves as 'Omnivores'. In upcoming sections; Architecture's critical role and the need for change is furthermore examined.

This section examines Architecture by putting it at the center of the ecological development model (fig.13) and tends to explore the active forces that shaped architecture within Microsystem (factors that gave birth, formed, informed and eventually transformed the profession of Architecture) and Mesosystem (interaction between those factors and involved institutes). This is undertaken by first examining the origin of Architecture profession and then in-depth understanding of its presence in Indian sub-continent. Through these studies, reader can anticipate to understand the cause of present day general stances of the Architecture profession with respect to Ecology.

3.1.2 Analysis : within Architecture Profession



Macrosystem
The scale of collective belief of people in an era

Exosystem
The scale of governing bodies of societies

Mesosystem
The scale of Systems within a Neighbourhood

Microsystem
The scale of Individual person and direct interactions with Mesosystem

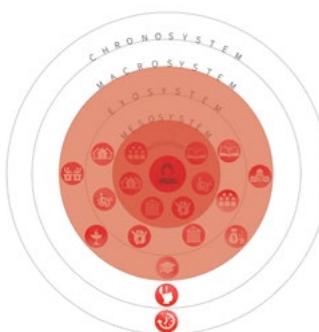
Figure 13

Bronfenbrenner's Human Ecological development model (for ease of reference)

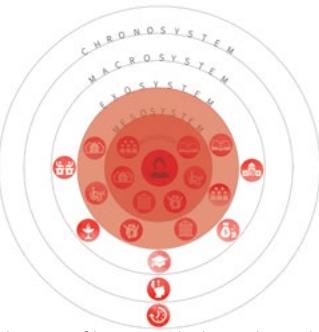
Architecture profession belongs to service sector. In order to situate the stances of Architecture profession with respect to ecology, at first, the roots of the profession and its close ties with the political as well as economical systems is outlined, because these forces enables the practicing environment of the profession.

The word ‘Architect’, coming from the Greek word ‘architekton’ - master builder - implies a person with the broad background of knowledge in planning, design, and construction, as well as the arts. **Architecture may thus be defined not as a discipline per se but as an umbrella for related disciplines (S.Ed., 2008).**

Although the journey of the profession began as an ‘umbrella of related disciplines’; it was soon realized by the political powers as an impactful tool to impart ideologies and imperial power on the society. “That it would be a worthy and most useful thing to bring the whole body of this great discipline to complete order (Vitruvius, 2001).” In the west, the foundation of Architecture profession dates back to the time of Vitruvius, who also in a way wrote ‘Foundation story’ of the Architecture profession.“It was not architecture as such that initially attached Vitruvius to Julius Caesar’s might. It was, rather, the connection of Architecture to ‘imperium (Berube,2006).’ This indicates that wider pretensions of Vitruvius to tie his architectural approach into the imperial program of expansion and authority. “The term ordering all too easily conflates the visuals with the political. This mistaken (and dangerous) conflation of visual order with social order continues to this day (Till, 2009).”. In pursuit of this ‘higher order’ in built expression along with overwhelming importance to ‘statement making’ (disguised in the form of art) through built environment; the Architecture profession seems to have largely deviated from being a discipline with ability to cross-pollinate interdisciplinary knowledge, to its imperium connection, to eventually becoming ambiguous in current scenario (Till, 2009).



Influences of immediate interaction between workplace (profession), people (Peers)-Mesosystem-and governing institute-Exosystem-on Architecture profession.



Influences of key people (Peers) on the workplace (profession)-Mesosystem-on individual Architect's aspirations.

“I deeply consider architecture as an art - the most abstract of all of them.” this famous statement by Santiago Calatrava has shaped plethora of Architects and young students. On the other hand, Ceasar Pelli (AIA Gold medalist) has said that the architects values “the looks” of an Architecture and “concept of sustainability doesn’t necessarily photograph (Stephens, 2009).” **Such stances by ‘star’ architects of the profession indicates that the profession sees the science of building divorced from the “art” of making of Archtecture.**

OUR CHARLES JENKS MOMENT
by Paul Mokovsky

How do you mark the last 30 years of architecture and design? That was the question we asked ourselves when trying to put together this anniversary issue. We turned to Charles Jencks's famous "Evolutionary Tree of Twentieth-Century Architecture" diagram from 2000, which seems to have whittled out the last of time. Many of the movements that were

around when the magazine was founded in 1981 have either come and gone or mutated into something different. Our highly subjective chart maps out the mostly terrains of architecture and design through which they moved. In the spirit of collaboration, we encourage you to mark key movements. Free tree, in other words, to move some things around.

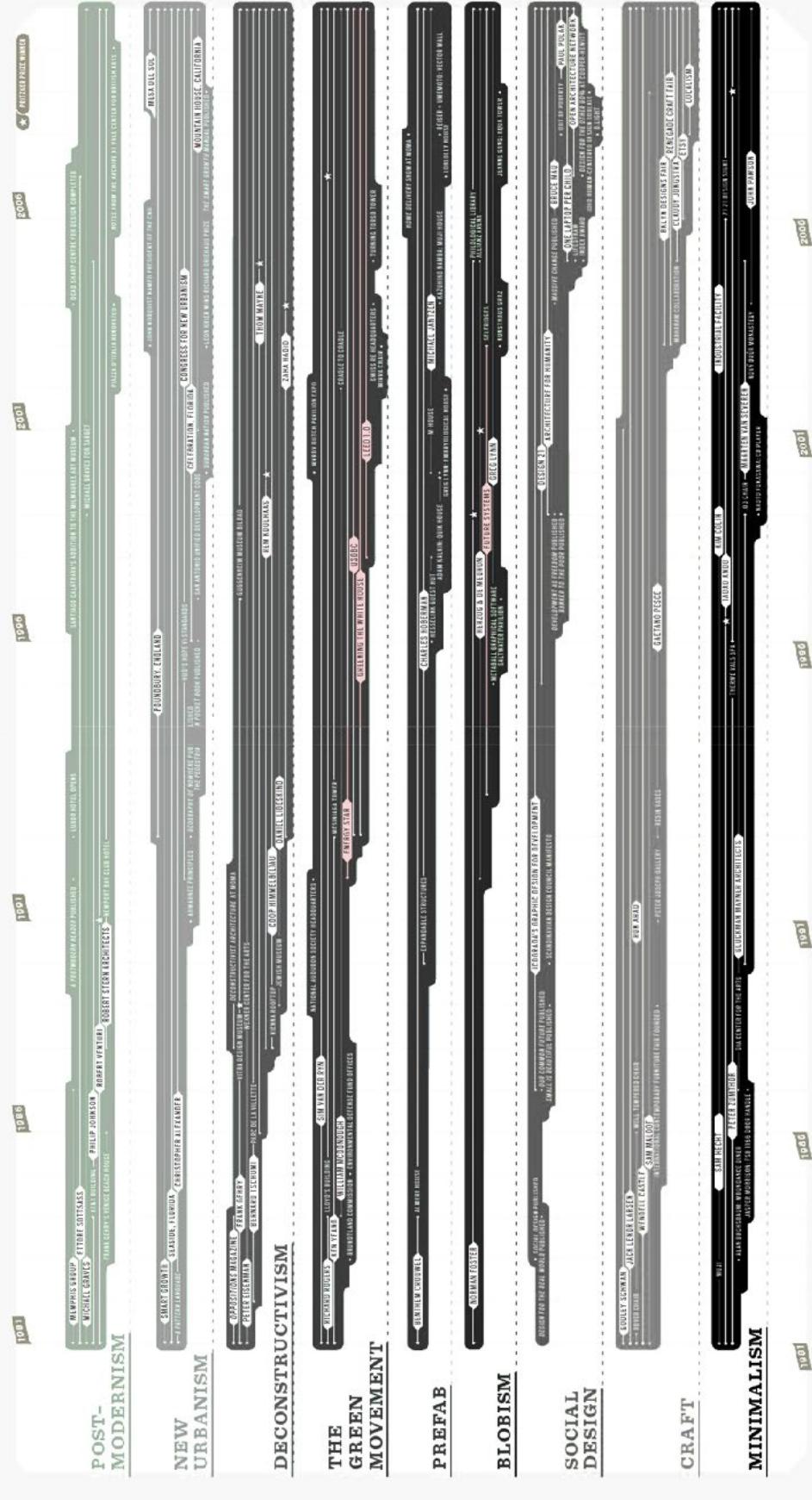


Figure 14
Last 30 years of Architecture (1981-2006): Influential phases in history of Architecture
Source // "Our Charles Jenks Moment" Metropolis (September 2012)



*Influences of Economic system -
-Exosystem- on the workplace
(profession) of Architecture profession.*

Architectural movements heavily associated to stylistic expressions and an Architect's artistic aspiration throughout the history. The famous critique on populist association of Architects to that of (housing) tower blocks (Jacob, 1992) tends to overlook "the fact that the tower block were not the demented aspiration of Architects, but rather the very direct result of economic and social housing market in the 1950s and 1960s (Till, 2009)." This powerful statement suggests the strong hold of economic forces. And the profession chooses to respond to it under disguise of either Artistic expression or that of breaking free from history (which was underlying slogan of modernism movement).

These combined umbrella of art, economy and politics raises a very crucial question for the profession: **does sustainability alter the face of Architecture, or only the content?** How much economic and political forces on Architecture profession plays a role in the direction of sustainability? The general notion of Architects seems to be "sustainability has, or should have, no relationship to style" as per claimed by Architect Rafael Vinoly.



*Figure 15
7 World Trade Center
(LEED Gold certificate)*

Although, the green movement has become part of the profession in recent years, yet it relies heavily on the techno-fix solutions and leads to higher initial costs. Moreover, rated buildings reportedly performed worse than older buildings in some cases (Mehaffy, Salingaros, 2013). For example, new 7 World Trade Center is a LEED Gold-certificate building with score point of 74. As per US national rating policy, the building is just one point below the minimum 75 (the point offered to "high-efficiency buildings"). But this rating hardly considered embodied energy in the invention and production of new materials of 7 World Trade Center (Mehaffy, Salingaros, 2013).



*Influences of above mentioned
factors- Exosystem and Mesosystem-
on development of present form of
Architecture profession - Microsystem.*

All these recent discussion under green Architecture movement further provides insights into profession's inclination with respect to ecology. Unlike human settlement of pre-industrial times when people used to either integrate or co-exist with nature; in present days, the growth of towns and cities sets a clear boundary between humans and nature. Before the rapid rise in human population, settlements were relatively small and their impacts on the natural ecosystem were limited. Now, the premises of built environment seem to be built upon the notion of nature as something to be feared and to distance oneself from and something to be framed as view but not to dwell upon. (John Alle, 2001). This narrative hence translates in the way the built environment unfolds and despoils the landscape and ecological relations that once existed.

Indian Architecture history goes back to as old as Indus Valley civilization and with time, was layered with a diverse group of rulers and religions. But one can say that emergence of Architecture profession in its present form unfolds under British colonial experience. The first Architecture school was established in India in the year 1857 at Sir JJ School of Architecture in Mumbai and officially recognized as a distinct discipline in the year 1913 (before Independence). The British architectural presence since 1857 was with the purpose of enforcing their political power as well as residential or travel comforts of British officers. “The foundation of New Delhi was a measure of imperial policy towards the ideal architecture expression of British might (Story of India).” Along with political angle of Architecture in India, clearly, the present form of Architecture is an ‘idea’ and a system borrowed from the west.

3.1.3 Within Architecture in India

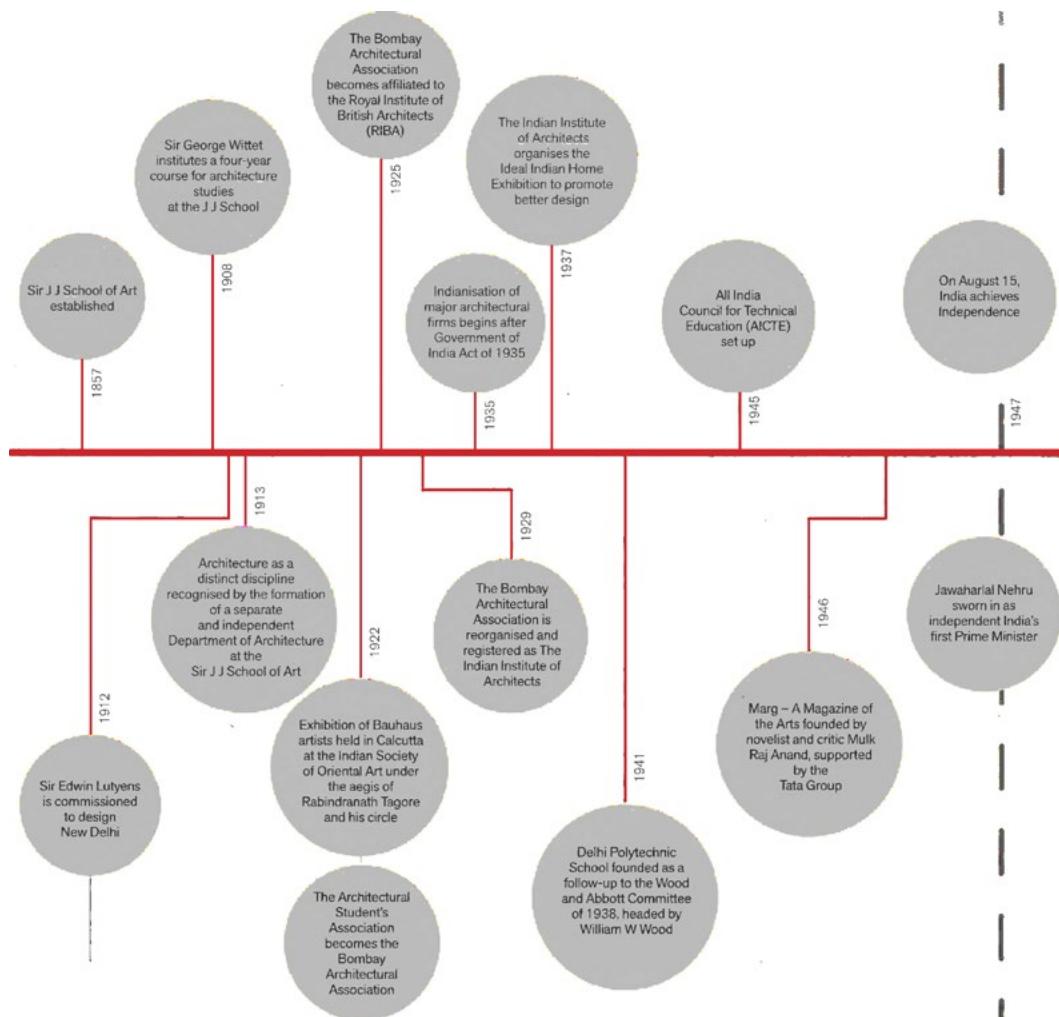


Figure 15
Architecture in India
Source // *The State of Architecture: Practices & Processes in India*, Mehrotra R. and others, Pg 23

The nationalist movement was preponderantly a broad international outlook (*Raja Rammohan Roy, 1772-85*). “It advocated the view that Indians while hating British imperialism, should not hate British people. Hence the involvement and acceptability of a number of Britons, including architects, in establishing a politically, culturally and institutionally independent India albeit from within their own cultural perspectives (*Zakaria, 1985*).”

