

**Sustainable Architecture**  
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**Lecture-11**  
**Definition and Characteristics of Sustainability**

Good morning, welcome back to the online course on Sustainable Architecture. And, I am your course Coordinator Dr. Avlokita Agrawal Assistant Professor at Department of Architecture and Planning IIT Roorkee. Till the last lecture, we have discussed about the impacts of development and impacts of built environment on the natural environment. We have seen how the concept and discussions around sustainable development initiated and how it grew to discuss the present form of definitions which we have for sustainable development.

So, far we have not discussed anything about sustainable architecture specifically. So, from this week onwards, we will be talking specifically about sustainable architecture, we would talk about the different processes on how to create, how to design sustainable architecture, what all does it involve and how do we exactly do it.

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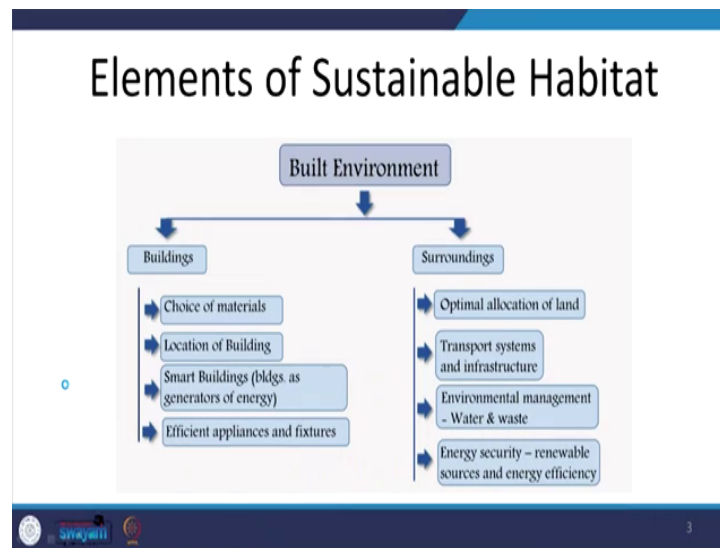
So, before we start discussing about sustainable architecture and the specific details of it; let us look at the different scales of sustainable built environment. Now, architecture is a subset of built environment. The built environment has various scales from micro to

macro. The built environment may be as large as a region itself. The entire region which has different built systems for example, the cities, the neighborhoods, the infrastructure that goes into the cities. And, it also has some of the manmade environments, which may not look as built as much built as cities and buildings, but yet they are built environment for example, the agricultural fields.

The region will have all of these different types of built environment all coming together. And, when we talk about sustainable built environment at a regional scale, we are talking of the bigger system. Now, this bigger system, macro system, consists of smaller systems, like neighborhoods. Further broken down into smaller systems like a site, the site itself may be comprised of a number of buildings.

Now, this building sustainable building or what we would usually refer as sustainable architecture. When, we talk about sustainable built environment and specifically come to sustainable architecture, we are often talking about a site, where on which a building is going to be constructed both of these to be designed in a sustainable manner.

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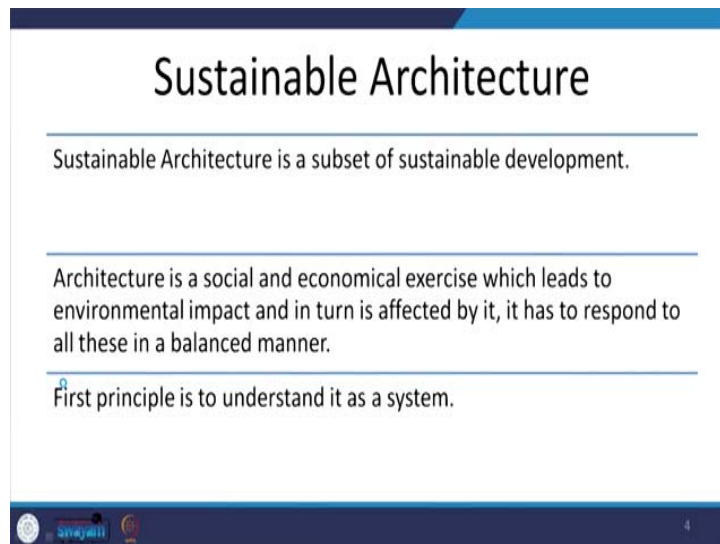
Now, if we look at the basic elements of sustainable habitat. We can categorize them in two distinct parts; one is building and the other is the site or the surrounding of that building, but both of these defined on a limited piece of plot. So, when we are talking about building the elements would be same materials, the location of it, different aspects

and systems for example, energy, water, thermal comfort systems which create thermal comfort and so on.

Now, this is the part which we will be largely dealing with, but this part is directly affected by and it affects its surroundings. For example, the land on which it is being constructed. So, the land around it, these transport systems and the infrastructure, which caters to this building. And, the building in turn affects this infrastructure, the environmental management of waste and water vice versa and energy, renewable sources and energy efficiency within the building.

So, when we are talking about sustainable ~~architecture~~architecture, we are talking about primarily these two components. Now, we come to defining what sustainable architecture is.

