Introduction to Ancient Indian Technology.
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Lecture-32.

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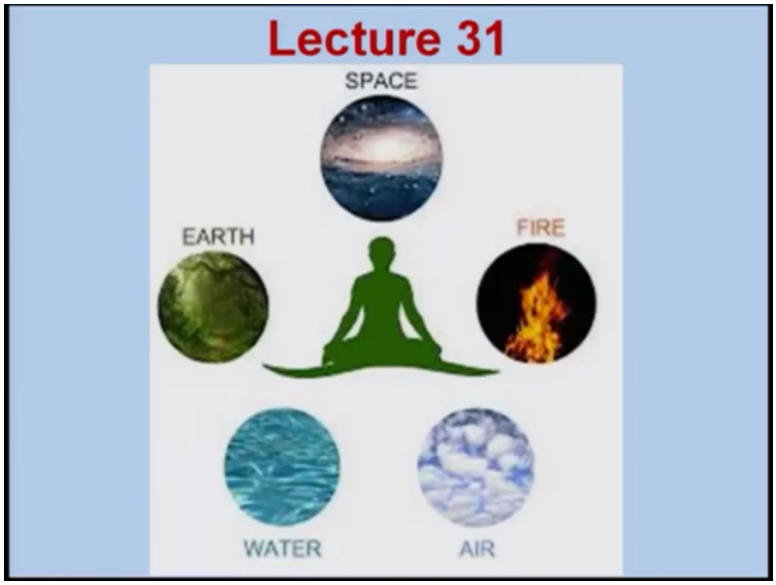

Let us start this lecture with a concept which are built into our psyche that is ‘panchamahabootha’. Of course it is a space, fire, air, water and earth, we are now discussing about water. How to preserve it, how to conserve it, how to use it sparingly so that it will be you know can be utilised properly and without spoiling its quality. And in the last lecture we discussed about various reservoir systems for irrigation and also we looked at various kinds of canals or the channels were being built by our ancestors for taking care of water needed for, both for the cultivation and also for the drinking. Today we will be talking about how they were controlling basically flow of the water from the river and also from the reservoirs.

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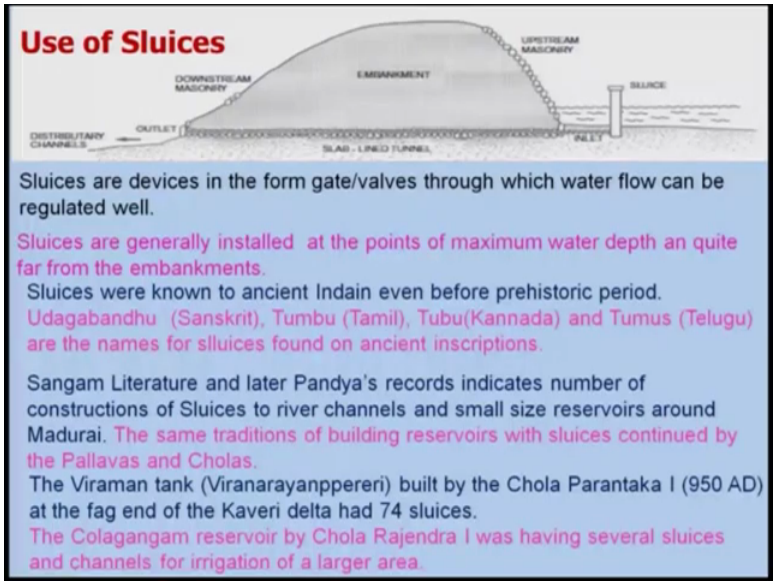

They were using the sluices. Sluices are basically devices in the form of gate or valves, through which water flow can be regulated well. Of course this is the modern way of doing but in the ancient days people were using that. If you look at generally this is the embankment which is being placed and then of course there will be some, this is made of generally earth or the soil and then there will be structure machinery kind of things and there will be water which is body is coming in. And there will be some line tunnel which will be there right.

And this will be the sluice gate which is to be basically placed and it can be controlled in such a way that you can have flow through this channel or the tunnels which is there to the downstream, in the distributary channel or some other channels. And generally this sluice are little bit kept away from the upstream embankment and the distance is very important for its life and also for its updations and those knowledge were there with them because we find lot of evidences of uses of sluice gates in ancient India.

