Water, Society and Sustainability
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Lecture - 12
Water Technologies in Medieval India II

So, this is a continuation to the previous lecture Water Technologies in Medieval India part 1. So, here in this lecture, we are going to focus mainly on the water lifting devices that are prevalent in North India during both the sultanate, and the Mughal rule. Now, the very interesting question is that are these a technologies or where this technology indigenous or, where they I mean did they enter India from other parts of the world, more specifically, you know Central Asia in this particular contest. So, this is a question that we are going to address in this particular presentation.

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And now to begin with like this a fashionative book is called Islamic technology an illustrated history by al-Hassan, and Donald hill. So, al- Hassan and Donald hill, they mention that this supply of water irrigation, drinking, domestic, and industrial, and agricultural purposes and this is very important as always been a vital consideration in Muslim lands. And of course this is important, because if you know, if you try to think the areas where the where there was Islamic conquers, so the areas which conquered by the Muslims. So, those areas to a great extent those were arid ok. So how to tap water;

how to you know collect water; how to conserve water; how to lift water; how to store water for agricultural purposes, for irrigation, for drinking that was a very important that was a very significant consideration for these Muslim rulers or for the Muslims for that matter.

So, yes as I had mentioned that you know if you see the map, you will find that you know these areas were inhabited by the Muslims and so Bagdad, Istanbul, Persia all deserts, and you know arid regions, where water is not available in plenty; so, how to tap water from these areas, which where to an extent water scarce. So, you know, we also get to know about different interesting hydraulic technologies in the Mediterranean specifically Spain, because Spain was under Muslim conquest for a long period of time.

And we find out from this particular book by Hassan and Hill that hydraulic technologies in the Mediterranean have brief wonderful rivers. So, the Muslim where successful you know in tapping water, using water, storing water, conserving water for the various purposes. So, wonderful rewards what why this wonderful rewards: productive fields, beautiful gardens, sparkling fountains and populous cities. So, these cities in spite of being water scarce, the way water was manage, the way water was you know use and store that never affected the population or the population density of the city.

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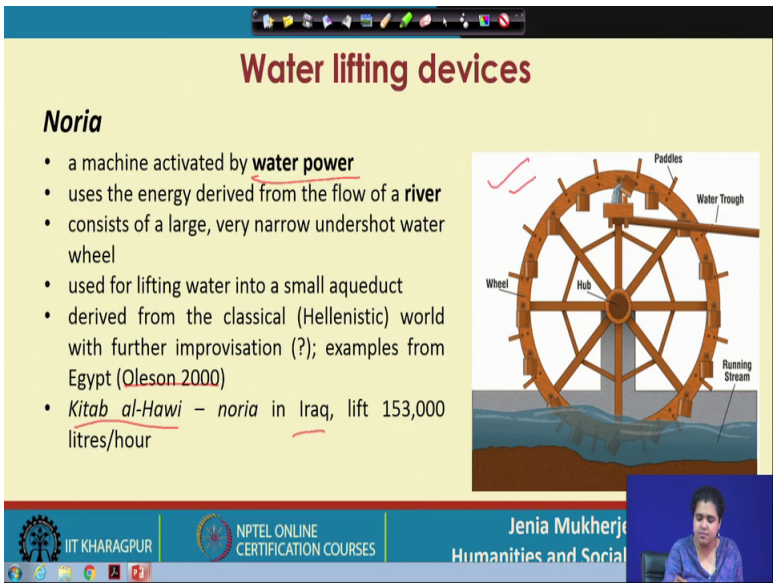

Yes, so now we come to the various water lifting devices to start with the Noria. So, the Noria is a machine, which is activated by water power. So, it is itself activated by water

power, and it uses the energy derived from the flow of a river. So, then Noria is never activated or the Noria it actually does not work on standing water body. For example, a well or something like that but it always derives energy from the flow of a river. So, it has to work on it has to get activated on a flowing water.