After Independence, this belief continued and further reinforced the faith in international outlook by adopting beliefs of “Modernism movement” as way forward towards development. “Modernism is an attitude. It is based on the perception that change away from past is required in order to make future better (*Desai Desai, Lang, 1997*)”. With such aspirations of breaking free from past, post-independence era starts with nation building experiments in which masters influenced and shaped the first generation of Indian Architects in India. Hence, architecture experience in India can be divided in 3 major eras:

Post independence// the era of national identity building

Critical regionalism // in between the 80s and 90s when preservation of regional identity became part of Architecture discourse and practice.

Post liberalization// where most celebrated projects were ‘Architecture of indulgence’ which removed the perception of architecture away from the public. (*Mehrotra, 2016*).

Each era brought its own story of the way the profession aligned itself during these times. The operating narrative was either identity creation projects or that for indulgence. The liberalization era brings a new dimension to the profession’s orientation and its role in society. It brought a drastically distinct shift in people’s aspiration and lifestyle almost overnight. Hence, the role of an Architect was redefined as a service to the elite and that of a status symbol. Along with this, the question of Identity and profession’s close ties with the state faded away. “We ended up being a lousy entity which made Architectural practice diffused, working centrifugally, aligned into various smaller constellations. (*Rahul Mehrotra, 2016*)”.

Although, there are a few practices that does reflect the genuine presence of ecological values but **their radius of operation as well as influence is largely isolated**. The pace of ‘Market-driven-script’ and its influence on other areas in extremely large proportions made

Influences of political history

-**Chronosystem**- on shift in beliefs

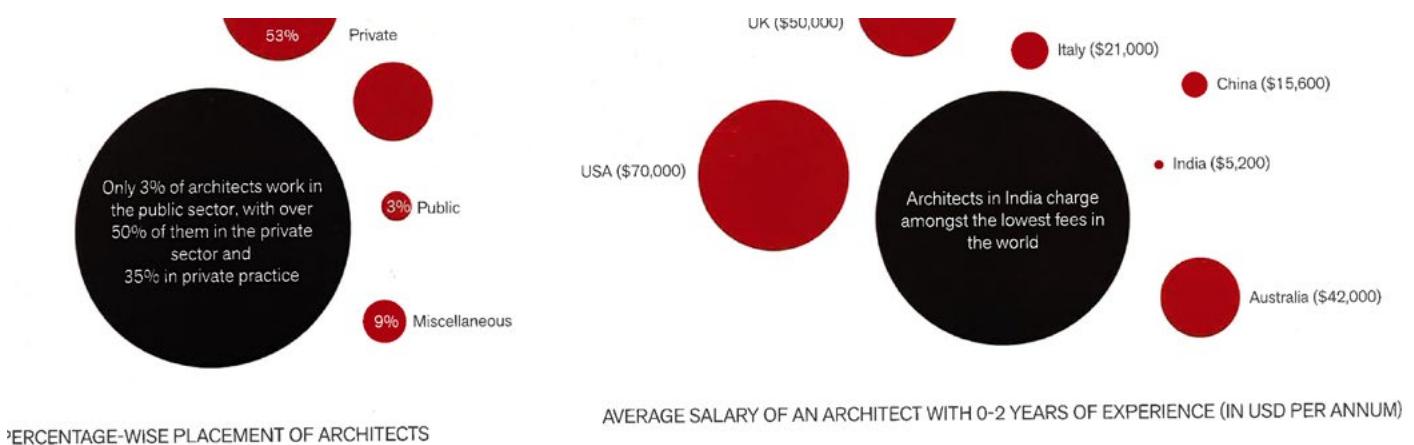
-**Mesosystem**- that eventually shaped foundation script of Architecture profession in India -**Microsystem**.

Influences of economic, political and governance system -Exosystem- on the way architecture unfolds -Microsystem- in present times.

such practices end up as an ‘island’ in the pool of mainstream Architects. (The roles and mechanism of market driven forces are explained elaborately in section 3.2.2)

The presence of discourse regarding ecological concerns was not seen unless talks began to gain momentum on the International architecture platforms with formulations of systems of LEED certification and other green certification standards. Although, these systems were a lot more rooted in “Techno-fix” solution (as per in section 3.1.2) and in many cases are criticized to be not as green as it claims to be; LEED projects demonstrate neither leadership in energy and environmental design nor utility within reach of most of those who may wish to engage the system. “The practical objectives of environmental stewardship have lost their way amongst methodologies, which are conspicuously burdened with counterproductive and costly practices, the quintessential antithesis of the tenets of lean(Orr, 2014).”

*Influences of key people (Peers)
-Macrosystem- on the workplace
(profession) -Mesosystem- Architecture
profession.*



THE STATE OF THE PRACTICE

At Independence, a mere 384 architects were registered with the Indian Institute of Architects (IIA). Many of them staffed the CPWD (Central Public Works Department) and the regional PWDs (Public Works Departments), which, until the late 1960s, executed most major building projects. By the early 1970s, the burgeoning urban economy demanded a larger role for architects. This was authorised by the Architects Act (1972), piloted through Parliament by architect-politician Piloo Mody. It established the Council of Architecture (COA). From 2,336 architects in 1975, the COA membership grew to 49,463 mainly urban-based practitioners in 2013. Meanwhile, architects' involvement with the public sector has decreased sharply. Only three per cent of registered architects are currently involved in public sector projects. Have architects abandoned the public realm to cater exclusively to the elite? And why do regions like Jammu & Kashmir and the North-east have architecture without architects?



Figure 16
Architecture in India

The Indian version adaption of LEED certification is formed through the framework of IGBC (Indian Green Building Council) certification and GRIHA (Green Rating for Integrated Habitat Assessment) Certification; both of which are heavily borrowed from LEED Criteria. Mainstream real estate markets also quickly recognized its profit potential and provided enabling pockets to flourish such practices. “Rating systems inherently reward intent rather than performance, possibly resulting in marketing propaganda rather than sustainable architecture (Raje, 2009).”

Yet this approach of making doesn't engulf large chunk of mainstream practices withing India, which becomes part and parcel of real estate market (further explained in section 3.2.2). The need of developing a thorough understanding of “ecology” does not seems to present in Architecture profession. Unlike ancient architecture, when most of the buildings heavily reflected the presence of its relationships with the surrounding ecology either as ritualistic practices or solely for the purpose of dependency on Nature; In present days, western stances continue to dominate the profession and pedagogic structure in India with very little regards for Ecological awareness and literacy.

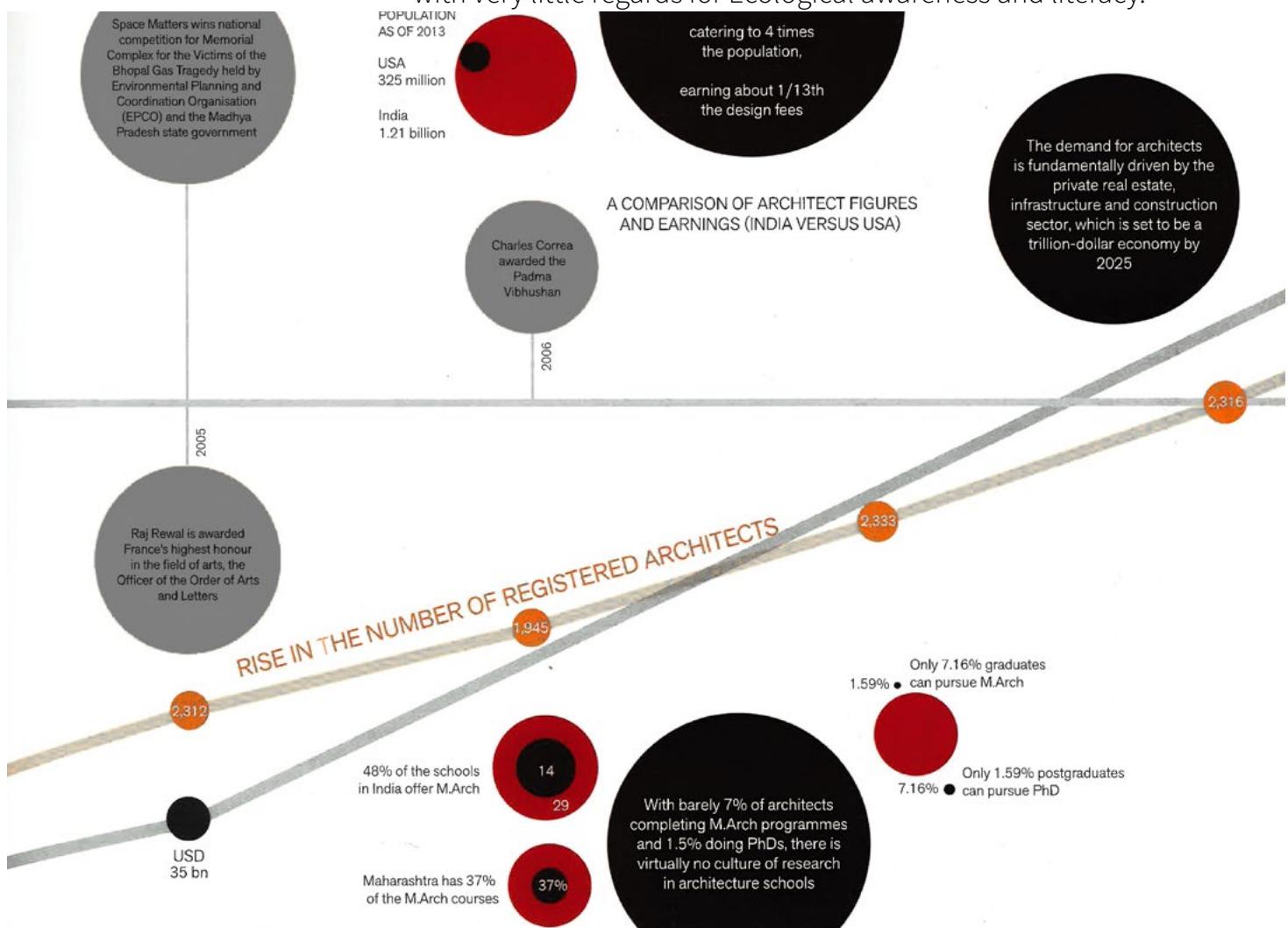


Figure 16
Architecture in India

Source // *The State of Architecture: Practices & Processes in India*, Mehrotra R. and others, Pg 25

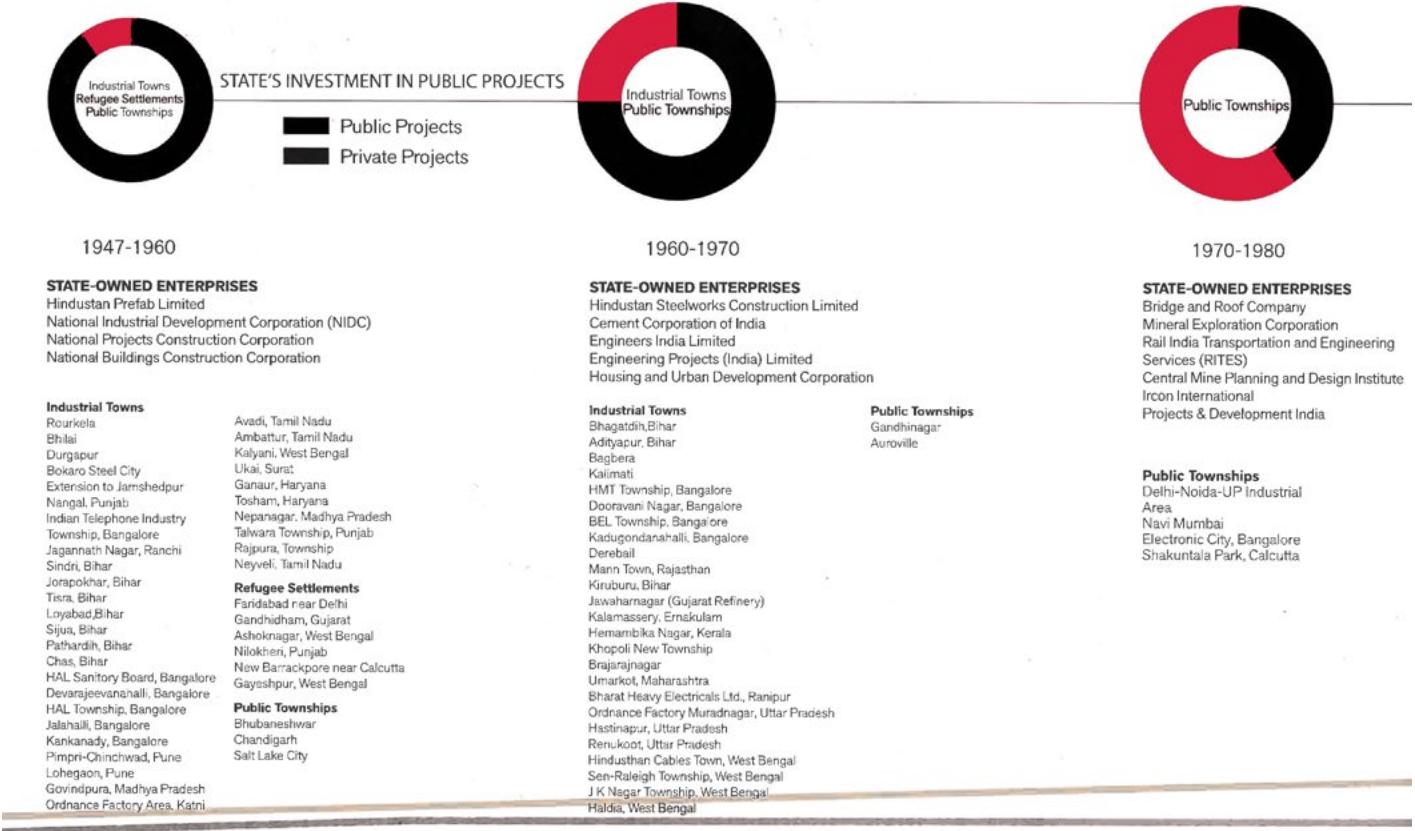


Figure 18

Growth pattern of Architecture firms in India

Source // *The State of Architecture: Practices & Processes in India*, Mehrotra R. and others, Pg 27

1947 INDEPENDENCE NATION-BUILDING EXPERIMENTS



Influences of economic, political and governance system -Exosystem- on the way architecture education -Microsystem- in present times.