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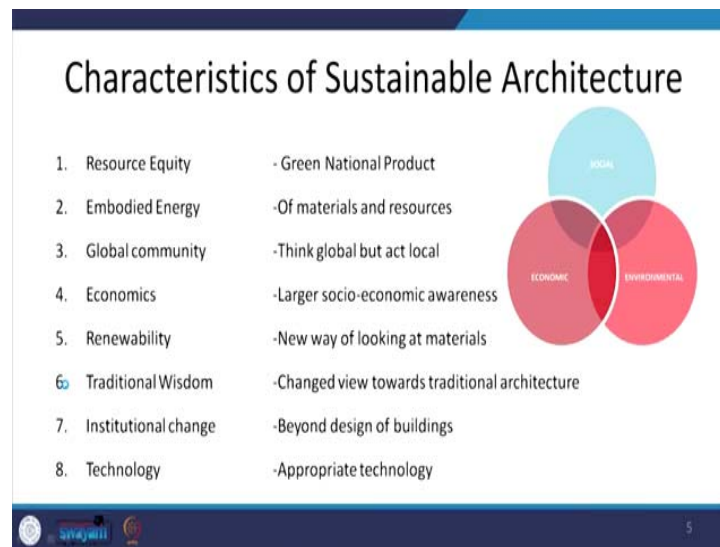


Sustainable architecture is a subset of sustainable development. So, the triple bottom line, which is used to define to evaluate, sustainable development holds good for sustainable architecture as well. The basic fundamentals remain the same; it is only how the manifestation takes place. So, when we are talking about sustainable development at a very large scale; we are talking about people, their economic resources, the employment, the opportunities employment opportunities that they have.

However, when we will be discussing about buildings, there we might not necessarily be talking about the employment opportunities when we are talking about people, the social aspects of it. ~~Rather, rather~~. We would be talking about thermal comfort for people. We would be talking about visual comfort; we would be talking about connectivity of people with from indoor to outdoor. So, these are the aspects which we would be talking about when we are discussing the social aspects. So, the parameters, the broad bottom lines remain the same only the manifestations the physical forms of them, they would change when we are discussing about sustainable architecture.

Now, when we talk about sustainable architecture or architecture in general, we realize that architecture is for people and it is an economic exercise, which has huge environmental cost, huge environmental impact. So, we are essentially talking about all the three domains and we have to respond to each one of them individually. Now, putting these three different domains together to come as sustainable architecture, we can define sustainable architecture through some basic characteristics.

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The characteristics are resource equity. Now, that is one of the most important ~~characteristic~~ characteristics of sustainable architecture, which is equitable use of resources. Now, any building or architecture, which has to qualify a sustainable architecture, has to use the resources in such a manner, that it is equally available to everyone. A building, which is very lavish in terms of resource consumption, resource

use, cannot be qualified as a sustainable building; however, environment friendly it may seem.

So, there it is a slight difference, we are addressing the ~~soeio-economies~~socio-economic aspects as well when we are talking about resource equity. The next is embodied energy. Now, this particular characteristic is largely environmental. So, sustainable architecture engages, uses the resources which have very less embodied energy. What is an embodied energy, we will know about that in subsequent lectures, but in very basic layman language, embodied energy is the energy which is embodied in a material or in a process. So, for example, I have a material say glass.

Now, huge amount of energy fuel is required to make glass. So, a sheet of glass has a lot of energy, which is embodied in it, which is contained in it, which is consumed through the process of its manufacturing. So, any sustainable building has to have very less embodied energy, which implies we have to use materials, which consume less energy for their manufacturing.

The third is global community, whenever we are looking at sustainable architecture, we must think of the global scenario though we have to act locally. So, it implies that I might have a surplus of one resource. For example, I might be a country, which is very rich in petroleum reserves, the fuel reserves, yet I have to design the buildings in such a manner that I consume less of that resource, despite it being available to me in abundance. Because, the global scenario is a scenario where we should use less and less of conventional fuels, this is what it implies by the global community.

The next characteristic is economics, we have to be aware of the larger economics, which is prevailing around us regionally, nationally and internationally. We have to be aware of all the economic resources, which are distributed equally or unequally. And, hence make our buildings which have to be less and less economy exhaustive. The next is renewability. Now, this is again an environmental characteristic, we have to look at the materials which are renewable, we have to look at the energy supply the fuel supply, which is renewable.

We have to look at the use of resources in such a manner that it is renewed. For example, use of water consumption of water. So, the wastewater goes back into the recycling, the

renewable aspect of it. The waste is the materials that are being wasted are again renewed in some or the other form, this is what we implied by renewability in buildings.

The next very important characteristic is traditional wisdom. Couple of decades back traditional systems were looked at with an appreciation, a sense of appreciation, but not as a subject which required a lot of research or from where we could derive. However, over the years researchers and scientists have found that the traditional systems of construction of designing the buildings, they were improvised and improvised over centuries and that is why they present at times the best of these systems as far as buildings are being discussed.

That is why instead of reinventing the wheel designing something absolutely new. It is always advisable to look back at the traditional wisdom, which is available and then move on, from the existing point which has been established through traditional wisdom means. The next is institutionalizing change. Now, unfortunately whenever we discuss about sustainable architecture, a lot of my students often question, that what do we do if our client is not ready to go for a sustainable building. At the end of the day we are architects and we have to respond to the clients need.