Sluices are generally installed at the point of maximum water depth and quite far from the embankment as I told earlier. And as I told earlier sluices were known to ancient, even before pre historic period, because in Sanskrit it is known as ‘udakabandhu’ and tumbu in Tamil, Tubu in Kannada and Tumus in Telugu, are the names for sluice gates found in ancient inscriptions. And Sangam literature of the south and later Pandya’s records indicate number of construction of sluices to river channels and small reservoirs around the Madurai.

The same tradition of building reservoir sluices, were continued by the Pallavas and Cholas also. People were doing how to do and it was a group of people who were expert and then doing that. And as I told earlier there were committees for controlling the sluices and maintain the sluices in the, I think 2-3 lectures back. And the Viraman tank built by Chola Paranthaka 1, around 950 AD was having something 74 sluices. And this was built at the fag end of Kaveri delta.

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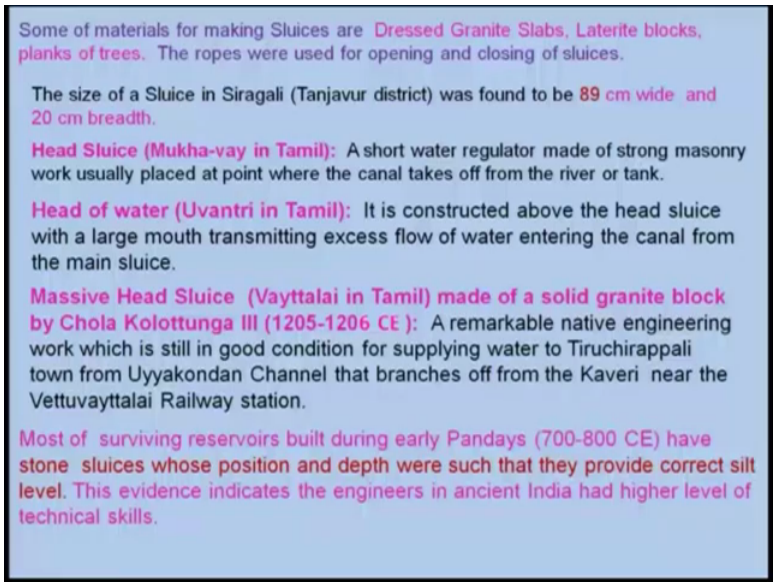

So these are all evidences you know which are you know historically found, and of course some of them were not being, known to people and Colagangam reservoir by Chola Rajendra 1, was having several sluices and channels for irrigation of a larger area. Let us look at like, you know how they were making these sluice gates, generally the dressed granite slabs, laterite blocks and plank of trees even like were used for making sluices. And ropes were used for opening and closing the sluices. Coconut fibers and then jute fibers were used for making ropes. The size of a sluice in Siragali, Tanjavur district was found to be around 89 cm wide and 20 cm breadth.

And Head Sluice which is basically known as Mukha-vay in Tamil. It is a short water regulator made of strong masonary work, usually placed at points where the canals takes off from the river or a tank. The Head of water, it is generally constructed above the head sluices which a large mouth through which the excess flow of water will be transmitting, that can enter into the canal from the main sluice. And Massive Head sluice, is basically made of a solid granite block which was built by Chola Kolottunga 3, around 1205 AD and it is really very remarkable native engineering work, which is still in good condition for supplying water

to Tiruchirapally town from Uyyakondam channels that branched off from Kaveri near the Vettuvayttalai railway station.

If you just analyse these things and also most of the surviving reservoirs built during the early Pandyas around something 700 to 800 CE, have stone sluices. The position and the depth of these sluices were very accurate such that they were providing the very least amount of silt level. Because you might be aware that wherever we place a sluice there is more chances that silt will be deposited there due to the slow motion of the fluid stagnation with the water. But they were you know, placed very nice way in ancient time. They were having lot of knowledge with them of placing the sluice gates in such a way that minimum silt deposition will be occurring.