So, we will elaborate that when we will talking about another other otherwise similar water lifting device called Saqiya. So, there is a subtle difference between Noria, Saqiya. And there is a confusion, because in some accounts we find that you know this they use there is over there is an overlap in the use of Noria and Saqiya. But, these two devices are not the same though they appear very similar and though they have very similar characteristics and attributes. But, yet there are some fundamental differences between Noria and Saqiya, which we need to be aware of. So, one fundamental difference is that the Saqiya; it always it is used on a well, but Noria it is used on river. So, it derives energy from the flow of a river.

So, it consists of a large very narrow undershot water wheels. So, you can see the Noria here, and it is used for lifting water, it was a small aqueduct. Now, there is again controversy debate regarding the whether this had been this particular technology had been derived from the classical Hellenistic world with further improvisation by the, you know by the Islamic or the Muslim engineers or whether you know it has been device and designed and developed by the Muslim engineers themselves.

So, there are some works on this, the most significant being the works by Oleson. So, Oleson has worked a lot on the mechanical water lifting devices. And Oleson has worked on water lifting devices in the Romanist the Roman and the Hellenistic empire also you know across different other empires as well. And Oleson says that you know there is a high possibility that though the Noria was prevalent, before you know, I mean though the Noria was not designed by the Muslim engineers. But, the Muslim engineers they had fundamental role to play in the improvisation of Noria in making it more effective, in making it more you know meaningful.

So, Kitab al-Hawi this text it mentions the use of extensive use of Noria in Iraq. And not on this small Noria's but large Noria's also existed. And you know very large Noria's even which could lift 153,000 liters of water per hour, so which is roughly 2550 liters of

water per minute. So, this was the I mean, so the device though it looks very simple and small, but it is extremely powerful.

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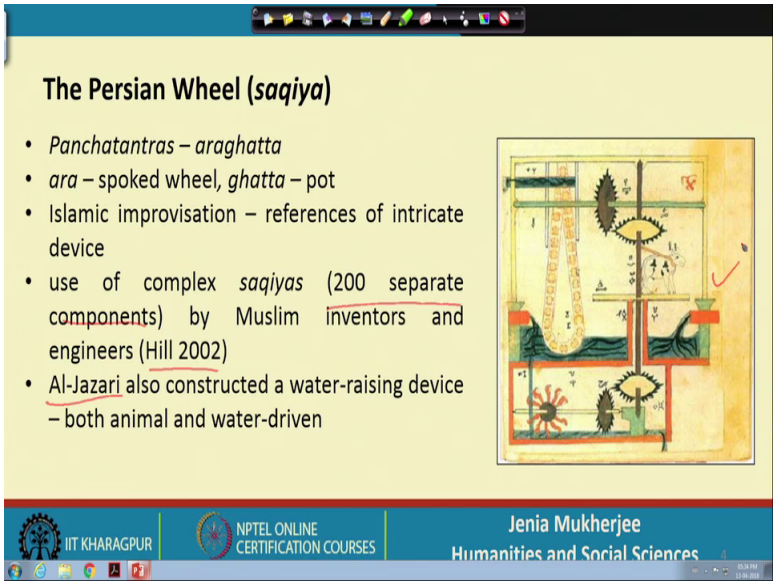

Yeah, so coming to Saqiya, so I mentioned that the Saqiya and Noria, they often confused with each other, and some people think that you know the Saqiya and Noria are similar.