Now, that is where as an informed architect, we can do our better architecture can help to institutionalize the change. We can see examples of many sustainable buildings, which have changed the way people looked at the buildings and perceived how a design for such a building could come up. For example, couple of schools one of these we would see in one of the lectures, upcoming lectures, within this week, where how the materials were chosen, how the design came up to be, has changed the way people looked at education itself.

We have several other examples, for example, the gates foundation building, where an entire ground floor and the landscape area has been opened up to the people of residential community around it. So, it is about changing the way the way people look at architectural building and the use of this building, which is what we mean by institutionalizing change and that to a great extent is in the hands of architects. If, we very clearly know what we want to do and how do we want to do it.

The last characteristic of sustainable architecture here is technology with the changing times and with the changing challenges that we have and new and new technologies

coming to the market available to us, while we use traditional wisdom, we also have to use the latest technology. Most of this technology is helping us save resources. It is helping us operate and manage the buildings better, it is helping us to consume lesser amount of resources, land, for example, is a precious resource in today's time, the cities are becoming denser.

More and more people are moving to urban areas. And, that is why to save a precious resource as land, we have to rely on technological advancements. For example, the vertical buildings, the high rises. So, instead of spreading horizontally in ~~an~~ city, we use technology to go vertical. Now, a vertical building can also be sustainable and I have always discussed and argued that sustainability is always context specific.

Now, in a city which is very dense, we cannot advocate the growth of a horizontal city, where we know that the density is very--very high, it will always be more sustainable to go for a vertical building and use the rest of the area to green to leave it as green open area. Now, this is just one context, this is not a solution to every context.

So, any sustainable architecture or any sustainable solution will always have to be context specific, it has to respond to the context. In the same manner, the technology that will be chosen, the technology which will be employed also has to be context specific.

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The slide is titled "Three constant themes" and features three distinct colored boxes, each containing a definition of a theme. The top box is red and defines "Tradition". The middle box is green and defines "Technology". The bottom box is purple and defines "Urbanism". At the bottom of the slide, there are logos for "swayam" and "MOE" on the left, and the number "6" on the right.

### Three constant themes

- Tradition** - Tradition essentially represents accumulated knowledge of past generations in dealing with environment and place-specific techniques that have been used by people to alter their micro climates.
- Technology** - Evolutionary distinction between our species and those that did not use tools as effectively. Technology is then intertwined with tradition.
- Urbanism** - No serious assessment of sustainable development can be made by ignoring urban arena and most topics relate to civic issues.

swayam MOE 6

So, for employing these characteristics of sustainable architecture into buildings, we can follow various themes. And, here we will look at some of the very popular and constant themes, which the designers and architects employ to design and deliver sustainable buildings. So, the first theme which is also the most important theme is tradition. Now, it just as we have discussed in the essential characteristics of sustainable architecture, traditional wisdom is very important to be taken from. So, we first ~~\_understand the we first~~ gather the accumulated knowledge of the generations in dealing with this same set of problems. Almost the same set of problems for example, climate of a place, for example, the resource availability of a place.

So, such common set of challenges have already been answered through traditional wisdom. And, hence often the solutions to sustainable architecture have a lot of learning, have a lot of solutions from the traditional side. The next is which is also an important characteristic of sustainable architecture, which is technology. So, we have to understand the context find out some of these solutions through the traditional means and then for the new set of challenges, which we have, we have to look for solutions through the technology advancement. The last theme which at times overpowers all other themes and becomes the major driving force is urbanism.

Now, the pace at which our urban areas are growing and the kind of new challenges, that these new urban areas the ~~ever-growing~~ ever-growing urban areas pose in front of us. No development, no architecture can be developed made as a sustainable development or architecture, if the challenges from the urban side are not properly assessed and then catered too. Now, this is something which we often do not find through traditional wisdom often not always. And, here technology comes to rescue of the challenges which are posed through urbanism. Let us look at each of these things individually and in a little depth.



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## Tradition as a theme

- To set tradition and technology against each other is a false dialectic.
- Until early 1980's, traditional was considered picturesque but not worthy of research.
- Bernard Rudofsky's *Architecture without Architects* was a courageous attempt in 1960
- There are many notable exceptions who respected traditional wisdom before it became fashionable to do so.
- Rediscovering the past to move into future.



Katsura Villa, Kyoto, Walter Gropius and Bruno taut praised its aesthetic qualities and talked about the potential of its modular system being adopted in contemporary prefabricated system


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Now, tradition and technology are often set against each other. However, it is not necessary and it should not happen. Now, as I was mentioning earlier also traditional wisdom, traditional solutions, were actually looked at as a fantasy by the modern researchers. We were looking at them with an aesthetic appreciation. However, until almost 1980s we realized, researchers realized that there is a lot of potential, for research, for understanding these traditional systems in a better manner. And, then use them for their implementation into the modern system or for solving modern day problems.

One essential thing which traditional systems had invariably was their sensitivity towards environment. Across the world traditional architecture, traditional systems of architecture have respected environment. And, they have responded to the local context and the environment, which is what can very conveniently be understood and the solutions may be adopted in the modern times for the for solving the contemporary problems.