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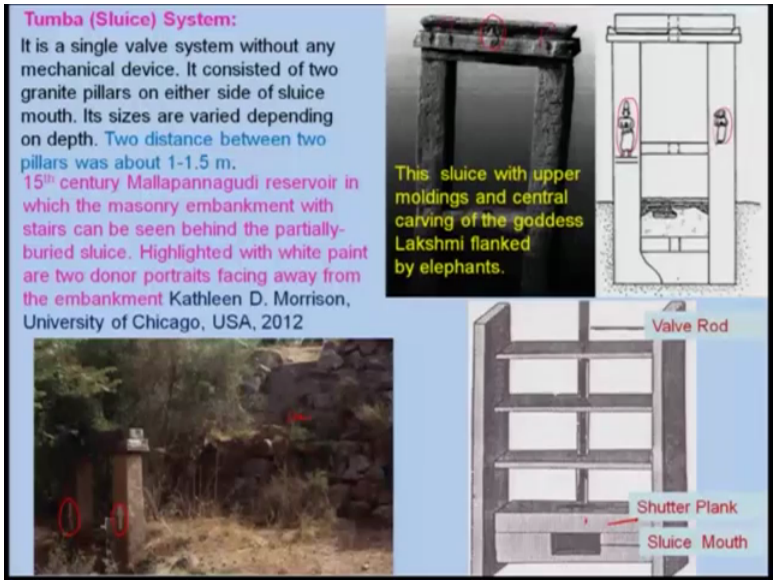

And this evidence and also there are several other evidences clearly indicate that the engineers in ancient Indian had a higher level of technical skills. So let us look at the sluice system which I will be trying to give a feel that how it looks, it is basically single wall system without any mechanical device. It was built of two granite pillar on either side of sluice mouth and its sizes vary depending on depth and basically the distance between two pillars was around 1 to 1.5 meters.

So this is a, if you look at two stones pillars are there here and this is having a sluice gate and sluice with upper moulding, this is the upper mouldings and there is also it is not visible to you people might be, there is a carving of Goddess Lakshmi flanked by elephants, here. And these are the you call remnants of that and if you look at besides this there is also some

carvings will be here in the sluice whoever will be donors, their names I will be giving some evidence which was basically mentioned in the work of Kathleen D Morrison, University of Chicago.

If you look at this is the remnants of a sluice system and this is the place where you can see, white painted portraits of two donors, right, one is here and other is here. This is the 15 century Mallappanagudi reservoir in which the masonry embankments with the stairs can be seen. These are the stairs, you know, these are also stairs which are partially buried sluice, and this sluice is being buried in that. That means this clearly indicates that people were donating money for building of sluice gates and then embankments and also the irrigation systems. This is the mouth of the sluice where the water will be you know getting into and this is the shutter plank.

This plank is the shutter plank and there is a valve rod which will be lifting up and down so that you can allow the water to pass through that. And in modern times also similar sluice you know gate systems are being used. But not made of granites or not made of stones rather made of kind of metals. If you look at there are several embankments in ancient India, particularly for the rivers. What do you mean by embankments?

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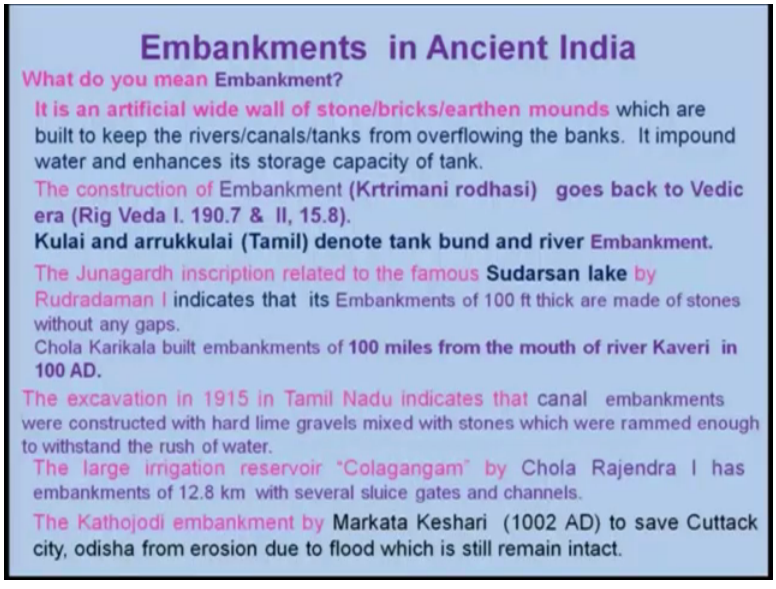

Embankment is basically an artificial wide wall of stones, bricks or earthen mounds which are built to keep the rivers, canals, tanks from overflowing the banks, right. It impound water and enhances storage capacity of the tank or the river. See, earlier days you know, embankments were made in a better way kind of things and these construction of

embankment which is in Sanskrit known as Krtitimani Rodhasi goes back to the Vedic era in Rig Veda there is a description about it.

