**Disaster Recovery and Build Back Better**
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**Lecture - 24**
**Lessons from Peru**

Welcome to the course disaster recovery and build back better. My name is Ram Sateesh. I am an assistant professor from Department of Architecture and Planning, IIT Roorkee. Today, we are going to take some lessons from a very different geography of the world from the South American side the Peru. So, this I call it as lessons from Peru.

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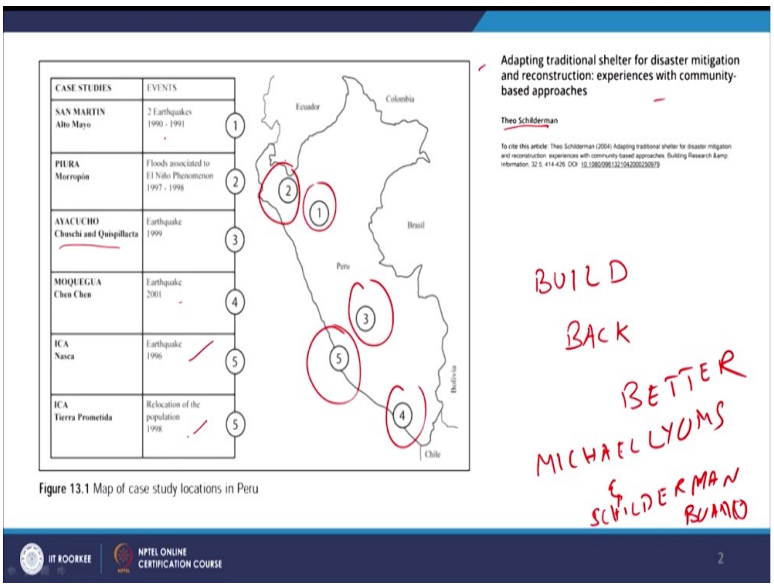


And, I am going to discuss about information gathered from various resources; one is, the earlier discussed version of build back better by Michael Leone and Theo Schilderman and as well as with Camillo Boano. So, the earlier version with that was a chapter on long-term impacts from the short-term recovery. So, this is here, what they did was they tried to compile a variety of cases in that particular geographical region.

And they have looked at how people have adapted to it, how people have responded to it in different context. So, there is also some other information we can see from adapting traditional shelter for disaster mitigation and reconstruction, experiences with community-based approaches. In all the discussions, they highlights on different modes of participation and different context and different responses to it.

So, this is Michael Leone and Schilderman and Boano; Camillo Boano, so what they did was they have taken about 6 study areas, which are affected by different earthquakes in different timings and different parts of Peru. Number 1 which we are talking about San Martin area, Alto Mayo which has been affected by 1990 and 1991 earthquakes. Number 2 which is of Piura Morropón region; in Piura region in Morropón which has been associated with the floods and it is not just only a one event oriented.

But it is also the El Nino phenomenon where a longer term impact has also like drought and other things have also been seen here. Ayacucho earthquake which is in 1999 which has affected the Chuschi and Quispillacta. Then, you have the Moquegua earthquake in 2001, down south and whereas, this is about the Ica area, which is 1996 earthquake and as well as in Ica Tierra Prometida, which is the relocation.

So, now in these, we have the relocation context as well. So, let us go case by case and briefly discuss about what they have worked on. So, I'll discuss about the technological aspects in the first case and then in because many of the things are common in all the cases but there is a slight variance in different cases especially with the adobe type of construction, so I will just briefly go through each and every case.

And finally, I will summarize it, see what are the various generic aspects of it and the specific aspects to it.

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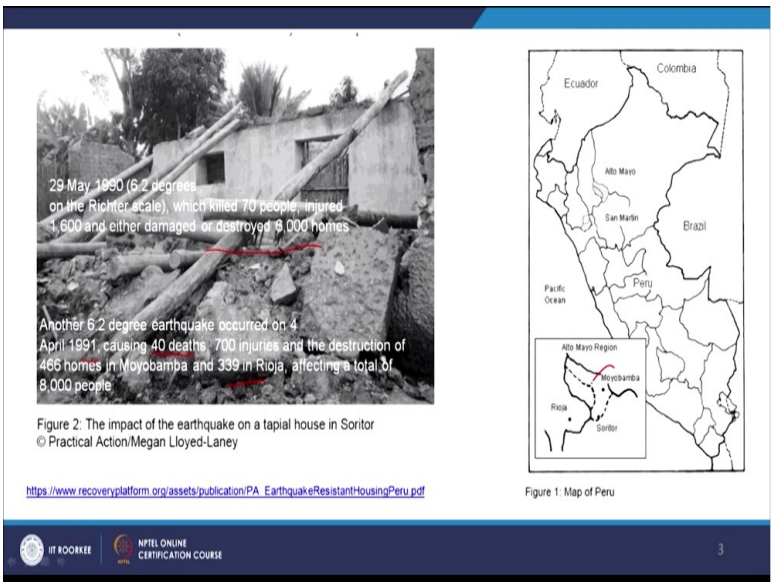