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## Technology as a theme



- It is situated on a steep hillside on land previously considered unusable.
- Landscaped outdoor teaching areas at each cluster act as courtyards between buildings.
- Minimizing the displacement of earth for budgetary and environmental reasons, the siting of the project took advantage of a natural bowl for the playing field and primary football field, embedding them in the sloped earth at the south of the site to create an economically efficient hillside seating area.

Diamond ranch High School, California, architect Thom Mayne.

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The next is technology as a theme. Now, this particular example is diamond ranch high school in California, by architect Thom Mayne. And, here the choice of materials, the choice of structural system, the choice of systems used for creating thermal comfort inside the building, all have been enabled through the use of ~~high-end~~ high-end technology. Yet the design, the way buildings were oriented, the way site was used, the placement of the buildings was done, was ~~-once~~-derived motivated from the traditional architectural systems solutions.

Hence, with the help of technology in solving some of the very complicated problems or serious challenges for example, this one which was on a steep hillside, where very efficient and robust structural systems have enabled to construct technology can actually help in overcoming such challenges, while traditional systems at the same time can help in providing with established solutions.

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## Urbanism as challenge

- Cities continue to hold out great promise as well as potential to become source of enormous environmental problems if not dealt properly.
- They also have obvious advantage of housing more people on less land thus reducing the impact.
- They are engines of job creation and can provide better services.



Transit oriented Development in Curitiba  
(Source: URBIS)

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Now, the third theme which we have seen is urbanism as a challenge. Now, cities which have a lot of opportunities, economic opportunities, often that is why more and more people are shifting to urban areas, they come and they itself become a source of environmental problems and beyond that social problems as well which we have seen in the past lectures.

Now, for solving these problems, we have to assess the problem the challenge properly. If, we do not assess the challenge, we will not be able to provide this specific solution to it. So, to provide this solution we have to understand the challenge, we have to identify and assess this challenge. Now, that is where, if we look at sustainable architecture all the researches which are being carried out in the domain of sustainable architecture fall within one of these 3 domains.

Either we are trying to identify the traditional solutions understand them and then implement them, improvise and implement them in modern day scenario, that is one where a lot of research is being done. The second one in developing new and new technology so, developing new ways of treating water and you developing new materials, developing new systems HVAC and all that. So, this is the technology.

So, we are researching in that domain lot of research is actually ~~\_happened\_~~ happening in the technology domain. And, the third domain is of urbanism, urbanism domain, where a

lot of studies and research is being carried out to just understand the context and challenges.

Once, we have those challenges and context clear to us that is when the solutions which are being derived from the tradition as a theme and technology as a theme they can be implemented. So, together these three, form the distinct and most important themes of sustainable architecture and all the research and studies, which are being carried out in sustainable architecture.

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Now, some of the architects have understood the concept and the fundamentals of sustainable architecture long before it was being discussed the way we are doing. Sustainable architecture probably was not even a term which was coined at that time, when these architects were creating these buildings. One of the most noted architects, who worked on sustainable architecture, is Hassan Fathy. He was an Egyptian architect. And, this particular picture is actually a market in Kharga Oasis in Egypt.

Now, unlike a lot of architects, who were fascinated by the western market concept. Hassan Fathy developed design of this market absolutely new building though it does not look like. The unique point being taking the traditional design the established design solutions from traditional architecture, which is of using walls, using domes, for creating spaces, using wind catchers, using these domes as exhaust for hot air, using verandas all around for cutting off the direct radiation and all these and incorporating them into a into

the design of a marketplace, which was an out and out or modern use and along with the design.

Also using materials which are locally available, which are easily available at less cost and are also environment friendly for example, adobe, this earth which was abundantly available and also performs very good as far as thermal is thermal efficiency is concerned. So, the architecture of Hassan Fathy was actually very sensitive and it bears, it has all the characteristics of sustainable architecture which we have seen just now. It is resource ~~efficient~~, efficient: it uses the resources which are available to the common man, the adobe, the boulders, the bricks out of these and along with that, it continues forward it takes lessons from the traditional wisdom carries it forward.

The concept of the market itself is a new idea; it was a global idea having a central market. However, the response to it was out and out local. So, it is a global community. So, all these themes looking at tradition as a theme using technology not as much in this particular example, but provide probably because it was not much needed here, but if it was then taking the help of technology for solving a specific problem.

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## Hassan Fathy



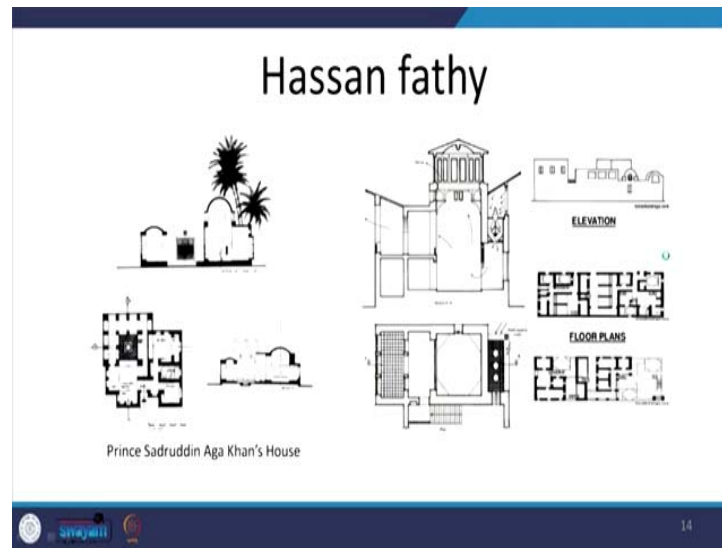
- Fathy's tenets derived from humanistic values about the connections between people and places, and the use of traditional knowledge and materials especially the exceptional advantages of earth as full-fledged construction material.
- promotions of ideas of sustainable architecture but also help recognize the fundamental role of communities.