And aslo in Tamil it is known as Kulai and Arukkulai denote the tank bund and the river embankment. And Junagradh inscription related to the famous Sudershan Lake by the Rudraman 1, indicates that it is embankment of 100 feet thick were made of stones without any gaps, right. I had mentioned that, you know, how they were dressing the stones in such a nice way without modern equipments such that there won't be any gap in between. Otherwise the water leakage will be there.

And Chola Karikal built embankments of 100 miles from the mouth of the river Kaveri in around 100 AD. The excavation in 1915 in Tamil Nadu indicates that canal embankments were constructed with hard line gravels mixed with stones and these were rammed enough to withstand the rush of water. Last irrigation reservoir Colagangam by Chola Rajendra 1 has embankments of 12.8 km several sluices and gates and channels.

And if you look at the Kathojodi embankment by Markata Kesari around 1002 AD was built to save the Cuttack city of Odisha from the erosion due to flood which still remain intact. Unfortunately few years back this, on the top of it people have made, you know another embankment kind of things because of the sand depositions.

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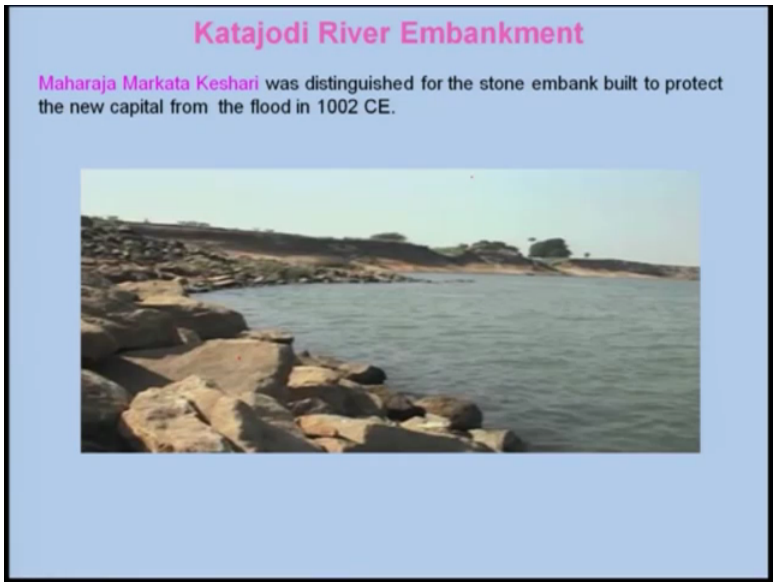

And I will just show you pictures here, these are all made of stones right and which were there, now of course this is the river Kathojodi and this is now the city is at a higher height because of this embankment. New embankment has come up, this is known as the ring road.

If you look at, there is also, I remember that when they make some embankments, what they do, they keep this embankment on the river on one side and other side they will be you know having a provision of inundating the fields such that during the floods the water will be allowed to pass through the other areas where the cultivation will be going on.

So the silts and other water also will be going and being to the fields intentionally. And that helps in what you call having a good crop due to the enrichment of soil and also the water. So and also they were building some of the temporary wells on the other side of the river where they will be allowed the water to inundate. So these kinds of ways and means where there and now we will be talking about how did our ancestors manage water you know, harvestings and also water conservations at that time, what they were doing, the communities were providing volunteer labour and material cultivation for building these facilities, for common good.