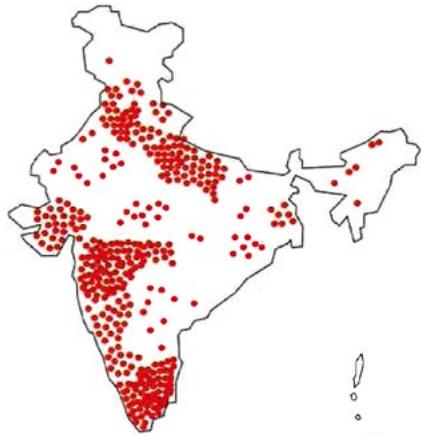


Figure 20
Region wise distribution of school of Architecture

In context of Architecture education, the parameters for Architectural academic training and standards of professional experience were laid down and regulated by the Council of Architecture (under Architect's act) since 1972. But there seems to be large deviation since its conception. There is sudden rise in number of Architecture schools in India within last five years (fig 18,20). Out of 416 school of Architecture, only handful are government run. Most of these new schools are autonomous, privately owned and limited to certain regions and cities (Mehrotra, 2016). These privately owned schools mostly brings question of affordability of Architecture education as they are expensive in most of the cases.

This is again a result of market mechanism (further explained in section 3.2.2), but such a situation potentially creates much wider gap between Architecture for the general public and the one that serves limited sections of the society. As Architecture emerged in this market-driven script; the pedagogic structure also aligned itself to this narrative, and hence, the issue of addressing ecological literacy is neglected (further elaboration in section 3.2.3).

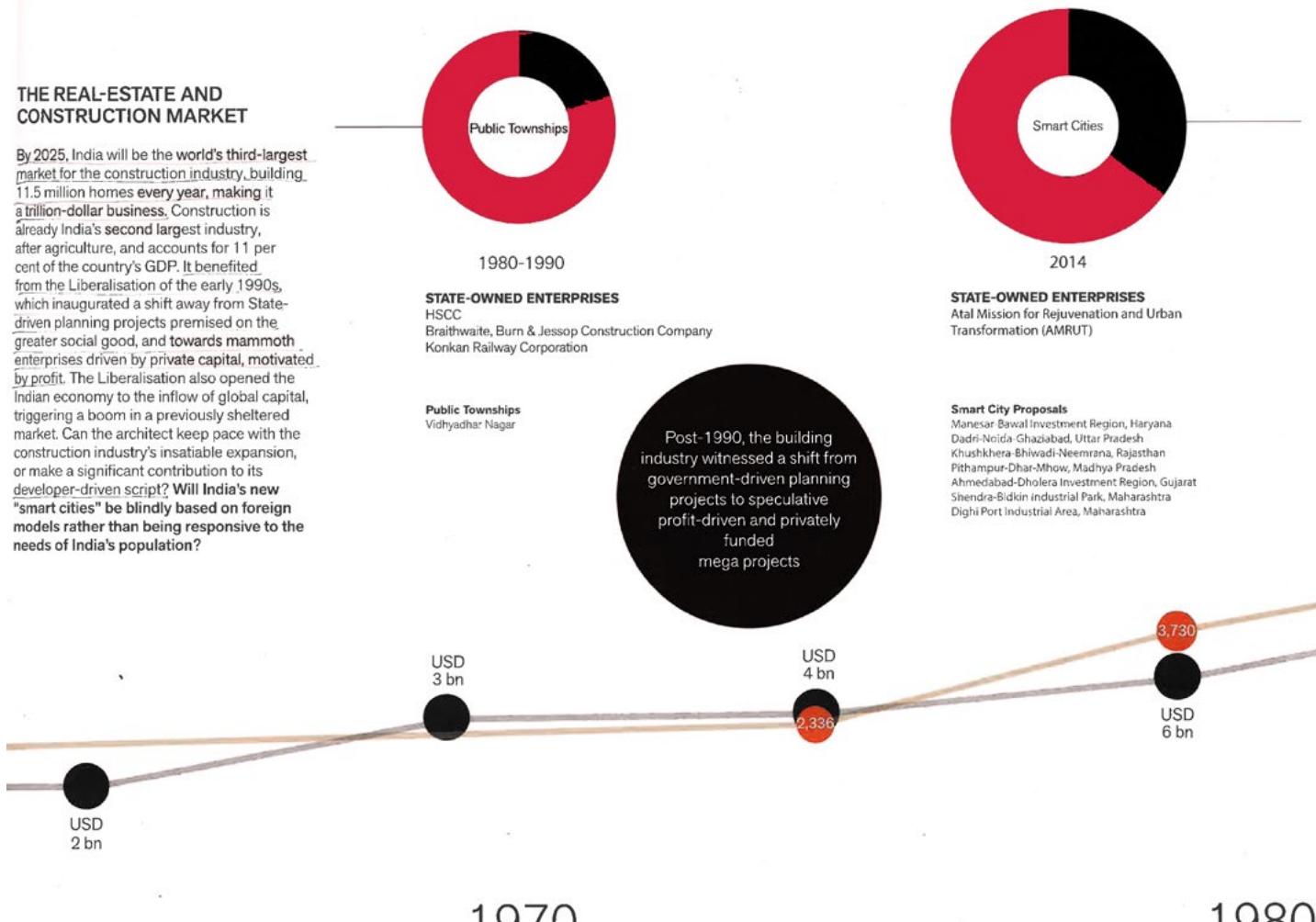


Figure 17
Changing role of Architect
Source // *The State of Architecture: Practices & Processes in India*, Mehrotra R. and others, Pg 26-27

3.2

Radarign ignorance in Exosystem

“From the point in the early twentieth century when architects fought to stand apart from engineers and projected themselves as designers and thinkers, participating in the cultural landscape of society, today architecture has slipped into modes of luxury or vanity commodity – pretty houses and rich interiors! Today architects are introduced as lifestyle producers – handmaidens to a demand for style and fancy living (Rahul Mehrotra, 2016).”

This phenomenon is not only confined to Indian context but also has a widespread presence in the developed as well as other developing countries. **In order to understand this phenomenon in depth, the Bronfenbrenner’s ecological theory model (fig.5, section.2.3.1) is chosen as a tool to dissect the reasons and it’s affects on the development of Human psyche.** The salient features of the model are already described in detail in section.2.3.1

Hereby, its important to remind that while Microsystem is most influential for an individual, as it encircles closest relationships with the person; but the Macrosystem - *overreaching beliefs and values* - governs the way inner circles i.e Exosystem, Mesosystem and Microsystem potentially unfold over a period of time. Therefore, eventually Macrosystem plays a huge role in influencing an Individual or a group of people sharing the similar workplace (in depth reasons and arguments explained in section 2.3.1).

Human ability to perceive future makes outreaching beliefs and values (Macrosystem) a key factor that dictates the way an individual as well as governing institutions, align themselves. Eventually, these believes shape the fundamental values of ecosystems (like political, economic, education, government, and religious systems) that govern the communities and a particular region that abide those set of systems. These systems eventually interact amongst each other and result in imparting values in Mesosystem as well as Microsystems (in depth reasons and arguments explained in section 3.4).

If Architecture practice is kept at the center of the ecological development model, one can determine that it operates under various forces from Exosystem and Mesosystem. The alignment of these two systems dictate the beliefs and values within Architecture profession.

Therefore, in this section; the first part focuses on locating the problem within Exosystem ie. Economic, political and education system. This is carried out by first examining economic system through critiques and discourse from various literature; political system through the root narrative of development framework of India; whereas Education system is understood through analyzing the form and the nature of schooling through critique by educationists. The second part focuses on locating the problem within Mesosystem and Microsystem.

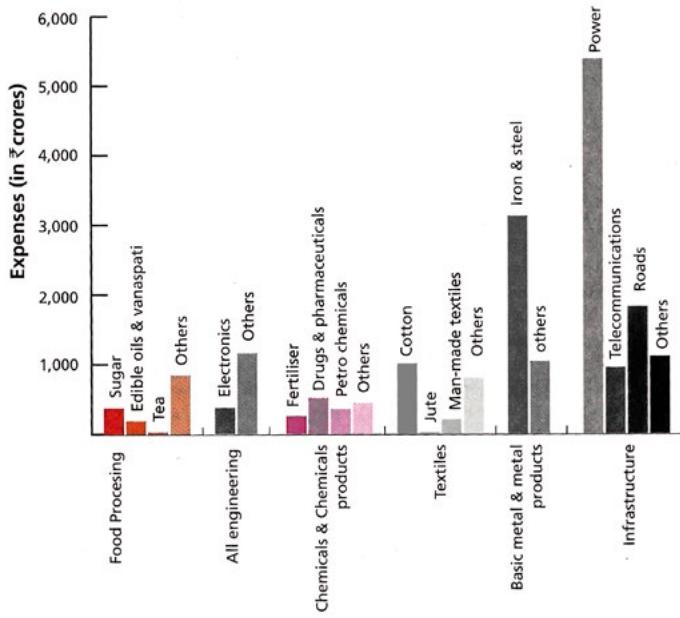


Figure 18

Industry-wise deployment of Bank Credit : In 2015-16, the infrastructure and power sectors got the maximum bank credit
Source// Handbook of Statistics on Indian Economy, RBI

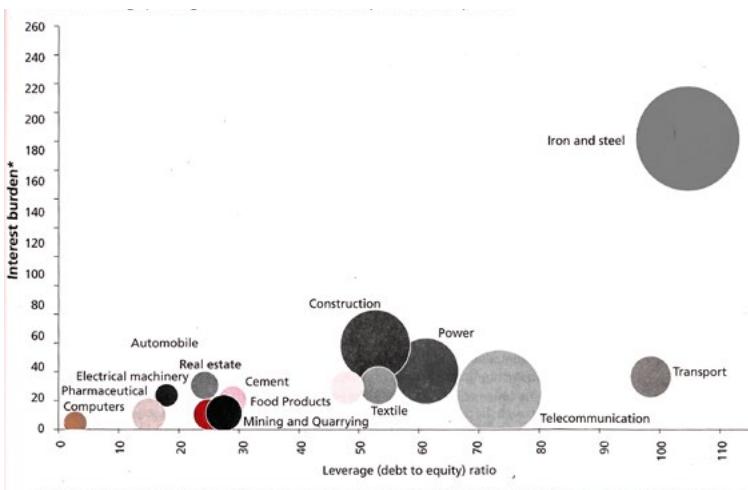


Figure 19

Risk Profile of selected Industries : since 2015-16, highly leveraged sectors declined from 14.2% to 12.9%
Source// A Down to earth Annual, 2017 report

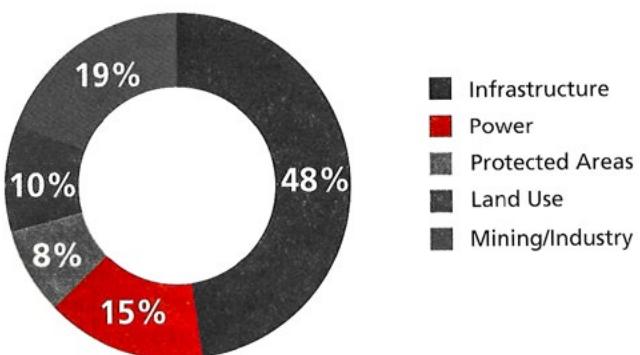


Figure 20

Distribution of Land Conflicts : A majority of land conflicts are emerging from infrastructure projects
Source// Land conflicts in India - an interim analysis (RRI, UN FAO, ISB, Hyderabad & TISS)

3.2.1

Within Political system and Governance

This section is examined by first looking for political willingness to address ecological issues through examples and then analyzing the causes with the help of Human Ecological Development Model (fig.5).

In order to examine political and governance willingness to take efforts towards ecological concerns, following case studies are chosen.

1. Funding Distribution analysis: an overview of Indian Construction Industry.

2. State of Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs) as literature study.

3.2.2.1

Funding Distribution Analysis

An Overview of Indian Construction Industry

Government expenditure on different sectors provides a macro-scale picture of political and governing orientation. As per fig.18, **the largest expenses belongs to the Infrastructure sector**. The responsibility of providing infrastructure comes under Construction Industry. In India, Construction Industry is highly fragmented with only a few major companies involved in construction activities covering almost all sections; niche activities are carried out through medium-size companies and contractors undertake the field work (*Mohideen, 2015*).

There had been numerous project delays because of the mismanagement of *environmental and social risks (E&S risks)* associated with it. In fig.19, out of 14 projects, 6 projects belongs to serve the demands of the construction industry. It provides alarming evidence of

- i. The amount of expenditure these projects demand and
- ii. The attitude of the State towards Environment and socio-economic aspects.

The consequences of this not only affect the owners but finance as well as creating the situation of debt. As per the data in fig. 21, the **sector engaged in construction i.e Iron & steel, construction, mining, and cement are one of the largest debt bearers**. Also, this gives birth to land based conflicts. The interim report by Rights and Resources Initiative analyzed that, in the year 2016, there were 289 land-related conflicts in 185 districts across the country. “*They observed that conflicts affected 32 lakh people, encompassing almost 12 lakh ha of land and stalled roughly Rs.12 lakh crores(Bisht, 2017)*.” Another analysis (fig 20) found that there are 378 halted projects due to land acquisition issues and 345 projects due to clearance issues. The ratio between the number of projects halted and the amount of risk for each is highest for land acquisition, followed by clearance (*Bisht, 2017*).