New Gorna Village is located in Luxor on the West Bank of the Nile River, within the World Heritage property of Ancient Thebes in Egypt. The Village was designed and built between 1946 and 1957, an outstanding example of sustainable human settlement and appropriate use of technology in architecture and planning.

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Most of the architecture of ~~Hasaan~~ Hassan Fathy, whether it be the entire new corner village, the entire settlement all the buildings in it, or designing this new marketplace, or designing the residence for the prince, princess house.

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Prince Sadruddin Aga Khan's house was designed by Hassan Fathy. He was designing for one of the most prestigious persons, most important persons in that area and yet if we look at the design of Prince Sadruddin Aga Khan's house. He is used the same materials, which are available to the local to the common man, he is used the same design principle, same design solutions, which were available from traditional times as traditional wisdom, using domes wind catchers, courtyards, worldsvaults for solving the problem, using the same materials and same type of architecture for creating a building for a prince.

This is institutionalizing change; it must have not been easy for Hassan Fathy to convince a prince to construct his house, to construct his home, using the same materials, while the prince might have had availability or the capacity to procure any resource in the world both economically and other ways. However, as an architect Hassan Fathy was able to convince the prince to construct his house using the same traditional technique that is what institutionalizing change is.

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## Le Corbusier

- Though he is remembered as a modernist, his architecture shows great sensitivity to context and an interest in more earthy forms of building.
- He possessed an exceptional visionary grasp of the potential of new materials making him a leader of modern movement.



swajati 15


Another architect which I often quote is Le Corbusier all of us have heard about Le Corbusier and the kind of architecture modernistic architecture as we would see. So, it is at times very difficult to understand how are we referring to his buildings as sustainable buildings or sustainable architecture. However, if we look at some of the Corbusier building especially the later buildings and the one's which are done for India.

We look at them and the solutions that he has incorporated the design that he has incorporated is fit for the context. This building for Chandigarh uses some of the traditional techniques though they look modern. For example, the use of Braisollezila, the use of shading devices, the use of jaellies, the use of water bodies around it, it is all absolutely context specific. Though the aesthetics is modernist the overall look of this building is modernist aesthetics yet it shows a great sensitivity to the context and the materials which are used to construct these buildings.



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## Le Corbusier



- Construction system made of panels which could be connected together, easily transported and filled with concrete.
- Less material consumption, time saving, response to context
- Connectivity with nature
- Historical, environmental and technological synthesis


Villa Savoye  
swjani 16

So, the works of Le Corbusier and this is an absolute contrast to the kind of architecture he created for the west, because the context was absolutely different. All the buildings which Corbusier did for India did not use glass and large areas, which are exposed to direct sun unlike his buildings which he did for the west, where huge glass facades, where sun could penetrate in and heat up the interiors, which was actually needed unlike the Indian buildings, where none of the windows are left directly exposed to the sun, they have shading over them, they have projected verandas, they have projected roof which cuts off all the direct sun.

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## B V Doshi

- Western modernism with traditional environmental responsiveness.
- LIG housing improvement



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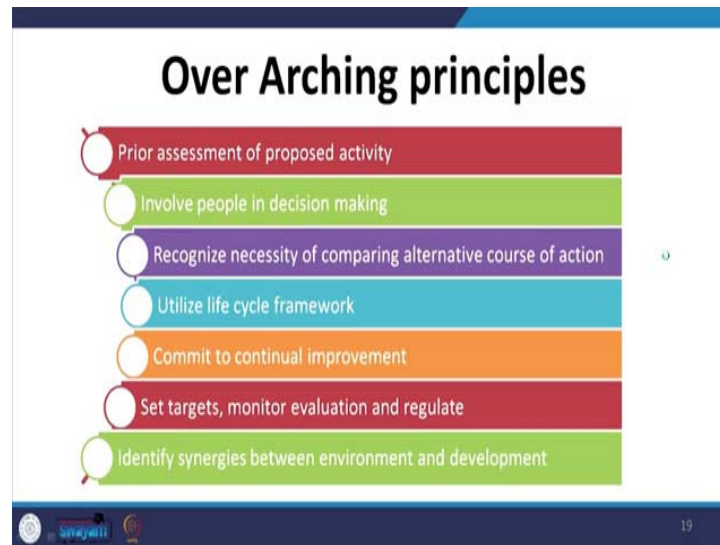
Another Indian architect whose work can be qualified as sustainable architecture is B V Doshi. Now, here I would say that few of these architects, who I have included as part of this lecture are not the only ones the list is exhaustive. And, it is practically impossible for me to cover all those names; I am just taking few works and few architects to explain my point of sustainable architecture.