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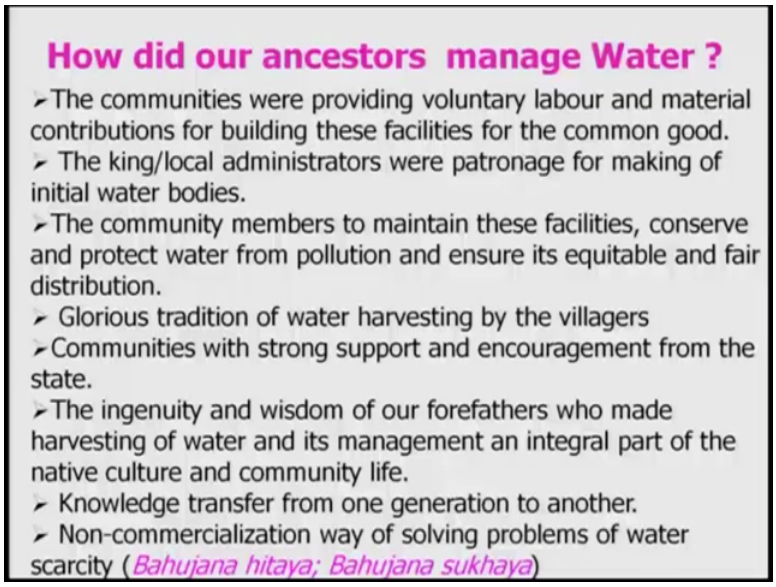

That was the mind-set unlike in modern days where we always think that government will do. That doesn't mean that king or local administrators were not doing anything at that time. They were also helping for the local people for making of initial water bodies. They were paying some money also or the resources they were mobilising their resources to build also. But the maitenece you know always will be the community members and they conserved and protected the water from pollution, ensured it is equitable and fair distribution.

That was there, the job was done by local governance and also the people were you know, coming and participating in the process, they were owning those water bodies, but today it is not. And glorious tradition of water harvesting by the villagers were talked about in several

places in the scriptures and also in history books. Communities with strong support and encouragement from the state was the need of the hour today and it was there earlier also. And ingenuity and wisdom of our forefathers who made the harvesting of water, its management, and integrated part of native culture and community life.

So we need to revive this , community life and native culture of harvesting and considering water as divine, not misusing it, abusing it or polluting it , for the sake of industrialisation, for the sake of you know, harbouring more money or hoarding the resources. And knowledge transfer from one generation to another was the very important which was being stopped today and as we don't have faith in traditional knowledge. And non-commercialisation way of solving the problem of water scarcity, like because today commerce is entering into everywhere. So what we need to do, 'bahujana Hitaya, bahujana Sukhaya' should be the ethos with which we should go ahead.

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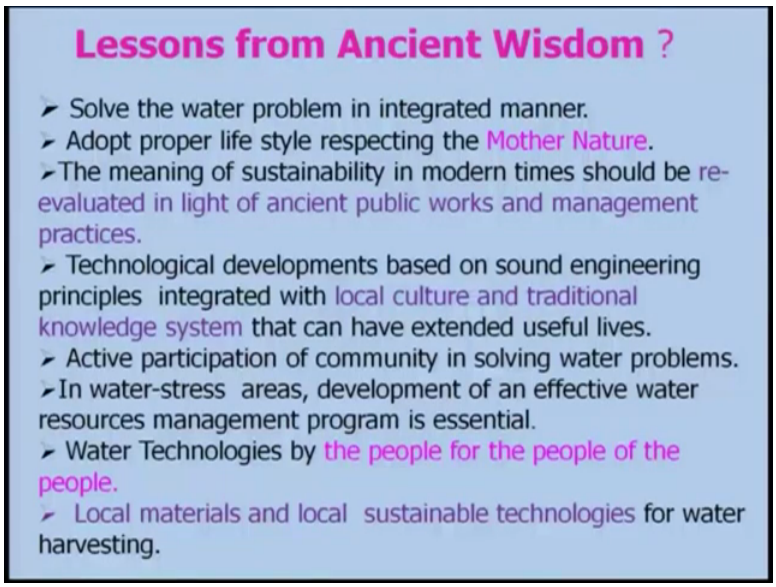

And lesson from ancient wisdom we can summarise that we should solve the water problem in an integrated manner. Not that only the water, but it has to be looked through the eyes of environment and other creatures, other trees and other things. Adopt proper lifestyle respecting the Mother Nature in each entities of the Mother Nature, you know are divine and we should protect it and we should look after them. Meaning of sustainability in modern times should be re-evaluated in light of ancient public works and management practices.

Today we were talking about sustainability but it is not a part of design and our way of life. Technological developments based on the sound engineering principles integrated with local

culture and traditional knowledge system that can be extended useful lives. Because that we need to look at it. It is not that we will use the old technology of ancient time, but we need to improvise it. We cannot really do that at this moment.