Project	Total project cost (in rupees, crore)	Environmental Clearance granted on	Delay (in years)	Current status
Gare Palma Sub Block IV/6 Coal Mining Project, Raipur, Chhattisgarh	479	18 May, 2009	6	Scrapped on 25 August, 2015
East Coast Energy Thermal Power Plant, Kakrapur, Andhra Pradesh	9,443	9 April, 2009	4	Under construction
Nagarjuna Thermal Power Plant, Sompeta, Andhra Pradesh	12,000	9 December, 2009	8	Scrapped on 15 July, 2010
Nirma Cement Plant, Gujarat	894	11 December, 2008	7	Under construction
Coastal Andhra Power Limited Ultra Mega Power Project, Andhra Pradesh	17,400	23 October, 2007	10	Yet to begin construction
Athena Damwe Hydroelectric Power Project, Arunachal Pradesh	13,145	12 February, 2010	5	Under construction
Lavasa Hill City Project, Maharashtra	30,000	9 November, 2011	6 (Phase I)	Phase I yet to be completed
Dhamra Port Project, Bhadrak, Odisha	3,200	1 April, 2000	8 (Phase I)	Operational
Vedanta Bauxite Mining Project, Odisha	4,000	22 September, 2004	10	Scrapped in January, 2014
Kalinganagar Steel Project, Odisha	10,000	7 November, 2006	8	Operational
Bhaironghati Hydro Power Project, Uttarakhand	296.82	Not granted	2	Scrapped in March, 2014
Jindal's Tamnar Thermal Power Plant, Chhattisgarh	13,410	18 March, 2011	6	Operational
Loharinag Pala Hydro Project, Uttarakhand	2,895.1	8 February, 2005	NA	Scrapped in December, 2010
Posco Steel Plant, Odisha	52,810	7 January, 2014	7	Delayed

Figure 21

Project Affected due to Environmental and Safety Conflicts: Besides project owners, banks and FIS incur financial losses due to poor environmental and social risks assessments

Source // Centre for Science and Environment

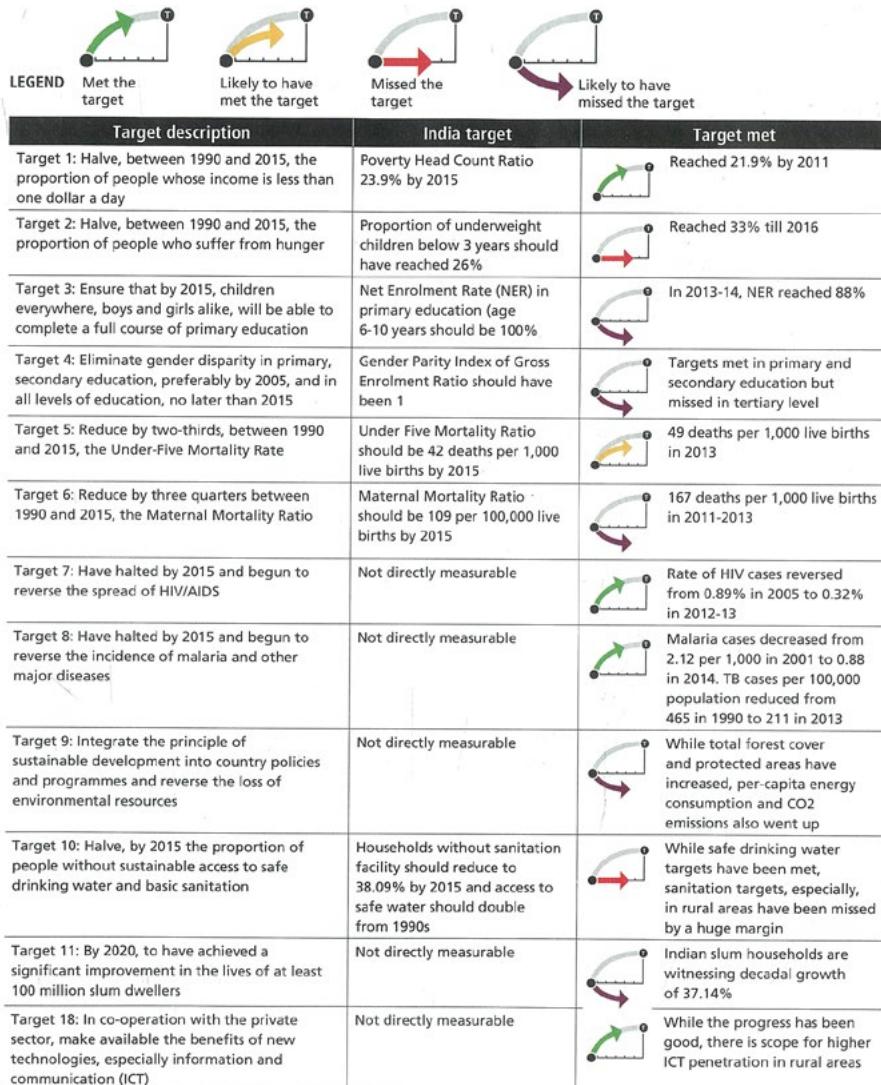


Figure 22

India's MDG Performance : The country met just four of the 12 targets

Source // Ministry of Statistics and Programme Implementation, Government of India

3.2.2.2

State of Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs)

Millennium Development Goals (MDGs) were eight international development goals set for the year 2015. India couldn't achieve most of the targets set in that plan.

As per survey done by Center for Science and Environment (CSE), India; the reasons for missing the MDGs were

1. Absence of relevant indicators to measure the outcomes.
2. Most agencies implementing social schemes did not have latest/relevant data
3. Sustained investment in social sector hinder meeting

(Fig.22) provides an overview of India's performance in MDGs for the year 2015.

"India missed most of the Millennium Development Goals (MDGs). And going by the current level of preparedness, the story is unlikely to be much different with the Sustainable Development Goals (SDGs)(Kiran Pandey, 2017)." This statement is made on the basis of current state of preparedness to be able to meet SDGs (refer table/figure).

From both the studies (3.2.1.1 & 3.2.1.2), it is strongly evident that there is lack of Political willingness and efforts in the direction of ecological conscious practices even though there are organizations in place that can facilitate the execution.

Influences of history -Chronosystem- and newly developed belief in science -Mesosystem-in present day politics -Exosystem. Eventually, affecting into Mesosystem and Microsystem.

Indian political history provides further insights in order to analyze the reason behind current political attitudes. When the British imperial rule was handed over to the country, the institutional and structural framework of fetching resources cheaply from the largely agrarian society was already in place. And many positions of power were occupied by the rural or urban elite who served British authorities in those times. "When political power was quickly monopolized by the rural and urban elite after independence, these elites saw their interests as being far better served by the model of rapid industrial development. The solution obviously lay in industrialization; in tapping the energy of coal and petroleum, of hydroelectric power, in producing steel and cement and using the resources so generated to promote manufacture (Guha, Gadgil 1995)."

Currently, India is largely a Neo-liberal Capitalist state. A lot of political and economic policies are driven by or within Neo-liberalist approach. This makes the state to inclined towards a particular notion of development that puts more belief in Private sector over greater public good (Rajan,2011). The close co-relation of Architecture profession with these forces that promotes particular notion, are outlined in next section.

	Indicator	India value	Min value	Max value
	Goal 1: No poverty			
Poverty headcount ratio at \$1.90 a day (%)	21.3	0	81.76	
	Goal 2: Zero hunger			
Prevalence of undernourishment (%)	15.2	1.17	53.4	
Cereal yield (tonne per hectare)	3	0.04	11.54	
Prevalence of stunting, under-5 years (%)	38.7	0	57.7	
Prevalence of wasting, under-5 years (%)	15.1	0	22.7	
	Goal 3: Good health and well-being			
Under 5 mortality (per 1,000 live births)	47.7	1.9	156.9	
Maternal mortality (per 100,000 live births)	174	0	1360	
Neonatal mortality (per 1,000 live births)	27.7	0	48.7	
Physician density (per 1,000 people)	0.7	0.01	7.74	
Incidence of tuberculosis (per 100,000)	167	0	852	
Traffic deaths (per 100,000)	16.6	0	73.4	
Healthy life expectancy at birth (years)	58	39	76	
Infants who receive 8 WHO vaccines (%)	83	22	99	
	Goal 4: Quality education			
Expected years of schooling (years)	11.7	4.1	20.22	
Literacy rate of 15-24 year olds (%)	81.1	23.52	100	
Net primary school enrolment rate (%)	93.1	37.69	100	
	Goal 5: Gender equality			
Women in national parliaments (%)	12	0	63.8	
Female years of schooling (% male)	49.8	22.61	134.2	
Female labor force participation (% male)	34.7	14.9	103.76	
Unmet demand for contraceptives (% in ages 15-49)	28	5.41	93.01	
	Goal 6: Clean water and sanitation			
Access to improved water (%)	94.1	31.7	100	
Access to improved sanitation (%)	39.6	6.7	100	
Freshwater withdrawal (%)	33.9	0.01	2075	
	Goal 7: Affordable and clean energy			
Access to electricity (%)	78.7	5.06	100	
Access to non-solid fuels (%)	42.4	0	99.9	
CO ₂ from fuels & electricity (MtCO ₂ /TWh)	1.6	0.08	6.11	

Figure 23
How prepared is India to Achieve SDGs
Source // SDG Index & dashboards: A global report 2016

	Goal 8: Decent work and economic growth			
	Unemployment rate (%)	3.5	0.24	53.93
	Child labor (%)	11.8	0	49
	Goal 9: Industry, information and infrastructure			
	R&D expenditures (% GDP)	0.8	0	4.04
	Quality of trade and transport related infrastructure (1-5)	2.9	1.5	4.32
	Quality of overall infrastructure (1-7)	4	2.1	6.47
	Mobile broadband subscriptions (per 100)	3.2	0	149.3
	Internet use (%)	18	0	98.16
	Goal 10: Reduced inequalities			
	Gini index (0-100)	33.9	24.9	65.77
	Goal 11: Sustainable cities and communities			
	PM2.5 in urban areas ($\mu\text{g}/\text{m}^3$)	46.7	4.36	70.13
	Improved water source, piped (%)	53.8	3.48	100
	Goal 12: Responsible consumption and production			
	Wastewater treated (%)	10.5	0	100
	Municipal solid waste (kg/person/year)	0.3	0.09	14.4
	Goal 13: Climate action			
	CO ₂ emissions from energy (tCO ₂ /capita)	1.7	0.02	44.02
	Climate change vulnerability (0-1)	0.3	0.01	0.43
	Goal 14: Life below water			
	Ocean Health Index - Clean waters (0-100)	51.3	34.74	93.92
	Ocean Health Index - Biodiversity (0-100)	85.6	64.67	98.26
	Ocean Health Index - Fisheries (0-100)	49	1	98
	Marine sites, completely protected (%)	4.2	0	100
	Fish stocks overexploited or collapsed (%)	23.6	0.02	95.01
	Goal 15: Life on land			
	Red List Index of species survival (0-1)	0.7	0.4	0.99
	Annual change in forest area (%)	2.7	0	100.73
	Goal 16: Peace, justice and strong institutions			
	Homicides (per 100,000)	3.5	0	90.4
	Corruption Perception Index (0-100)	38	8	91
	Registered births (%)	83.6	2.3	100
	Government efficiency (1-7)	4	1.41	5.77
	Goal 17: Partnerships for the goals			
	Health, Education & R&D spending (% GDP)	8.6	2.56	25.12

Figure 23

How prepared is India to Achieve SDGs

Source // SDG Index & dashboards: A global report 2016

3.2.2

Within Economic System “*Politics is continuation of economics by other means and vice versa (Ruppert, 2010).*”

As per already mentioned in the previous section, Indian economic system is featured as a mixed economy. In such a system, private and public sectors operate side by side. The government directs economic framework for socially important areas and the rest is left to be operated through price mechanism in the market. It is a mixture of the capitalist and socialist model. It unfolds as a combination of various elements from market economics and planned economics. The key characteristics of such a model are division of public ownership, private ownership, and means of productions.

The decisions of economic modes through which infrastructure improvements, policies and social security measures should be carried out are done by political powers. Hence, these modes of development is fueled by economic decisions. In general, the people experience or perceive the development through **improved infrastructure** facilities and living conditions along with many other factors like social security, equal rights, better healthcare and **affordable housing**. Just like in the case of infrastructure, where project responsibilities are outsourced to the construction companies (Mohideen, 2015), the case of affordable housing is encouraged through private property developers.

In 2015, under the project ‘*Housing for all by 2022*; government has granted followings schemes and incentives to promote private developer’s participation in Affordable housing (*The Hindu Group, 2017*).

Infulences of history (chronology) and newly developed belief in science (mesosystem) in present day politics.

need to rewrite and reposition

- Cheaper sources of funds, including external commercial borrowing.
- Developers will receive one year of time to pay tax on notional rental income on unsold completed units.
- More time for project completion - the deadline is increased to five years instead of three years.
- For the mid-income group, a new Credit Linked Subsidy Scheme (CLSS) is provided of Rs. 1,000 crore.
- Qualifying criteria have been revised to 30m² and 60 m² on the carpet, rather than saleable area - for affordable housing in metros as well as non-metros areas.

The first four points indicates that the housing responsibility is externalized to private sector. But the last point is extremely alarming change because doing so will lead to sacrifice in the provision of shared common spaces like lobby, staircase, lift, security rooms, etc.

Time to rethink public housing?

R. Srinivasan

NOVEMBER 04, 2017 20:41 IST
UPDATED: NOVEMBER 05, 2017 11:09 IST

The private sector cannot solve India's housing problem

India's real estate sector is in the doldrums. Of course, you already knew that if you were trying to sell property. 'Quoted rates' are just that – for conversation purposes – while real rates have already fallen by a fifth, with buyers still not showing up.

According to a recent report in *The Hindu Business Line*, new project launches in urban India – or at least in the major markets of the National Capital Region, Mumbai, Pune, Ahmedabad, Bengaluru, Chennai, Kolkata and Hyderabad – have fallen to a seven-year low, with just one lakh units being started this year compared to the average of over five lakh units between 2010 and 2013.

Unsold houses everywhere

The reason is not difficult to see. There is a huge pile-up of unsold inventory. The outer stretches of almost every major Indian city are littered with the skeletons of completed and partially completed projects. According to real estate consultancy Knight Frank, in the first six months of the current financial year, barely 17,000-odd sales of residential units were recorded across the country – in a country of over 1.2 billion people!

Unsold inventory levels are staggering. While the industry itself admits to unsold inventory levels of around 48 months across India, that is based on average sales during the golden years. If you extrapolate on current levels, the unsold inventory of built (or nearly ready) housing units across the eight top markets, estimated at 5.96 lakh units by Knight Frank, translates into a decade and a half's worth.

Further, the introduction of the Real Estate (Regulation and Development) Act, 2016 (RERDA) – albeit by just a handful of States so far – promises to make the situation worse. Most of the under-construction projects in RERDA States are stuck because the developers cannot meet the new, stricter provisions of the Act, and cannot sell them without RERDA approval.