So, in the worlds of B. V. Doshi we see the western modernism with the traditional environmental responsiveness. Along with the environmental responsiveness and the modernist approach, we see a great sensitivity in Doshi's work for people. He has worked on the slum redevelopment programs exhaustively and the kind of model that he developed for the slum redevelopment for these houses. Shows a great sensitivity towards people which is an intrinsic quality of sustainable architecture, where people are at the center of it.

It is not that we create the building and then we force people to use it, the way building has been designed; it should always be the other way around. We understand what people do how people use their buildings and then we design these buildings. So, that people are happily using those buildings, which is the quality of though Doshi's works.

We also have Louis I Khan the kind of buildings Louis I Khan has created especially the ones at, IIM Ahmadabad. The environment the climate is responded to in a beautiful manner along with the aesthetics it is modern yet the solutions are traditional. He uses a lot of verandas uses a lot of Jallies and Jarokhas, these become the places for student's staff to interact yet at the same time responding to the climatic context.

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So, from the works of these few architects, we can look at we can identify some of the overarching principles, which help us deliver the sustainable architecture, based upon the characteristics which we have already identified. So, to start with the first and the foremost activity the step would be prior assessment of proposed activity. We have to understand and that is where when I repeatedly say urbanism as a challenge. So, it may not be necessarily urbanism as a challenge, but any context has to be assessed and understood properly.

Once, we have done that the next step is involve people in the decision making. Majority of the times, we do not involve people who are going to be the prospective users of these buildings. Most of the time we as architects design buildings, based upon what the developer or whoever the client is who is constructing the building not necessarily the user. So, we are more driven by what the client wants and what we have to share as an experience and construct the building.

Unfortunately, in this entire process people are left out, they do not have any role in decision making so, wherever possible as far as possible people shall be involved in decision making. The third is to recognize the necessity of comparing alternative course of action. Now, this alternative course of action could be for every decision that is to be made, for example, the choice of materials, for example, the alternative of design, a design alternative altogether. Even before the design alternative the alternative for the

usage of space in multiple ways what people want, what different type of possible alternatives to the same space could be.

So, we have to come were the alternates and it is always a good idea, because we are comparing based upon a lot of factors, economy is one important factor, social needs of people is another one and environmental. So, the triple bottom line of sustainable architecture remains. And, hence we when we compare these options, we would be able to pick up the one which is most efficient.

Fourth one is to utilize lifecycle framework. Now, while comparing and assessing these alternatives. We have to have the life cycle approach, we cannot look at the building only up till it is constructed and delivered, we have to look at the entire lifecycle where the building will be operating. People will be using that building they will be consuming resources electricity, fuel, water, materials, throughout the course of this building.

So, we have to look at the lifecycle framework. And, we have to commit to the continual improvement of the design and construction process. In order to do that we have to set targets; we have to monitor evaluate and also regulate. We cannot just take learning's until a point and then stop growing; we have to continuously grow for each project and project of the project, if we really want to deliver sustainable buildings sustainable architecture. And, the last one is we have to identify the synergies between environment and development.

Environment and development has to go hand in hand, both have to develop, we cannot degrade the environment at the cost of development or hold the development at the cost of environment. These two have to be simultaneously going, they have to grow simultaneously.

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Now, if I look at these social aspects of sustainable architecture first. The environmental aspects are often the bigger discussion point, social aspects of sustainable architecture are often the most overlooked one, while they should be the fundamental aspects, because human's, human life has to be at the center of any architecture.

We create buildings for people, we do not tell people to behave themselves according to the building, which is unfortunately happening. So, when they are looking at social aspects, we have to look at some basic points. First is improve the quality of human life, which is by providing better thermal, environment, providing them the better visual better aesthetic environment, provide them with a peaceful environment acoustically and overall as a life experience, experience of that building.

We have to make provisions for cultural diversity in development. Now, that may at times seem a little out of the domain of an architect when he is designing buildings, but wherever there is a possibility of making provisions for cultural diversity, we have to allow that, we have to enable that. Ensure healthy and safe environments. For example: ensuring that the indoor environments in case of air-conditioned buildings have the safe limits of carbon dioxide, that is just one example, but there are several such implications.

Now, how does an architect do that is by virtue of design and also by virtue of the choice of mechanical electrical systems, MEP systems? Implement skill training and capacity enhancement of disadvantaged people, not this directly caters to the institutionalization

of change through architecture, where we bring people to the center and especially the disadvantaged people. Seek where an equitable distribution of social costs of construction. Now, that is at a level, which is slightly our scale, which is slightly bigger than architecture individual building.

Where while deciding what kind of development needs to come up, this is where we ensure that the this the social costs of construction are equally distributed. We have to design buildings in order to seek intergenerational equity, we cannot design a building just for a particular age group say working class, we cannot forget elderly, we cannot forget children or other generations.

So, we have to seek intergenerational equity. And, the last one, but one of the most important aspects is to humanize larger buildings. Since, the technology is developing we are able to make bigger buildings, buildings which are much larger in scale. The buildings are becoming more and more non-human, I am not saying inhuman; I am saying non-human the scale is much larger than that of a human being. So, we have to humanize the larger buildings, wherever possible.