But local culture and tradition must be integrated to that. Active participation of community in saving water problems must be encouraged and which should come from our heart and in water stressed areas development of an effective water resource management program is essential and the need of the hour. Water technologies by the people, for the people, of the people. It should not be with the companies or multinational companies, ok or any companies, even Indian companies. It should be with the people.

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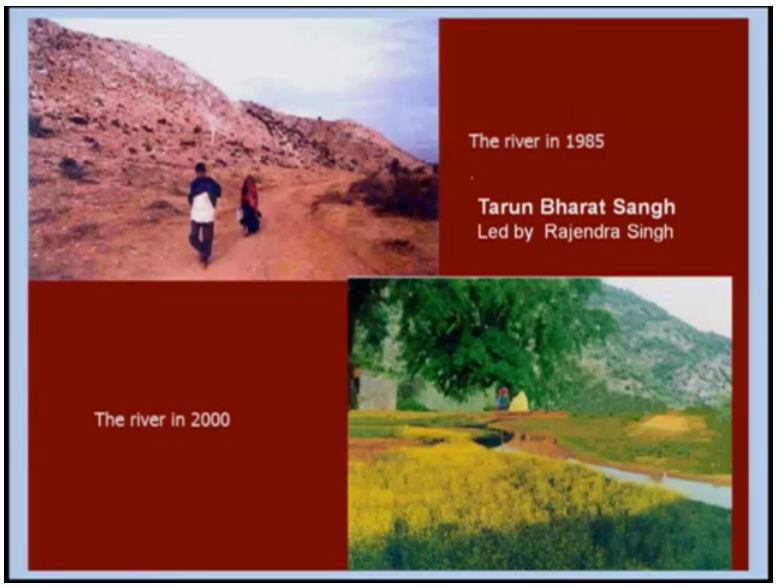

And local materials and local sustainable technologies should be used for water harvesting and water irrigation systems. And now with these, is it possible to use ancient knowledge for the water harvesting and reviving the dead river today? If you look at, this is the things, I will just tell you it is a very very dry area, and there are no rivers kind of things. It was in 1985 and a group Tarun Bharat Sangh, led by Sri Rajendra Singh who had done a wonderful work on this water conservation. He has developed with local knowledge and he could have , a river system revived the river which was dry, dried out in 1985, where in 2000. That means within 15 years, if you look at lot of greenery, this is the same mountain what it was earlier.

This is the mountain right or hill you can say, but now it is very greenery. Now that means, if we use traditional technology and the local participation of the people for conserving we can really do wonders.

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And this is another things, what I would like to show you also, this is the area what is very dry and they made these cheek dams here. This is the dam right, and water is falling by the local people, even water is (()) (19:52) and they could make a lot of greenery things in that area. And there is a, if you look at, its 1885 sorry it is 1985 this kind of things these people had made these dams and slopes and this water will fall and they could made you know, lot of cultivation in and around these water bodies have come up.

And similarly lot of you know good flowers, greenery you can see, in 2012. So that means with the use of these traditional technologies people can revive and people, of the local people are having developed rather in the local people have now developed a faith in that as

some of the people could demonstrate that it is possible. And the knowledge you know with the people, not with the companies.

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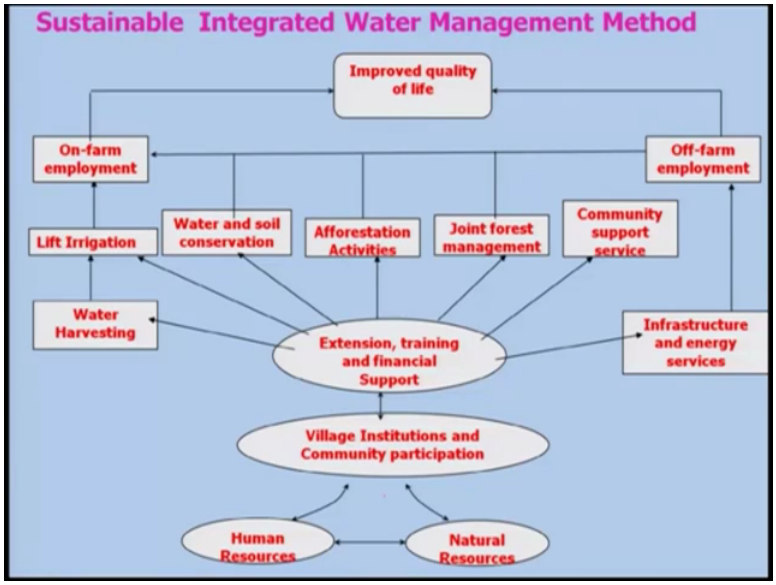

That is important. Let us look at how we can get suitable integrated water management method from this. And if you look at we should have basically two ways of looking at, improving the quality of life. Ultimately all engineering, all the activities what we do is to improve the quality of life. Quality of life can be improved basically on-farm employment which is very essential for us, so also the off-farm employment. If you look at I have already talked about you know off-farm employment like your what you call making houses and then cottage industries and also the textiles lot of things can be made locally.