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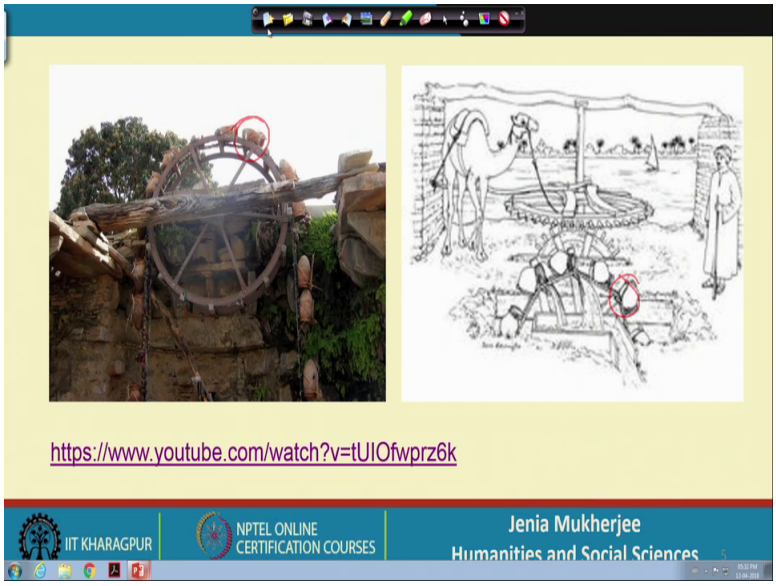

Because, if you see the picture, so this is a Saqiya; and this is the Noria. So, almost you know this water pots, this pots where water you know is collected from the river or from

a well, these are quite similar. So, this pots look identical in Saqiya also in Saqiya also, we have the similar pots similar pots, but there are some fundamental differences as I mentioned previously between Noria and Saqiya yeah.

So, Saqiya it is say that they mention of Saqiya is also there in Panchatantra. But, Panchatantra does not use the word Saqiya, it uses the word araghatta ok. So, what is araghatta, so ara- it means petty wheel or spoked wheel; and ghatta means pot. So, again the similar kind of you know functioning, but then it is argued, and it is shown by historians of technology, and science that if the Islamic engineers, they had made lot of you know improvisation, they had added whole lot of things to the Noria.

So, there are references of intricate and very sophisticated the Saqiya, sorry I mentioned Noria just now, it is not Noria, we are talking about Saqiya. So, it is argued by the historians of science and technology that though you know maybe some form of Saqiya was there, before the before it was devised by the Muslim engineers. But, then they added whole lot of features to it, so we get to know about use of complex Saqiyas, and here the Muslim inventors and engineers really played a crucial role. And you get a detailed coverage of this in that particular book or in the works of Hill, Donald hill.

And so he talks about the use of complex Saqiyas, which even consisted of 200 separate components. And this complex Saqiyas, where of course invented and devised by the Muslim inventor. So, we get to know about Al-Jazari this is the device, which Al- Jazari designed. So, he constructed he came up with the design of a Saqiya, which could be simultaneously animal and water-driven.

So, yes, this is the this is, the Saqiya, typical Saqiya. And, yes, as I was mentioning about the difference between Noria and Saqiya, so Noria the first difference is that Noria, it is it always gets activated in a river, a flowing water it needs, flowing water to get activated; on the other hand, Saqiya it is, it its mainly operational on the standing water bodies specifically the wells, so this is one difference.

The second difference is, Noria is always water-driven; but Saqiya it is mainly animal driven. So, we get to know or we get to the mention of different animals like oaks or mule or here you know we see the picture of a camel used in lifting water from a well through the use of Saqiya. So, the animal will turn the horizontal you know horizontal

wheel, which is engaged to the vertical wheel, and in that particular way the entire device would function.

So, this was this was, how the Noria used to work. And very interestingly it is still operational in some of the villages, in the north-west province. For example, now we will see an interesting video, which shows that how the Noria is still under much use in a particular village, in Pakistan, which is you know in Punjab most specifically Punjab, Pakistan. So, there we will see how the Saqiya is still functioning in that village. So, let us watch the video.

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Ok. So, you have seen the wonder that was, and that is Saqiya, how it is still operational in a particular village in Punjab, Pakistan. So, you can understand, how old this entire system or this entire technology, water technology was, and how the legacy still being carried on in some of the villages in arid, you know arid parts of India and also Pakistan. Because, part of this north-west frontier province is already is already know under Pakistan has gone to Pakistan after partition. So, so this was one interesting clip from Punjab Pakistan about the functioning of Saqiya.