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If you look at the socio-cultural and economic dimensions, we have to look at few points foremost being identity and sense of belonging and ownership. If we look at any traditional architecture, we can identify architecture of a place and associate that with the community. If we talk about Bhungas of Rajasthan, we know which community makes

Bhugas. If we talk about Bhugas of Kutch, we know which community makes that, if we talk about the traditional architecture of Japan, we know what kind of community or place does this architecture belong to and that is like almost everywhere. Unfortunately, with the way modern architecture is growing, we have no identity and hence there is no sense of belonging and ownership of architecture.

Because, the architecture was never created for people, architecture was only created as a response to the challenges, another important aspect is socio-economic regeneration through buildings. Now, while deciding the kind of activities which are going to come up in a neighborhood in a settlement, we have to look at the possibility of socio-economic generation through the design and construction of buildings, not during the course of construction, but even after the construction has been completed and the buildings are being used.

We also have to look at economic aspects, which combined with the aspect of affordability. Many of the buildings the high-profile buildings I would say totally ignore the aspect of affordability, which are during the construction as well as through the use of that building cannot be afforded by the people, the common people. We have to look at that aspect of affordability as well.

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Now, to show this example identity and the crisis of identity; so, in the background we can see this beautiful traditional building somewhere in Japan. And, right in front of that we have a signage for McDonald's.

Now, almost all the tradition society cities, old cities, are going through that crisis. Crisis for identity, the new ones have no identity of their own, majority times and the old ones are undergoing this identity crisis, because we are not able to respect that uphold that, that becomes an important point important aspect of sustainable architecture.

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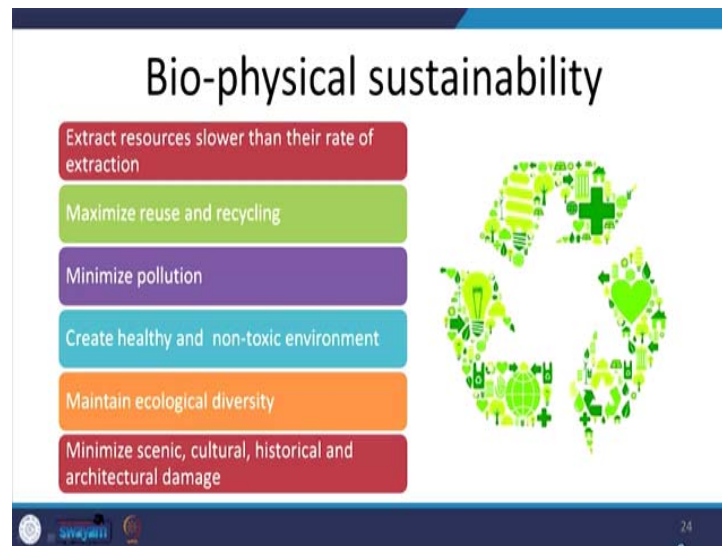
If you are looking at the economic sustainability besides affordability, we have to ensure that there is affordability for intended beneficiaries. It is not just the common man the user, but also the intended beneficiary for example, the developer or whoever the client is, we have to promote employment creation through the design and operation design, construction and operation of the building.

We have to enhance competitiveness in market by adopting sustainable policies and we have to choose environmentally responsible suppliers. Now, most of these aspects except affordability are driven through government policies. The government has to create policies where we ensure that, the environmentally responsible suppliers are chosen that there is competitiveness in market, by adopting sustainable policies.

So, these are policy driven aspects. However, as far as affordability is concerned it is a self-driven thing. Anything, which is not affordable does not sell in the market. So, if housing in general for any class it could be an EWS housing, or an MIG housing, or an HIG housing or even higher than that. If it is not affordable to the particular class for which it is intended, it will not sell.

And, hence at any given point of time architecture would at least comply with this financial affordability aspect, but it has to be an integral part element of sustainable architecture.

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Now, we come to one of the most important domains or part of sustainable architecture, which is the biophysical sustainability, because I see most important, because it is also the most threatened one. We are talking about environmental sustainability in architecture. Now, we have to ensure that, the rate at which resources are being consumed is lesser than the rate at which the nature replenishes these resources.

We have to maximize the reuse and recycling of materials, of space, of everything, we have to minimize pollution, we have to create healthy and non-toxic environment. Here direct implication is on using materials, which are say CFC free or HCFC free. Maintain ecological diversity. Now, we may be constructing on a site which is home to native species, which is already a habitat.



Now, we cannot totally remove the habitat and create a new one for them, the trees have to be retained, the native species, the native trees and the way plantation is done all that to maintain the ecological diversity. And, we have to minimize the scenic cultural, historical and architectural damage to the site, during the process of construction.

Now, one more point which I usually add is of technical sustainability. Often, we are discussing only the three aspects social aspect, economic aspect and environmental aspect of sustainable architecture, but technical sustainability or the technical, technological aspect becomes very important, when we are talking about sustainable architecture. It is simply because our cities are becoming bigger and denser.

And, we have no other way, but to go with high technology, the latest advanced technology, which helps us fulfill the previous three aims which is of social, economic and environmental sustainability. We have to use the technology which helps us save resources, resource consumption, which helps us deliver buildings, which are safer more durable for people, which are more affordable for people, that is why we have to construct durable, reliable and functional structures using the advanced technology.