And on farm, the farming, is very important, and when you talk about that we need water we need soil and there is Lift Irrigation and water harvesting systems and there will be water and soil conservation also important. And that what you call, afforestation activates has to be also stopped and joined forest management, which will be basically by the local people, community support services has to be developed.

And these all these can be developed with the extension of training and financial support and this will be coming from the village institution and communicate participations. It can be, if you look at this will be the main thing and of course for this during the training we need to have infrastructure, energy services which may be utilised for the off farm system kind of things. And which will be, again we can develop the human resources and we can aslo look at the natural resources, it will be integrated manner. It is not that only the water, it is related to

the you call, the ‘roti, kapda and makaan’ which is the basic needs. That is your house, food and the clothes which are the basic needs had to be made in an integrated manner without really spoiling the nature rather leaving with the nature.

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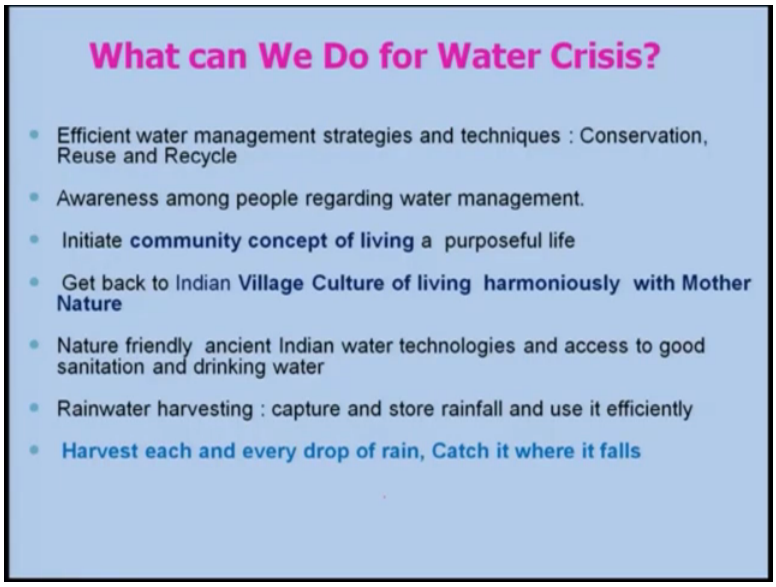

So that is the thing what we need to learn from this. So what can we do for the water crisis? We need to have efficient water management strategies and techniques, that is conservation, reuse, and recycle and we will have to develop awareness among people regarding water management, how to use the water sparingly and initiate community concept of living a purposeful life which is very important and we need to go back to the indian village culture of living harmoniously with Mother Nature. Today the people are you know trying to convert the villages into towns. I always feel that we need to convert the towns into village that means which will be integrated with the Mother Nature.

And there will be some cultivation lands inside the town itself so that they will be self-sufficient. Nature friendly ancient Indian water technologies, access to the good sanitation and drinking water must be nurtured and rain water harvesting, is very important that we need to look at because that is the, what you call, we need to collect. Unfortunately because of industrialisation we are getting acid rain. Now how we will take care. Basically we will have to stop this industrialisation, however we can go for the cottage industries and we will have to capture and store rainfall and use it efficiently.

Harvest each and every drop of rain and catch it where it falls. Like you know, ‘pani ki barbadi roko, is ke liye sabhi ko toko, bachat karoge bood boond ki apne man mein thano.’ So

with this quotation from poet, I would like to stop over here. And water is precious, we need to conserve it. We will have to use our ancient technologies and also the way of life, live with the nature not against the nature. And all our lives should revolve around such that we will be a part and parcel of the Mother Nature and lead a very purposeful and peaceful life. Thank you very much.