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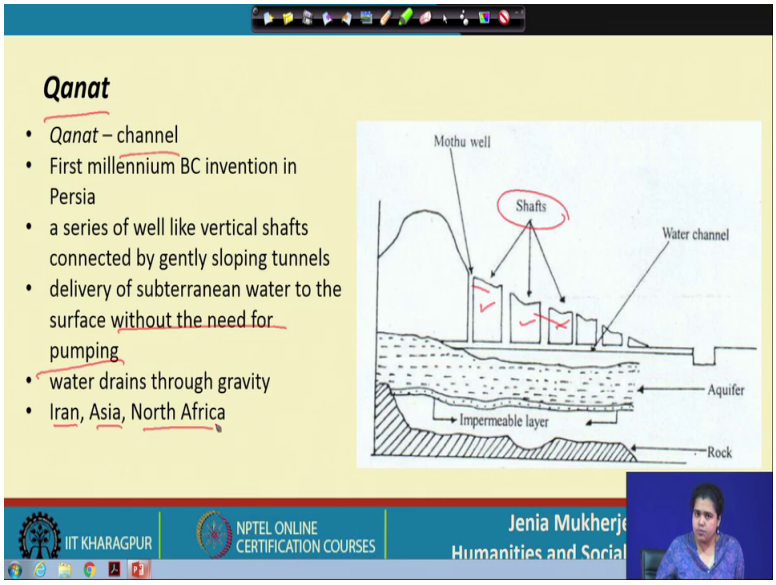

So, now we will move onto the last very important water lifting or you know water lifting device, which was also very significant so far as arid or desert regions were concern. So, this is what is known as the Qanat. So, now let us discuss about Qanat. So, Qanat is it is a Persian word, which means channel. And it is a first millennium BC invention in Persia. So, you can see a Qanat the picture of a Qanat right here, at the right hand side of the slide. So, like you can see a series of well like vertical shafts, these are the vertical shafts connected by gently sloping tunnels. So, they are all connected to each other.

So, this shafts they are connected to each other by the gently sloping tunnels. And this was very important in terms of delivery of subterranean water to the surface. And what the most important thing about Qanat is that, it can it could deliver or it can deliver subterranean water to the surface without the need for pumping. So, it saves energy. So, you do not require a pump. And easily you know water can be collected from the subterranean surface to the to the surface level without any pumping without, so it is not energy intensive at all.

So, how the water (Refer time: 21:05) drain the water drains through gravity. So, it drains to gravity, and what is collected from the up land aquifer, and then it gets easily drain through gravity. And this system this extensive system it was very significant for a desert areas like, you know Iran, Asia parts of North Africa. So, till now you know Qanats are in use, but of course the number have numbers have reduced. And finally like

Qanats were also used in the North-West Frontier Province. And the use of Qanats become very prominent during the mediaeval rule in India.

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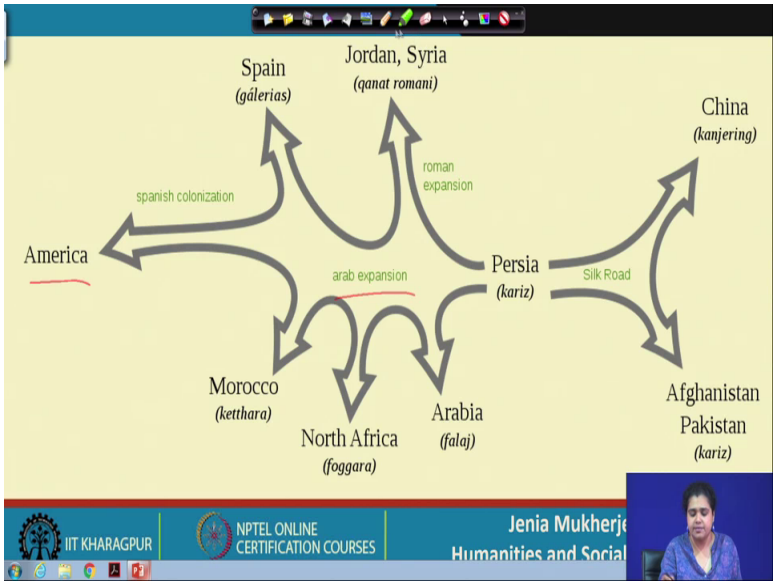