This, in a country where there is still a staggering shortage of housing, particularly in urban areas. According to the Ministry of Housing and Urban Affairs, housing shortage across urban India was estimated at 18.78 million units during the 12th Plan period (which ended, along with the era of planned development, on March 31 this year). But that may be a serious underestimate. According to a white paper 'Indian Housing Industry' by research and consultancy firm RNCOS, the housing shortage is expected to rise to 34.8 million units by 2022.

The developers we need

Of course, the private sector has woken up to the so-called 'affordable housing' segment and has been pushing it. The problem is, its definition of affordable is limited to price. But just because the price is lower doesn't mean those needing houses buy them, because most of these houses are unliveable from a practical point of view – too far away from economic or employment hubs, poorly

Figure 24

Newspaper article : 'Housing for all' critique

“Some support to low-income housing might have had benefits and prompted little private-sector reaction. But support at a scale that distorted housing prices and private-sector incentives is too much. Furthermore, the private sector’s objectives are not the government’s objectives, and all too often policies are set without taking this disparity into account. Serious unintended consequences can result (*Rajan, 2011*).” Although this statement was made by Raghuram Rajan in context of American housing bubble and the financial crisis that USA faced in 2008; but in the present scenario, it proves to be equally applicable to the case of affordable housing in India.

In theory, it is the Government’s responsibility to regulate and check that the private and public ownerships abide by the rules and regulations. But after liberalization of economy in 1992, “it is noted that the economic model is being skewed towards private ownership and Government seems to take decisions in the favor of privatization (*Klein,2016*).” Eventually, in present scenario the role of the state is perceived differently. Instead of a provider, it shifts to that of serving the private sector. This phenomenon gains further momentum when it is coupled with the abiding belief of idea of capitalism - which is limitless growth (*Meadows, 1972*).

While the capitalist system seems to be an efficient way for use of resources, it continually encourages higher levels of consumption of material. **The Frenzy of earning and spending in the capitalist system is thus not at all compatible with moderating the impact of people on the environment** (*Gadgil, Guha, 1995*). Hence, this brings fundamental lack of ecological awareness in the people. Despite the increasing scale of ecological issues, the ideology of capitalism rejects the physical ‘limit to growth’ and trusts technical innovation to rescue the plausible arising problems (*Meadows, 1972*). “ **Just as religion and custom legitimized patters of resource use in pre-industrial societies, in the industrial mode science provides the organizing principle for Human interactions within nature** (*Gadgil, Guha, 1992*).”

This suggests that over reaching belief itself ignores the need of ecological consciousness and hence economic alignment unfolds as irresponsible towards ecological issues, which eventually drives irresponsible practice of markets. This further sips into Mesosystem and Microsystem. As Architecture operates within these larger political and economic context, it inevitably becomes sub server of this system.

“Architecture is an important non-verbal medium for the communication of values about ways of life, aesthetic aspirations and, more generally, cultural ideologies. It always reflects the distribution of political and economic power within society (*Desai, 1997*)”.

As mentioned in above sections, Architecture is inevitably part and parcel of economic and political powers. But the question arise is **whether Architecture education consciously address this presence and effects of political and economic systems?** Does it makes conscious attempts to inform the existing systems (political and economic) regarding the need for change?

Another conclusion that can be drawn from the analysis done in other sections is that, if belief system is robust, it has potential to affect each layer of development (section 2.3.1). Education is the system that shapes learning environment for people, create and share knowledge, skills, habits, values and beliefs; and eventually pass the acquired knowledge to the next generation. In a way, it is a resource pool that anticipate to bring advancement of the people. “Present education system provides a very narrow view of human being. If the question is raised that what is it for and who really succeeds by the outputs, an interesting correlation between industrialism, capitalism, and education immerses. Almost every education system on the earth has the same hierarchy of the subjects – at the top Science, and Mathematics and languages; then the Humanities and at the bottom Arts (*Robinson,2010*).”

3.2.3 Within Education system

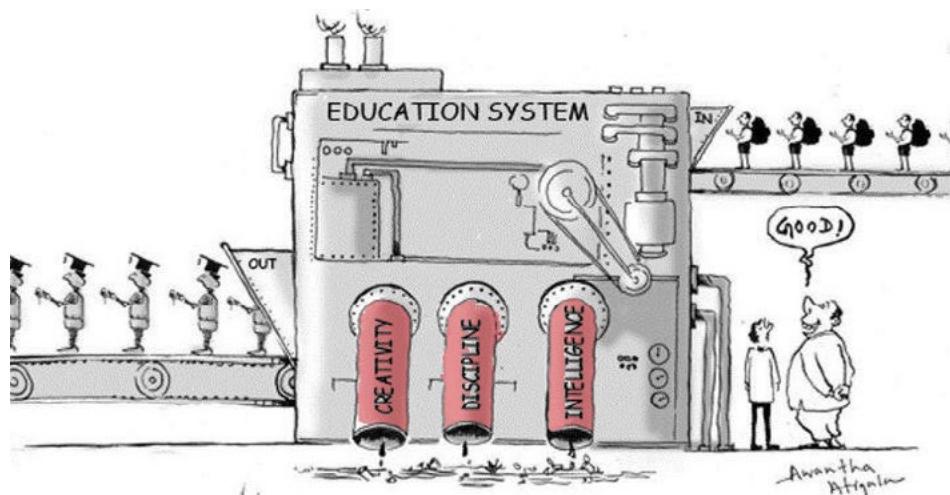


Figure 25
Education system analogy

The whole system was invented around the 19th century. Before that, there was no system of public education. They all came into existence to meet the need of Industrialism (Robinson,2010). So the hierarchy is reached on two ideas : 1. Most useful subjects for the work are at the top 2. Academic ability. This suggests that the education system is structured to extract the Human resource that can participate only in industrial mode of development. This fundamental base eventually reflects in the value orientation of the schools and universities.

Most of the contemporary Architecture is highly derived from visual art, and eventually influenced each successive generation of student. “ So you will find a rash of “post-modern” buildings built during the 80’s and early 90’s across the world. Similar style expressions before and since indicate that schools still emphasize form over function, style over content (Martiz, 2008). ” This type of architecture generates from superficial thinking. Further elaborating the same argument, Martiz says that Architects need to learn about (or at least learn to how to find out) social patterns, regional economics, environmental impacts, resource management and numerous macro-scale issues that directly links to architecture. In his paper “One world Architecture” presented at Oxford conference: re-evaluation of Architecture education (2008), he argues that because these factors are not considered to be integral part of pedagogic structure, most of the Architecture students (i.e. future architects) remains devoid of ecological and system based literacy.

Another important aspect that Architecture education seems to ignore is the fact that the profession operates under rules and regulations laid down by economic and political forces (influence of ecosystem - section 3.1.3 and section 3.2.1). There are limited possibilities for Architects to challenge these forces within mainstream professional framework. So, only few of those projects and school of thought that choose to operate outside the conventional framework (laid down by ecosystem) shows the signs of exploration of ecological conscious service.

“When professionals fails to recognize or respond to value conflicts, when they violate their own ethical standards, fall short of self-created expectations for expert performance or seem blind to public problems they have helped to create, they are increasingly subject to expression of disapproval and dissatisfaction. Radical critics like Ivan Illich (1970) take them to extreme criticism as a task for misappropriating and monopolizing knowledge, blithely disregarding social injustices and mystifying their expertise”

Schon, Donald A.; Educating the reflective practitioner : towards a new design for teaching and learning of the profession.

-
- ### 3.3
- ## Analysis
- ### Conclusions:
- from Chronosystem,
Macrosystem and
Exosystem**
- From the literature studies carried out in earlier sections, it is clear that there is lack of ecological literacy, sensitivity and responsibility within the institutions of Chronosystem, Macrosystem and Exosystem.

So, hereby a conclusion is derived that largely there is ignorance of Ecological costs as far as natural world is concerned. Therefore, during case studies it would be assumed that there is less focus on Natural world during design and construction process and hence the focus of the case studies will be largely on Human world parameters from Ecological Cost wheel. Despite of this assumption, an attempt is made to derive behaviors within Natural world through help of Interview in order to rectify the assumption.

The mesosystem and microsystem are comprised of immediate institutions that determine an individual's development. These institutes that affects an individual are : family, peers, neighborhood, workplace, school/college and religion. In this section; the focus is to examine the development of an Individual or a group of Architects that share similar school of thought withing mesosystem and microsystem, in order to look for inclination of Architects involved in the mainstream Architecture practice. Here by, mainstream refers the practices that operates under real estate market mechanisms.

This is done by examining the case studies projects through ecological cost wheel (section.2.3.2) that will help to locate the cause within mesosystem and Microsystem (fsection.2.3.1). The drivers of general inclination of Architecture profession ,within Indian and International context, is already outlined In section 2.3.1 and 2.3.2.

The tool chosen for undertaking the study is ecological cost wheel model (developed in fig. 7, section.2.3.2). It's constituent aspects contains two major aspects :

1. Analyzing impacts of act of building within human-made world

Amount of Effort// This parameter refers to total amount of human effort involved in the act of building. This includes manual and mental labor of everyone involved in whole process of making (i.e.designing and construction teams, planning team, Architects, builders, construction workers, tool developers and so on). This is not just confined to only one project but also consider the time and resources spent for educating the professionals and laborers involved in the process - from material extraction to the final built form. Although, the degree of uncertainty is higher in order to infer results in precise numbers through these factors, an attempt has been made to be able to gauge the amount of effort through informal interview on the basis of the history and background of involved people.

Amount of Material// This paramter refers to types and amount of material used for the act of building in the form of energy. This includes distance of the material, hence embodied transport energy; material industries that converts raw material into usable form, hence embodied energy to convert it into usable form; and the quantity of the material used. In case studies, this is derived with the help of questionnaire.

3.4 Radarign ignorance in Mesosystem and Microsystem

3.4.1 Parameters to determine Ignorance

Amount of resources// This parameter refers to amount of raw resources and mode through which the resources were utilized during the process of building. This include consumption of water, electricity, material (unprocessed in raw form), land and finance. Although, it is difficult to analyses these qualities in terms of precise quantities; the attempt has been made to quantify it with the help of questionnaire in order to screen the case studies.

Amount of time and utility// This parameter refers to the amount of time utilized during construction and as well as life span of the built form. The ratio of total time (includes education till the final built form) vs life span of building is extremely important parameter because this also help to gauge wise finance decisions.

Risk incurred// This parameter refers to possible risk assessment to human, cultural and natural health and whether the case study project made conscious attempt for the needed actions.

Green Certification// This parameter refers to find if the project is a certified “Green” and crosscheck whether it suffice the criteria of Natural world.

2. Analyzing impacts of act of building within Natural world.

Species Health// This parameter refers to well being of individual species present in the area of construction. The presence of infestation or a particular specie’s presence in disproportionately large or small size population. Therefore, this has been examined through study of ecological history of site. The keystone species of birds, insects and other abiotic relations are selected to determine the species health through population dynamics.

Species composition// This parameter refers to population of different species sharing the same geographic location. The intent is to check whether the concentration of one species increased or decreased because of construction and weather the span of dwelling facilitate the balance between various species of the area.

Ecological process//

Hydrological cycle// This parameter is to examine whether the act of building facilitates optimum water use and recharge possibility in preconstruction as well as post construction phase.

Nutrition cycle// This parameter refers to maintenance of ecological loops. Through this, the attempt is to find the optimum interruption during the act of building. This includes examining nutrition cycle disruptions in the place where the built form is made, from where the raw materials are brought and in the per-design and post -design phase (i.e. materials and tools used during design phase) as well.

Biotic interaction// This parameter refers to check the maintenance harmony between biotic and abiotic interaction. The non-living factors like sunlight, temperature, atmospheric gases, water and soil are considered to be abiotic components. This aspect is screened by examining judicial resource use.

Habitat Structure// This parameter refers to the physical arrangement of a thing in a space. This factor “serves a physical link between sociocultural and ecological system, which can be used as a focus for interdisciplinary and applied research about multiple, interactive effects of urbanization on the ecology of soil (Byrne, 2007)”. Hence, the attempt to look for the links that suggest maintenance of habitat structure.

Hereby, its important to note that the parameters listed in human-made world has short term execution span and faces immediate reactions, while that of natural world takes years of process to build up and shows sign of impacts (either good or bad) over a period of time. On the basis of these understandings of ecological cycles, it can be learn that this basic dichotomy is an interesting phenomenon in itself ,because it tends to more favorable environments for short term gains and bear intrinsic tendency to neglect long term needs.



Figure 26
Ecological Cost Wheel

3.4.1.1

Sample Selection A total of four Projects from Vadodara and Ahmedabad were selected for the purpose of the study. Out of four projects, 1 is at its construction stage, and 1 is just about to finish project. All selected firms and projects are located in peripheral part of the city belonging to VUDA (Vadodara Urban Development Authority) regulatory framework and AUDA (Ahmedabad Urban Development Authority) so that the projects are subjected to similar set of governing rules and regulations.

Medium size firms are selected operating under real estate market mechanism. Only residential projects belonging to similar geographic location is selected because of following reasons

- The projects are subjected to comparatively similar ecological conditions
- Operates under similar regulatory framework
- Allows comparison on the basis of similar governing factors

3.4.1.2

Data collection method The first part of Data collection method is through interview. A questionnaire that helps to determine Architect's general as well as ecological orientation (refer appendix A) were prepared. The questionnaire was printed and appointments were scheduled with the Architects and the Builder of each of the selected firm. All responses were from the owners/ head of the firms/ senior employee of the firm. Data is collected in month of November 2017.

The second part involves informal discussion with the participatory firms to be able to find additional information to fulfill the limitations of questionnaire format.

3.4.1.3

Data analysis method To be able to infer general trend, statistical graphical method is used to analyses the raw data. Data was analyzed using Page feature in Mcbook. The Analysis is divided into two different parts.

In the first part, general inference has been derived from the interview through pie charts. The second part represents awareness degree for ecological costs by placing it on Ecological cost wheel from fig. xxx.

The above mentioned factors are highly based on quantitative analysis and needs further precise development of the model. Yet, it does provide holistic approach to look at the act of building human environments.

//Note

Because of dynamic and constantly evolving nature of Architecture firm, the results are the momentary snapshot of the Interview. There is possibility of change in belief and characteristic of the firm over period of time.

In order to make sure authenticity of data, efforts have been made to receive it directly from the head of the firm and had been voice recorded for purpose of reference.