In 1990, in 29th May, Alto Mayo, which is this region we are talking at 6.2 Richter scale and it has killed about 70 people and injured 1600 and almost 6,000 homes either damaged or destroyed. Later within one year in 1991, again another 6.2 Richter scale have occurred and this is when 40 deaths and 700 injuries and the destruction of 466 homes in Moyobamba and 339 in Rioja affecting so this is all, the Moyobamba and Rioja and Soritor.

So, this is the Alto Mayo region and this has been carried out with the practical action group. A practical action group they does mostly on the recovery process, mainly in the long-term reconstruction rather than the short-term relief. So, how did they account the beneficiaries obviously based on various surveys, various on the feedback from the local residents and the leaders? So, they have actually calculated the whole expenditure of it and as well as what kind of requirement and needs assessment has been done.

And then they identified, yes these are the potential beneficiaries. So, at this point of time, when it comes from the architectural aspect of it, so, with all the consultation process with the local leaders and various stakeholders within that region, so they have decided to discard the use of rammed earth and adobe.

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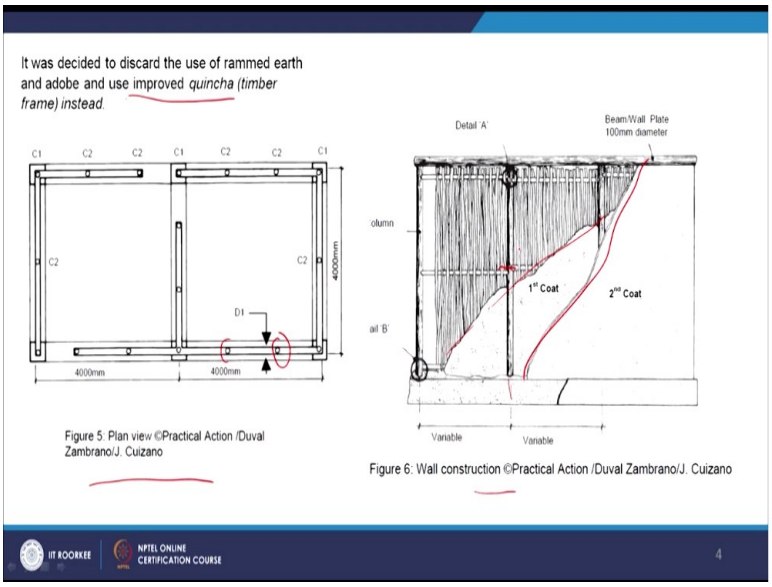


And they want to promote the quincha timber-frame instead to be as a better earthquake-resistant material. So, what you can see is from the practical action groups, the model they developed the plan with the timber posts in between and they have this is called quincha construction. So, what you can see here is it is a kind of timber studs embedded in the either in the concrete bedding or little deeper into the foundation.

So, then this whole wall like we know the rattle and daub sort of thing, so we have this bamboo screen, which has been weaven and then the first coat of slender has made and then the second coat of slender is made later on the bamboo screen. So, in that way, it has an intermediate vertical studs and which also having a horizontal stud because you can see to nail it on to other two studs and this is a whole very indigenous technique, they have slightly upgraded this part.

And in the first coat, what they did was in the render they first allowed it to dry and then cracks have appeared on it. So, when the cracks have appeared obviously they are made of a second coat that is where it can fix the second coat because it gives a texture for it.