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We have to pursue quality, if we construct good quality buildings, they are more sustainable. And, we have to use the technology to reuse the existing structure totally to give it a new lease of life that is what I would include in technical sustainability. Now,

once we know what we have to do, what we have to deliver, we have to have certain points in mind when we are starting the design process.

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**considerations for design process**

- **Ensure connectivity-**
  - Reinforce connectivity between project, site, community and ecology.
  - Minimize changes to natural system functioning
  - Reinforce natural characteristics of the place
- **Indigenous- what has been sustaining for centuries?**
- **Design for future looking at the past**

I will very briefly go over these considerations for design process. The first is to ensure connectivity, because sustainability is essentially a system thinking. We have to think of all the components put them in one system and then see. We cannot design a building in isolation; we cannot say that my building is sustainable, if we send out our waste to another site if we send out our waste water to another one, if we take a lot of energy from the third one.

We have to think of wherever this building interacts all of this as one system one integrated system and to do that we have to ensure connectivity. Connectivity between the site, community, ecology, so, all levels. So, were talking about building we are ensuring connectivity between building to site, site to the region and this entire thing as a system. We have to minimize the changes to natural systems and we have to reinforce natural characteristics of the place both socially, economically and environmentally.

For this we can take examples, we can derive solutions from the indigenous way of doing things, which are sustained for centuries. However, looking at the future, designing for the future, while deriving solutions from the past.

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## Sustainable Neighborhoods

- Design on a human scale
- Provide choices
- Encourage mixed use development
- Vary transportation options
- Build vibrant spaces
- Create identity
- Conserve landscapes



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So, when we are looking at the neighborhood scale not at the building scale, we have to design on a human scale, we have to provide choices as we have already discussed, we have to encourage mixed use development at any given point of time, for ensuring sustainability at a little larger scale says, neighborhood or even larger than that. Encouraging mixed use development enhances the socio-economic aspects of the entire development.

We have to provide different options of transportation and we have to build vibrant spaces. Majority of the sustainable neighborhoods and even the bigger built environments for example, cities have vibrant public spaces, which again reinforced their fact that people are at the center of it. So, we need spaces these vibrant spaces for people and while doing that create identity of each place.

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## Sustainable region

- Climatic conditions
- Topography – terrain
- Vegetation
- Water resources
- Land as a resource
- Connectivity



The image shows a city skyline with several tall buildings under a blue sky with white clouds. In the foreground, there is a dense area of green trees and smaller buildings, suggesting a mix of urban development and green spaces.

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If we go bigger than that if we are talking about the region, we have to look at the climatic conditions; we have to look at the topography. So, there might be mountains, there might be rivers, there might be an entire ecological system where the groundwater gets recharged automatically. So, there are jungles there are water bodies and all of that together work as a system.


The majority of our cities, because they only focused concentrated on the problems, which within the city, they forgot that they are part of this region. And, hence in majority of the big cities we see that water table is dropping down very fast especially in our country. We see that majority of the cities have their water table which have gone substantially down, we have cities where rains do not come, because of the urban heat island and many other reasons there are no rains.

The water resource has totally vanished the surface water bodies have totally disappeared and all of that simply, because we did not think about the entire region as a system. So, when we are talking about region, we have to look at vegetation, the water resources, land itself as a resource and connectivity between each of these components to develop the region in a sustainable manner.

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## Site to region

- Relevant urban, agricultural and natural characteristics
- Cultural and economic assets
- Climatic characteristics of bio regional system
- Natural disasters



The diagram consists of two interlocking puzzle pieces. The left piece is teal and labeled 'Site'. The right piece is yellow and labeled 'Region'.


swajati 29

So, when I talk about interconnectivity between site to region, we have to look at the relevant urban, agricultural and natural characteristics. We have to look at the cultural and economic assets, which will affect how the site is responded to we have to look at the climatic characteristic of bioregional system. So, our site has to respond to the bio regional system. And, we have to respond to the natural disasters to which the site is subjected to because of being a part of the region.

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## Site to site

- Context, scale, view, corridor, materials, geometric relationship, proportions
- Site and environmental analysis
- Microclimate
- Vegetation type and soil water retention characteristics



The diagram consists of two interlocking puzzle pieces. Both pieces are labeled 'Site'.

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We while developing a site should also look at the connectivity between different sites of context, scale, view, corridor, materials, and geometric. That is what helps us deliver sustainable architecture. We have to look at this site and environmental analysis with a very clear picture in our mind that there is a site next to us, which is affecting us and which is getting affected by us.

We have to look at the microclimate and the vegetation soil and water retention characteristics.

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The slide is titled "Site to architecture" and features a bulleted list on the left and a diagram on the right. The diagram consists of two interlocking puzzle pieces: a teal piece on the left labeled "Site" and a yellow piece on the right labeled "Architecture".

- Climate and human comfort
- Adjustments
- Area of microclimate alteration

Site Architecture

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And, the last one is the connection between site to architecture. Here, we have to look at the climate and human comfort, which is what all of you must have already read in climatology, we will also brush up on it. And, see how architecture responds to the climate and then we derive human comfort, the adjustments that we have to make because of the site-specific constraint and the area of microclimatic alteration.

So, this is how we respond when we are designing architecture and taking in consideration the site. I will stop here and in the next lecture we will discuss about the different definitions and the different concepts of sustainable architecture. See you in the next lecture.

Thank you.