4

Case Studies



- 4.1 Aries Empyrean Skyline
- 4.2 Nilamber Bellissimo
- 4.3 Aries Empyrean Courtyard
- 4.4 Idmnamam
- 4.5 Empyren Grass Fields

“A microsystem is a pattern of activities, social roles and interpersonal relations experienced by the developing person (a professional in context of this thesis) in a given face-to-face setting with particular physical, social, and symbolic features that invite permit, or inhibit engagement in sustained, progressively more complex interaction with, and activity in, the immediate environment. Examples include such settings as family, school, peer group, and workplace (Brofenbrenner, 1994).”

“A Mesosystem comprises the linkages and processes taking place between two or more settings containing the developing person (eg. the relations between home and school, school and workplace, etc.) In other words a mesosystem is a system of microsystems (Brofenbrenner, 1994).”

The case studies are undertaken for the purpose of in depth examination of factors affecting an Architect's decision, within Mesosystem and Microsystem. In order to determine the driving forces for an Architect's decision, the project is examined through the perspective of two major role players - The Architect and the client.

The case studies are screened to largely find answer of two major question - **Whether the project ensures Ecological stability or not? In either of the case, what were the guiding factors for the decisions?**

The principles of stable ecology are:

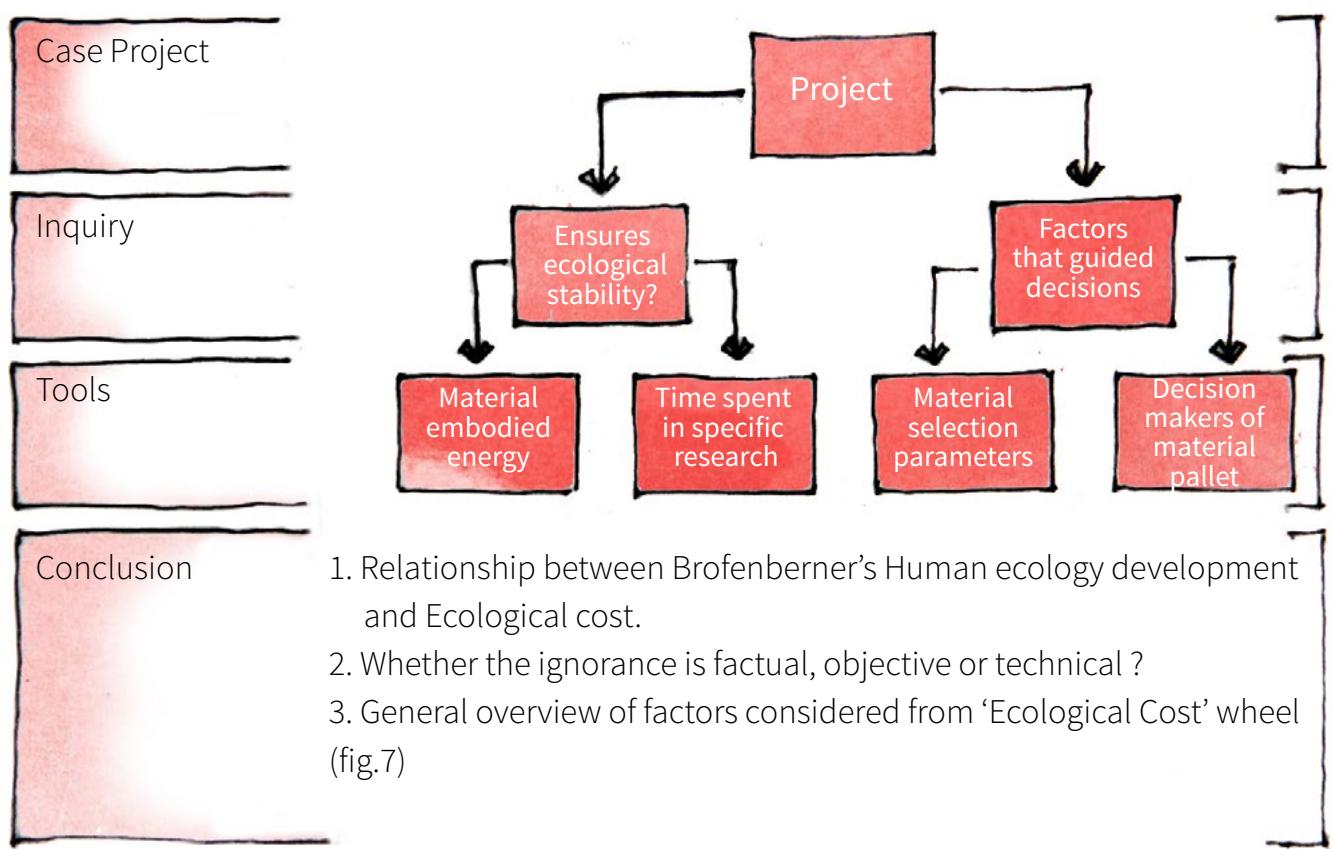
- Maintenance of nutrient cycle by disposing waste and replenishing nutrients.
- Maintenance of the size of consumer population to avoid overuse of the resources.
- Maintenance of Biodiversity.

Based on this, the two major critical act of intervention that affects ecological stability during the act of building are

Material// including the process of extraction, to industrial production, to ultimately final use & safe disposal

Time// inclusive of design decisions, consideration of pace of ecological processes on site, and its maintenance after occupancy.

Hence, outline for the project study is as per follow.



// Case Study 1//



Figure 27 Park space view (render)



Figure 28 Front Elevation



Figure 29 Building View

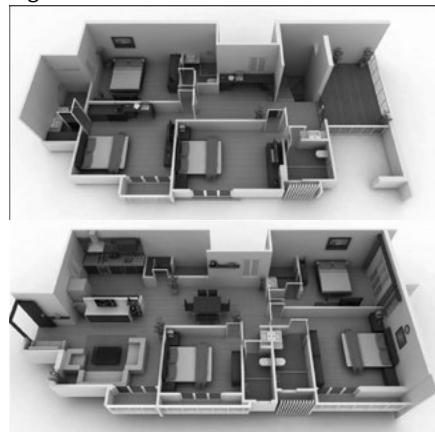


Figure 30 Typical floor plans



Figure 31 Typical Penthouse plan



Figure 32 Typical floor plan

Project details

Name// Aries Empyrean Skyline
 Location// Vasna-Bhayali Road,
 Vadodara
 Site area// 17,500 sq.ft.
 Built-up area// 11050 sq.ft.
 Year of construction// 2012
 Year of Occupancy// 2015
 Developer// Aries Infrastructure
 Architecture studio// Art & Architecture studio
 Project Brief// Apartment building of 48
 housing units in 3,4 BHK
 configuration

Architect's Details

Studio// Art & Architecture associates
 Principle Architect// Dharam Patel
 Establishment year// 2010

Developer's Details

Name// Aries Infrastructure
 Partners// Kushal Patel, Hem Rana, Anil
 Mehta

No.of group members// 3
 Establishment year// 2007

Materials used

Structure// Cement and steel
 In-fill walls// Bricks (Grade B)
 Door// Wooden
 Windows// Pre-fabricated Aluminium
 windows
 Paints & Finishes// Asian paints (Apex - Plastic
 and distemper)
 Flooring// Vitruvius tiles (interiors)
 Exteriors and Pavers// Kota stone and Concrete
 pavers



Figure 33 Site context (2015)



Figure 34 Site context (2012)

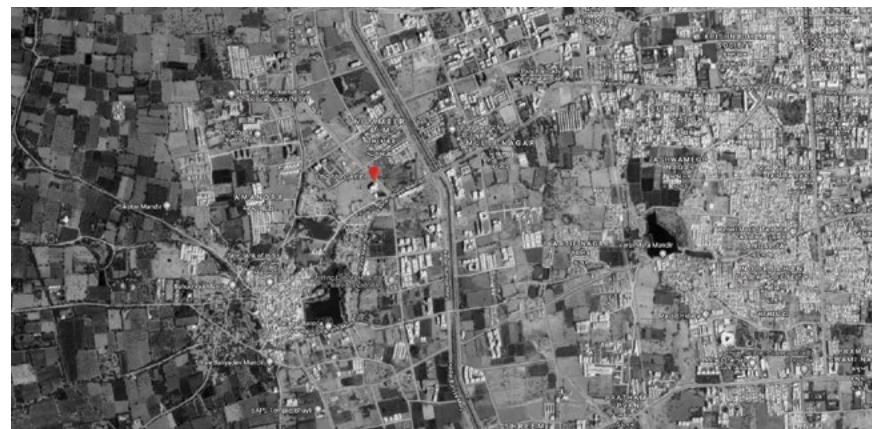


Figure 35 Site context (2012)

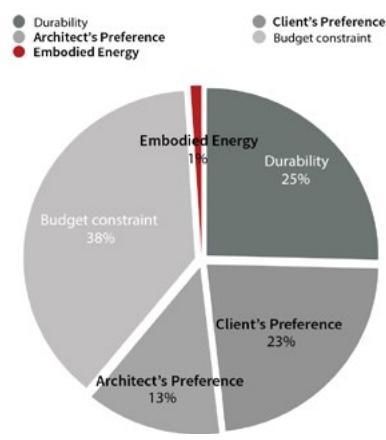


Figure 36
Material selection Parameters

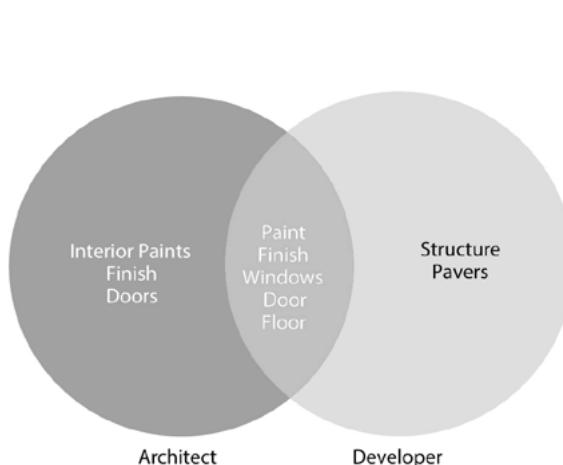


Figure 37
Decision makers of material pallet

Materials used

Structure Cement	Structure steel	Walls Bricks (grade B)	Doors wood	Windows pre-fab aluminium	Paints Asian paints	Flooring Tiles	Pavers Kota stone and cement blocks

	Ecological costs	Factual	Objective	Technical
Human made world	Effort		●	
	Material		●	
	Resources	●		
	Time and Utility		●	
	Risk Incurred	●		
	Green Certificate (if any)	●		
Natural world	Species Health		●	
	Species Composition		●	
	Ecological Process		●	
	Hydrological cycle			●
	Nutrition cycle		●	
	Biotic interaction		●	
	Habitat Structure		●	

As per the table, dominant presence of Objective ignorance is observed.

Table 3
Nature of ignorance Analysis

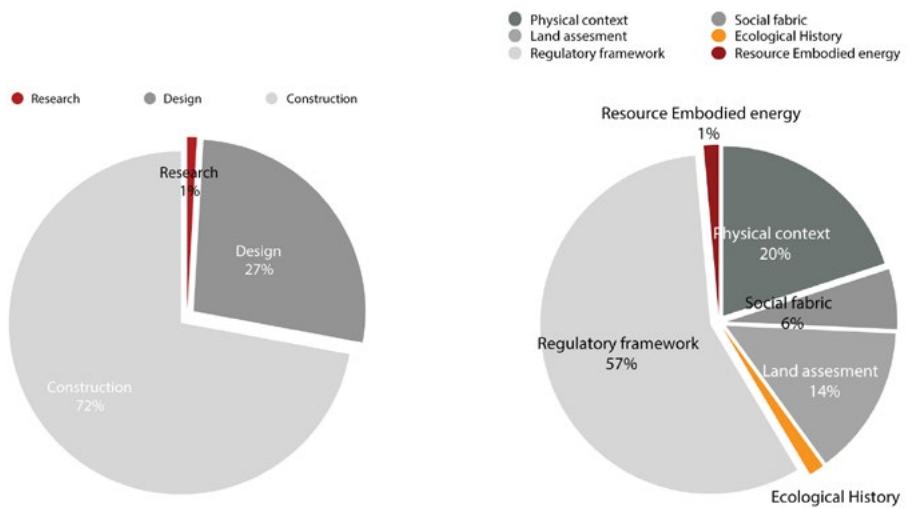
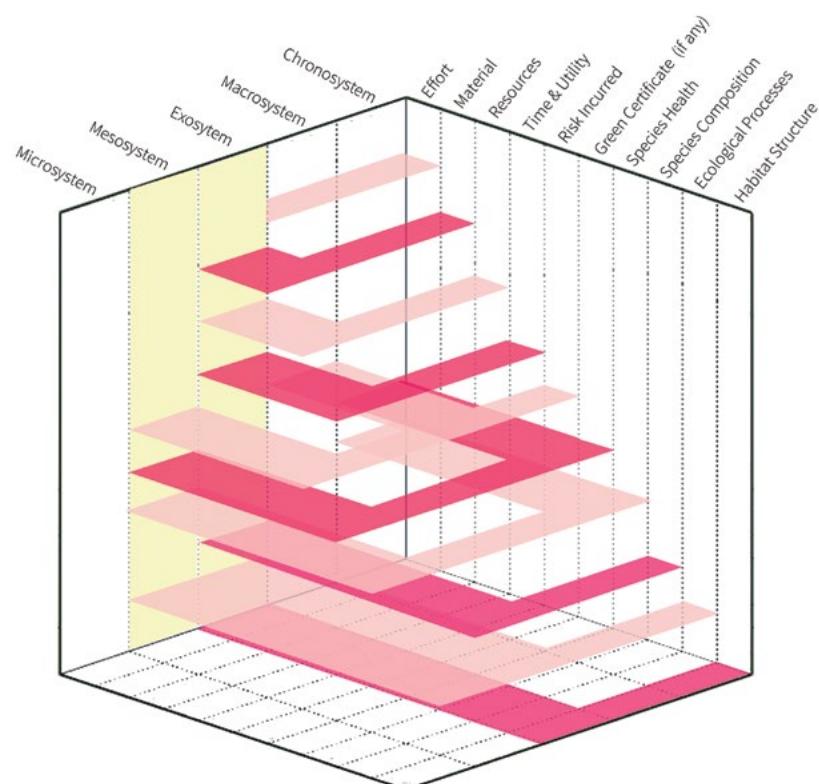


Figure 38
Total Time Spent

Figure 39
Time spent in specific Research



As per the analysis, Mesosystem and Exosystem are most influential systems for the decisions

Figure 40
Relationship between Human Development and Ecological Cost



Figure 41
Ecological Cost wheel

Legends

- Sincerely considered (80-100%)
- Partially considered (40-80%)
- Less considered or ignored (10-40%)

// Case Study 2 //



Figure 42 Front Elevation View



Figure 43 Elevation view Render



Figure 45 Building View



Figure 46 View Render

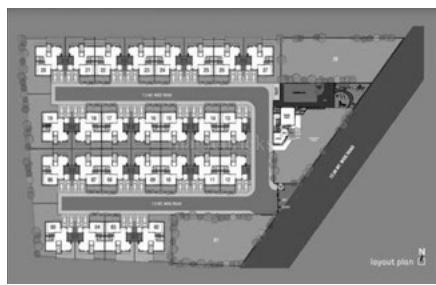


Figure 47 Plan



Figure 48 Typical floor plans

Project details

Name// Empyrean Grass Fields
 Location// Sevasi, Vadodara
 Site area// 35,500 sq.ft.
 Year of construction// 2016
 Year of Occupancy// 2018
 Developer// Rajvir Aries Infratech
 Architecture studio// Graphite Space Studio
 Design
 Project Brief// Comprises of 27 housing units (duplex), in site area of 35,000 sq.ft.