So, this is interesting illustration relating to the diffusion of this particular technology Qanats. So, you can see that it, it is known as known by various names so in Spain's called gallerias I really do not know, how to pronounciate; in Jordan Syria, it is Qanat Romani; in China, it is Kanjering; Persia - Kariz; Afghanistan Pakistan. So, Pakistan you can understand, so it was part of the North-West Frontier Province. So, now it is going to Pakistan, but definitely it was, you know within India during the mineral time. So, in Pakistan also it is called both Qanat and Kariz; North Africa - Foggara and all that. So, you can see very interestingly that the Qanat technology, it also went up till America.

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It went up to America through Spanish colonization. So, the Mediterranean, Spain I mean in Spain this a particular technology was prevalent, because Spain got to know about Qanat through Arabia expansion so, Arabia expansion, then Spanish colonization in America. So, so we can see that change through which this particular technology, it traveled across different parts of the world. So, it is a very successful water technology device.

Yeah, so I will just like to end this presentation with a particular question in mind. And I really think that you know the students or people or researchers they really need to evoke and understanding or a particular question in mind that, you know often in our school text books or often in some of the conventional works or literature Muslim rule or Islamic rule is depicted as the Dark Age right.

And these depiction, it comes from the imperial school of thought or the imperial historians, you know people like Moorland or people like Stanley pool or for that matter people like (Refer Time: 24:19) So, they try to a great extent stigmatized, and victimized the mediaeval period as the you know period of Dark Age. So, there was no development the society was extremely stagnant, it was a static society with no economic development, no I mean there was no scope, and opportunity for economic regeneration.

And even Karl Marx he talked about the Asiatic mode of production, so which was very different from the other continents, because he also talked about the you know the, how

stagnant the society was during this particular point of time. But, later also he try to revise his, you know previously talked out theories. And Irfan Habib as I talked about Irfan Habib in the previous lecture so who is a very you know historian on especially the Mughal rule or medieval Indian economic historians. So, he has written a lot on you know the various theories of frameworks relating to the Asiatic mode of production. And he is also counted some of the arguments propounded by Marx, and he try to validate his own particular point or hypothesis by showing that the medieval period or medieval India, the society was not at all stagnant or static. It was rather extremely dynamic.

So, whether should we regard this Muslim rulers as proselytizers only came here to loot, and plunder and you know convert and all that autocrats, destroyers of Indian civilization or we should critically interrogate this conceptualization of Dark age. And try to find out facts and evidences that actually provides us with an alternative history that shows how you know medieval India also was very much, you know the society was technologically advance, and the society was (Refer time: 26:22)

And if you remember, you know particular quote from the previous lecture. where we talked about you know where Abha khan, who had worked on Haryana; he said that you know the Water Technologies at least, it shows I mean this manifest or this reflect the kind of sophistication or the kind of sophistication that India could reach, in terms of Science and Technology is actually incredible. So, so we need to keep this mind that they really, I mean there was the construction and implementation of various sophisticated extensive, and elaborate water technologies during the mediaeval time, which were very much tuned to ecological and geographical settings, and specific contexts.

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So, with this I would just like to say that, you can go through this various references, which will be again important for you to, you know for capturing detailed coverage on Islamic technologies or more specifically, I mean Islamic technology in general across the world, and also Islamic technologies more specifically for India.

Thank you.