Materials used

Structure// Cement and steel
 In-fill walls// Bricks (Grade B)
 Door// Wood
 Windows// Pre-fabricated Aluminium windows
 Paints & Finishes// Delux paints (Apex - Plastic and distemper)
 Flooring// Marble and Kota stone
 Exteriors and Pavers// Kota stone and Concrete pavers

Architect's Details

Studio// Graphite Space Studio
 Design
 Principle Architect// Manish Patel
 Establishment year// 2009

Developer's Details

Name// Rajvir Aries Infratech
 Partners// Anil Mehta, Mithul Patel, Hem Rana, Kushal Patel

No.of group members// 6
 Establishment year// 2016



Figure 49 Site context



Figure 50 Site context



Figure 51 Site context

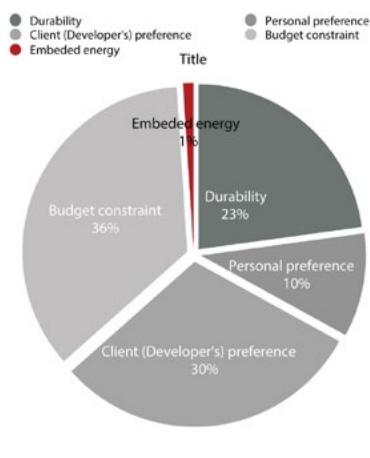


Figure 52
Material selection Parameters

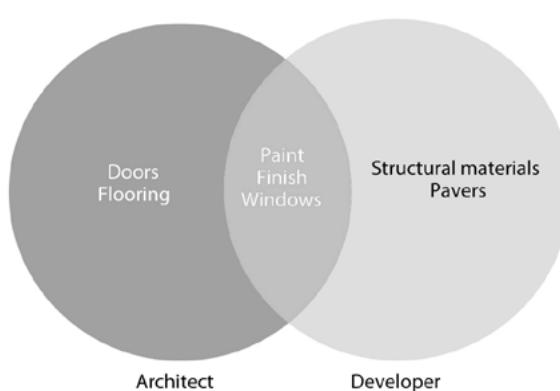


Figure 53
Decision makers of material pallet

Materials used

Structure Cement	Structure steel	Walls Bricks (grade B)	Doors wood	Windows pre-fab aluminium	Paints Asian paints	Flooring Tiles	Pavers Kota stone and cement blocks

	Ecological costs	Factual	Objective	Technical
Human made world	Effort		●	
	Material		●	
	Resources	●		
	Time and Utility		●	
	Risk Incurred	●		
	Green Certificate (if any)			●
Natural world	Species Health	●		
	Species Composition	●		
	Ecological Process	●		
	Hydrological cycle			●
	Nutrition cycle		●	
	Biotic interaction		●	
	Habitat Structure	●		

As per the table, dominant presence of Factual ignorance is observed.

Table 4
Nature of Ignorance Analysis

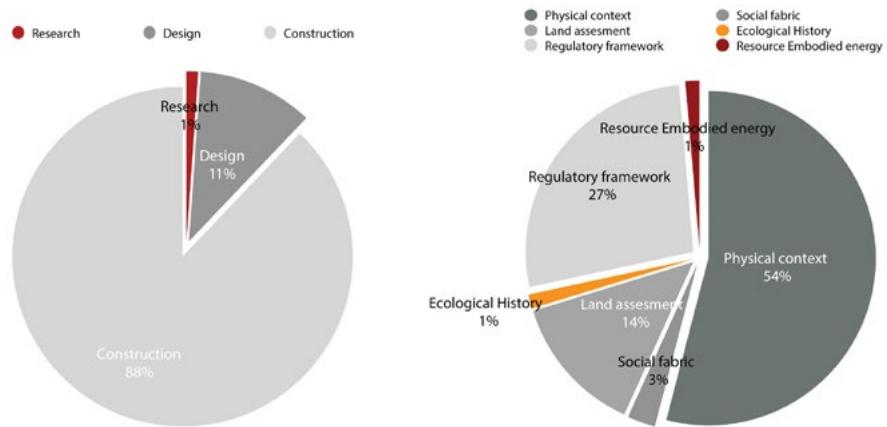
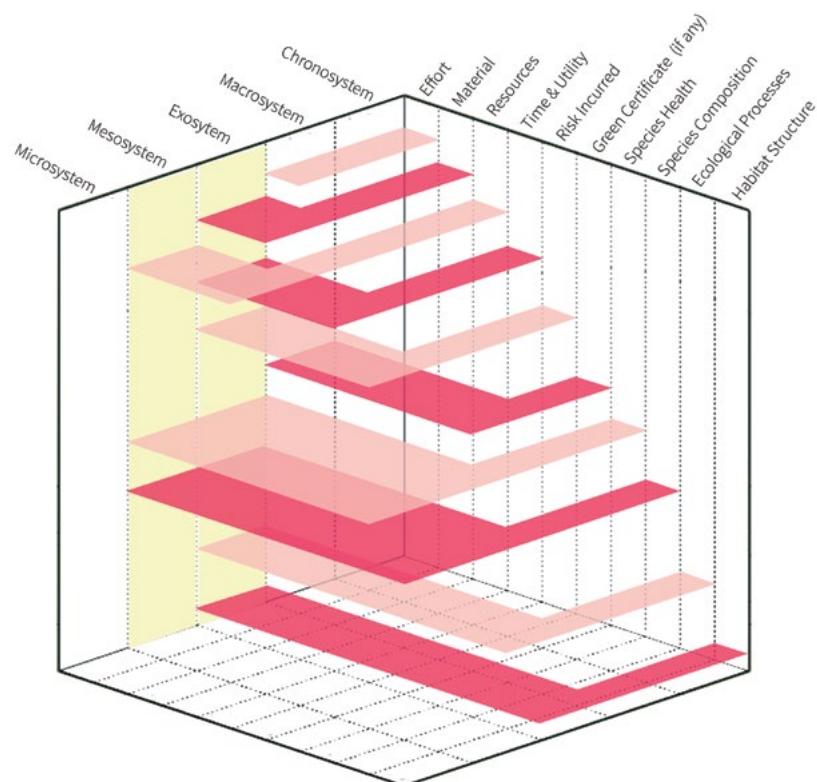


Figure 54
Total Time Spent

Figure 55
Time spent in specific Research



As per the analysis, Mesosystem and Exosystem are most influential systems for the decisions

Figure 56
Relationship between Human Development and Ecological Cost



Figure 57
Ecological Cost Wheel

Legends

- Factors sincerely considered (80-100%)
- Factors partially considered (40-80%)
- Factors less considered or ignored (10-40%)

// Case Study 3 //

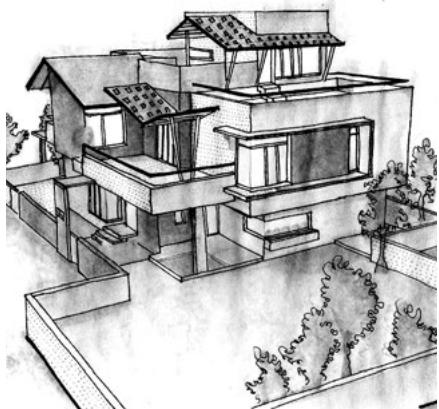


Figure 58 View



Figure 59 Front Elevation view



Figure 60 Elevation

Project details

Name// Idamnamam
 Location// Bhayli Road, Vadodara
 Site area// 24,000 sq.m.
 Year of construction// 2015
 Year of Occupancy// 2017
 Developer// Bhailal Patel
 Architecture studio// Graphite Space Studio
 Design
 Project Brief// Residential House

Materials used

Structure// RCC Frame structure
 In-fill walls// Surkhi Bricks (Rat-trap bond)
 Door// Wood (re-claimed)
 Windows// Wood (re-claimed)
 Paints & Finishes// No paints, Lime plaster
 Flooring// Jaiselmeir stone, Kota stone
 Exteriors and Pavers// Rajula Stone

Architect's Details

Studio// Graphite Space Studio
 Design
 Principle Architect// Juhi Bhandaria
 Establishment year// 2009

Developer's Details

Name// Bhailal Patel
 Establishment year// 2010



Figure 61 Site context



Figure 62 Site context

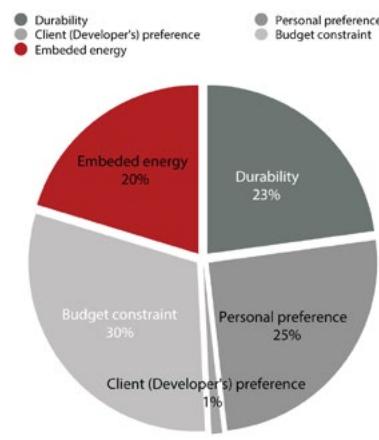


Figure 63
Material selection Parameters

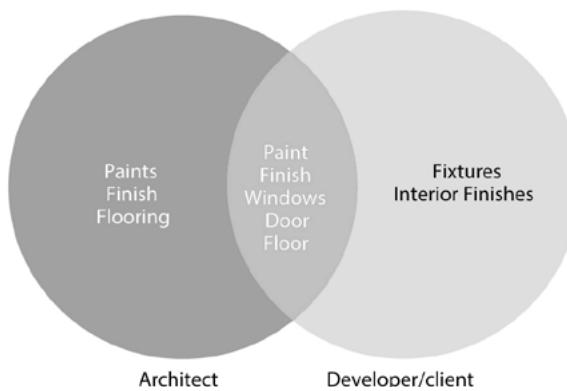


Figure 64
Decision makers of material pallet

Materials used

Structure RCC Frame	Structure Surkhi bricks (rat-trap bond)	Roof Filler Slab	Doors wood (re-claimed)	Windows Wood (re-claimed)	Paints Lime plaster	Flooring Jaipur stone, Kota stone	Pavers Rajula Stone

	Ecological costs	Factual	Objective	Technical
Human made world	Effort			●
	Material			●
	Resources			●
	Time and Utility		●	
	Risk Incurred	●		
	Green Certificate (if any)	●		
Natural world	Species Health	●		
	Species Composition	●		
	Ecological Process			●
	Hydrological cycle			●
	Nutrition cycle		●	
	Biotic interaction		●	
	Habitat Structure			●

As per the table, pre-dominantly presence of Technical ignorance is observed.

Table 5
Nature of Ignorance Analysis

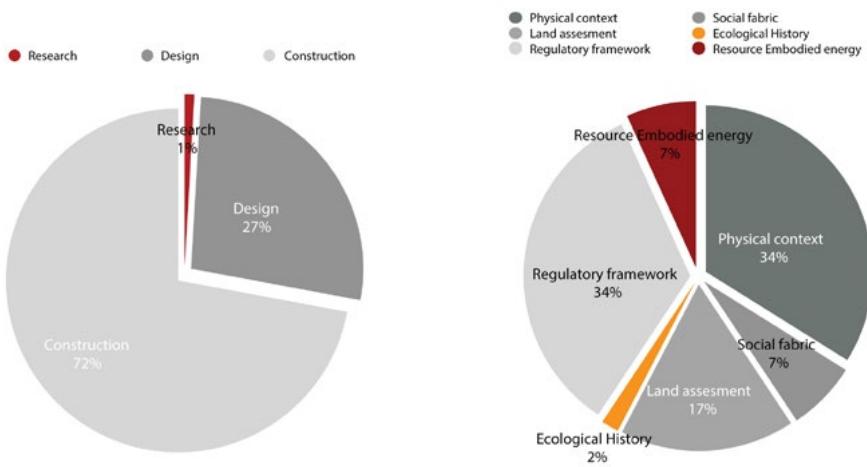
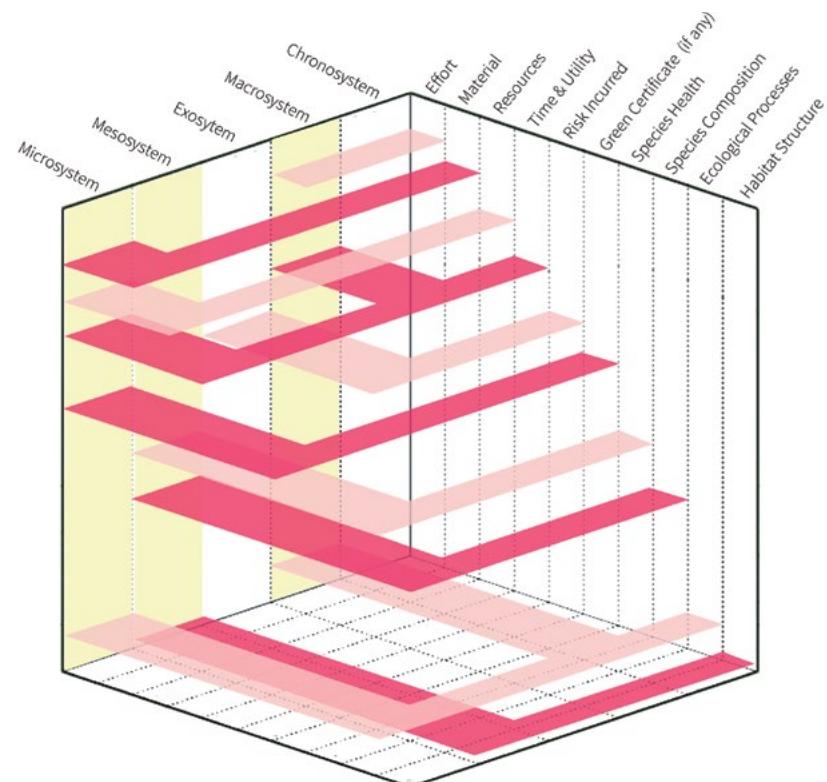


Figure 65
Total Time Spent

Figure 66
Time spent in specific Research



As per the analysis, Microsystem, Mesosystem and Macrosystem influenced the decisions in this particular project.

Figure 67
Relationship between Human Development and Ecological Cost



Figure 68
Ecological Cost Wheel

Legends

- Factors sincerely considered (80-100%)
- Factors partially considered (40-80%)
- Factors less considered or ignored (10-40%)

// Case Study 4 //



Figure 69 View (render)



Figure 70 Front Elevation view



Figure 71 Building View

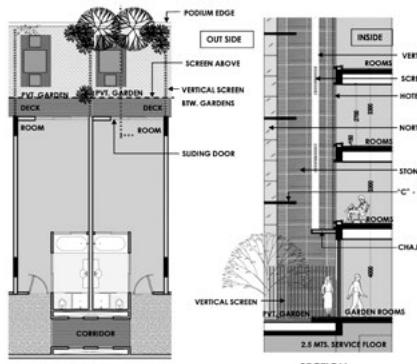


Figure 72 Detail plan and section

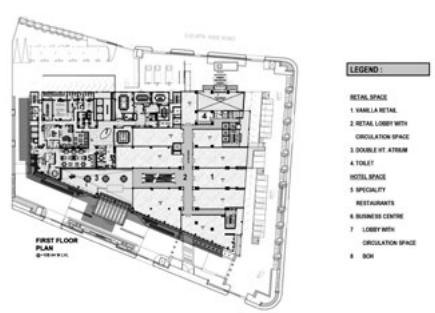


Figure 73 Typical floor plan



Figure 74 Section

Project details

Name// Shapath V
 Location// SG highway, Ahmedabad
 Site area// 5 lack Sq.ft.
 Year of construction// 2008
 Year of Occupancy// 2014
 Developer// Savvy Infrastructure
 Architecture studio// Kapadia Associates
 Project Brief// Retail shops, Offices and Hotel

Materials used

Structure// RCC and steel
 In-fill walls// Fly-ash Bricks
 Door// Wood
 Windows// Pre-fabricated Aluminium windows
 Paints & Finishes// Delux paints (Apex - Plastic and distemper)
 Flooring// Marble, tiles and Carpet
 Exteriors and Pavers// Concrete pavers

Architect's Details

Studio// Kapadia Associates
 Principle Architect// Kiran Kapadia
 Establishment year// 1991

Developer's Details

Name// Savvy Infrastructure
 Partners// Jaxay Shah, Sameer Sinha and Jigish Shah
 No.of group members// 3
 Establishment year// 1996



Figure 75 Site context



Figure 76 Site context

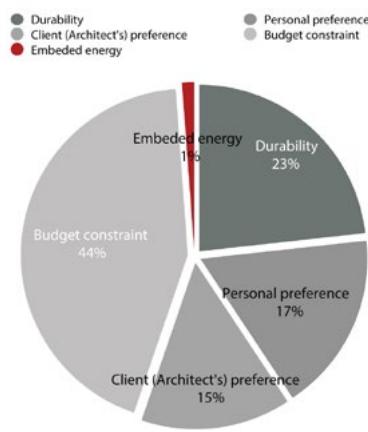


Figure 78
Material selection Parameters

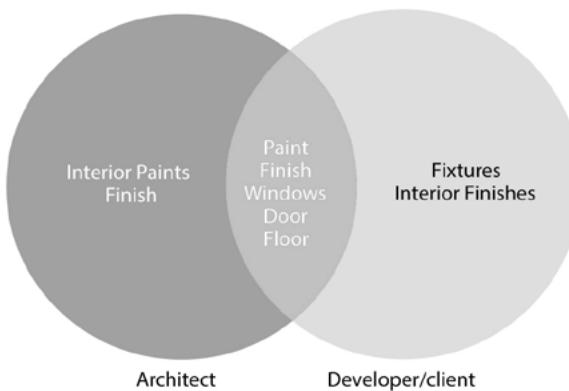


Figure 79
Decision makers of material pallet

Materials used

Structure Cement	Structure steel	Walls Bricks (grade B)	Doors wood	Windows pre-fab aluminium	Paints Asian paints	Flooring Tiles	Pavers Kota stone and cement blocks

	Ecological costs	Factual	Objective	Technical
Human made world	Effort		●	
	Material			●
	Resources		●	
	Time and Utility		●	
	Risk Incurred	●		
	Green Certificate (if any)			●
Natural world	Species Health		●	
	Species Composition		●	
	Ecological Process		●	
	Hydrological cycle			●
	Nutrition cycle		●	
	Biotic interaction		●	
	Habitat Structure		●	

As per the table, predominant presence of Objective ignorance is observed.

Table 6
Nature of Ignorance Analysis

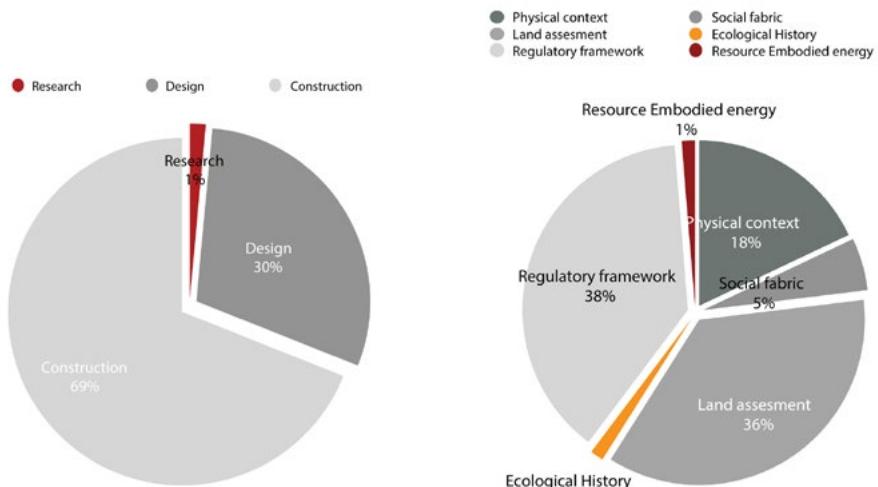
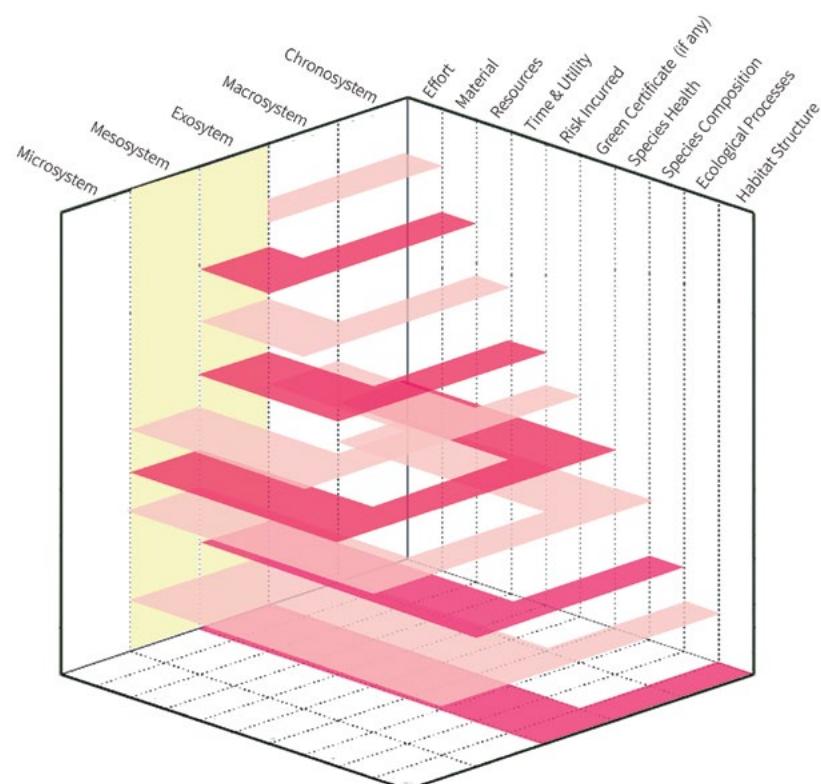


Figure 80
Total Time Spent

Figure 81
Time spent in specific Research



As per the analysis, Mesosystem and Exosystem are most influential systems for the decisions

Figure 82
Relationship between Human Development and Ecological Cost



Figure 83
Ecological Cost Wheel

Legends

- Sincerely considered (80-100%)
- Partially considered (40-80%)
- Less considered or ignored (10-40%)

5

Conclusions

5.1 Nature of Ignorance
5.2 Inference

5.1 Nature of Ignorance

Through the case studies, presence of Ignorance of Ecological cost is confirmed. Also it is observed that it is driven by many complex forces acting through both governing as well as user group systems.

The contrasting results from case study three and four gives a new insight in the factors that dictate design process, construction process and Market mechanism. It is found that the final product, either carried through Real estate market or Architects; is highly driven by client/ end user as well as the peripheral forces. Scale of the project is found to be one of the most important factor to be able to implement Ecological Conscious Practices. Also Real estate markets are highly susceptible to economic fluctuations, which eventually affects Architect's Practice . In this web of Human system, natural systems end up being that of least concern.

Through observations made from the literature studies and the case studies, the nature of ignorance is found to be per following.

	Factual Ignorance	Objectual Ignorance	Technical Ignorance
Economic System		●	
Political System and Governance		●	
Education System	●		●
Architecture Education	●		
Architecture Practice (small scale)			●
Architecture Practice (large scale)		●	

Table 7
Nature of Ignorance Analysis

As per mentioned earlier, Psychologist segregates the cause of state of being Ignorant into three major categories:

1. *Factual ignorance – refers to absence of knowledge of some fact*
2. *Objectual ignorance – refers to un-acquaintance (limited familiarity) with some actual object*
3. *Technical ignorance – refers to absence of knowledge of how to do something that could actually be done. (Nikolaj)*

5.2 Inference The overall study lead to infer that there is overwhelming presence of peripheral forces from real estate markets, governance, education systems and general aspiration of people. Architecture practice operates under these peripheral environments and tend to take decisions as per the situation demands. Recent awareness and heavy discussions around Sustainability has imparted, if not completely, but some degree of awareness regarding ecological conscious practices. They tend to take liberty of expressing these concern, either as a common norm or client's demand. But mass bulk practices still continues to be party to market mechanisms.

In the initial section of the thesis analysis, there is an interesting finding through literature studies that the 'Beliefs and Values' are composed for people to be able to orient their actions as per the future they project in their mind. The question raised was a Macro scale question to which the derived results found to be in Micro scale. Albeit, Exosphere scale systems hugely dictates actions in Mesosphere, the key to the change lie in the fundamental shifts in mindset of individual and awareness in the smaller groups. This eventually, will help to formulate larger over all belief shared by larger mass. This requires active and genuine efforts from all sorts of people.

The shift towards Ecological literacy can be reality only through combined efforts of everyone. It needs a drastic change in people's mindset and the way we live.

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Appendix Sample Questionnaire

[All data will be confidential and used for educational purposes only]

Name of Firm:

Year of Establishment:

Location of office:

Name of the Principal Architect:

Name of sub-architects:

What are the project team organization criteria?

- Client oriented:** Team set up is as per the client's demand. A dedicated team is put for that client only.
- Project type oriented:** Special team per project type. Eg. One team for all residential projects and another team for commercial or institutional projects etc.
- Service oriented:** As per the services provided by the firm. For eg. Architecture team, Structural engineer team, interior designer team, landscape team.
- Organised around partners:** Each partner has a project team and both pursue different projects.
Studio oriented: consists of single team capable to execute project from start to finish.
- Others. Please specify.**

Part 1 (Background)

Personal Background |

Name:

Age:

Home town:

Sex: M/F

Education Background |

Name of High school:

Location of high school:

Name of Architecture School:

Location of Architecture school:

Education degree:

Places of residence (how many cities/town/ villages):

Part 2 (Ecological cost wheel – Human parameters)

Project name:

Project location:

Client name:

Site area:

Year of Construction:

Year of use:

Project Brief:

Project details |

Project site history

Project team:

Name of Project Manager:

Name of Builder:

Name of Contractors:

Name of Sub-contractors:

Name of structural Engineer:

Team Hierarchy:

Materials |

1. List of Materials used:

Structure materials:

Door-Windows:

Paint and Finishes:

Flooring:

Pavers:

2. Parameters for selection of a material?

- Material dealers (list of brochure)
- Affordability (budget constraints)
- Client's choice
- Personal preference
- Proximity to the site

Why?

3. Time spent |

3.1 Research

- | | | | |
|--|---|--|--|
| <input type="checkbox"/> Context | <input type="checkbox"/> Social fabric | <input type="checkbox"/> Land assessment | <input type="checkbox"/> Site's Ecological history |
| <input type="checkbox"/> Resource availability | <input type="checkbox"/> Regulatory framework | <input checked="" type="checkbox"/> others | |

Additional notes:

3.2. Design

- | | | | |
|--|--|-----------------------------------|--|
| <input type="checkbox"/> Concept | <input type="checkbox"/> Zone planning | <input type="checkbox"/> Services | <input type="checkbox"/> User specific |
| <input type="checkbox"/> Spatial qualities | <input type="checkbox"/> Spatial areas | <input type="checkbox"/> others | |

Additional notes:

3.3. Production

- | | |
|---|--|
| <input type="checkbox"/> Site clearance/modifications | <input type="checkbox"/> bringing resources to site Construction |
| <input type="checkbox"/> Construction | <input type="checkbox"/> Fixtures & Finishes |
| <input type="checkbox"/> Laborer's Housing & safety | |

4. (From where) Resources (for construction site)

Water

Electricity

Machinery

Others

Part 3 (Ecology specific)

1. Design

Does following things were considered during design process?

- o Ground water recharge possibility
- o Native Vegetation
- o Natural light
- o Natural Ventilation
- o Land assessments (environmental & social risks)

Reason

- Time constraints (reason)
- Difficult to execute
- Lack of Knowledge

Additionally notes:

2. Any kind of infestation experienced on site?

T h a n k Y o u