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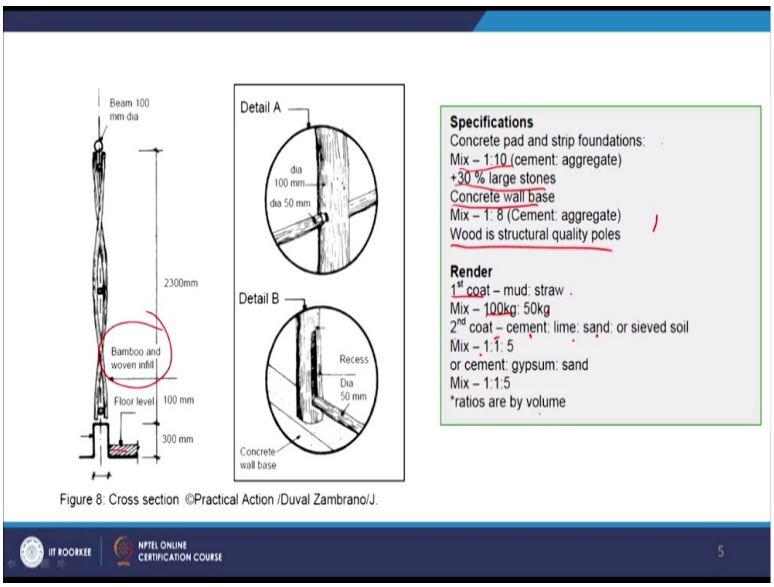

Figure 8: Cross section ©Practical Action /Duval Zambrano/J.

So, if you look at the cross-section of the woven timber, so this is how it looks where you have the floor level and about 300 mm height and then this woven timber is fixed upon it. So, this is about 2.3 meters, this is called we call it the woven infill and if you look at the detail A this junction and this junction, so these are the 2 junctions. So, now you have the 100 mm diameter and it has embedded the horizontal stud is embedded within it.

And there is also in the bottom, it have a recess so it goes into the wall base and as well as 50 mm diameter, so it fix the horizontal stud as well. So, this is a kind of detail it has been implemented. Then, the technical group also have suggested various specifications that concrete pad and strip foundations which should have a mix of 1:10 cement+aggregate+30%

of large stones and concrete wall base where it have mix of 1:8 cement and aggregate and wood is structural quality poles.

So, in render again they have mixed about first coat mud is to straw with 100 kg and 50 kg and second coat cement is to lime, sand or sieved soil as per the standards. So, this is where 1:1:5 or cement is to gypsum sand. So, this is again they are all about by volume.

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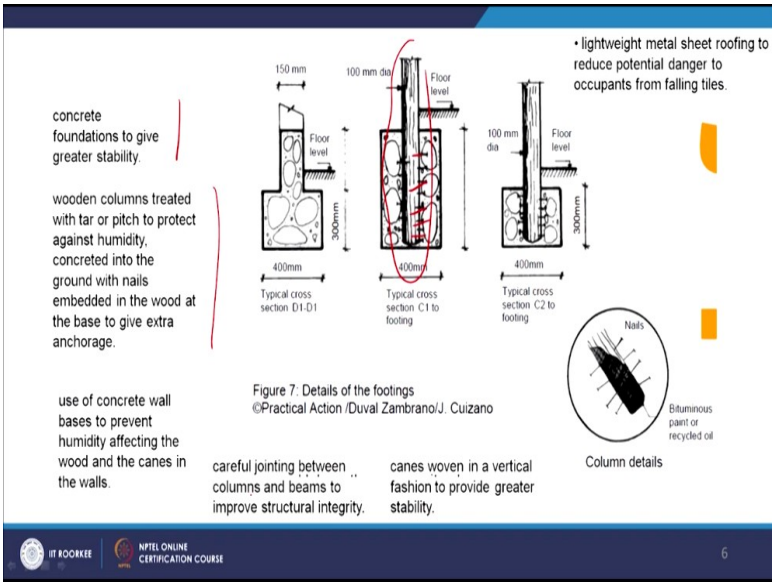

Figure 7: Details of the footings
©Practical Action /Duval Zambrano/J. Cuizano

And what are the benefits of this quince constructions; one is they have upgraded this type of construction also embedded the concrete aspect and the concrete foundations. They provided the concrete foundations, so which can give more stability, greater stability towards the earthquake. Then, the wooden columns treated with tar or pitch to protect against humidity concreted into the ground with nails.

So, this is what you can see here and these nails have been embedded into this, at the base to give extra anchorage and use of concrete wall basis to prevent humidity affecting the wood and the canes in the walls and similarly, careful jointing between the columns and beams to improve structural integrity.

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That is where you see in the next slide, you can see that here that the joining of the beams and the columns, how carefully they have them because that is where, it is going to tie the whole building and it is going to make sure that the whole structure acts in a better way in terms of the earthquake, when earthquake happens and because when the canes are woven in a fashion it will also not only the aesthetic character of it but it also gives a kind of structural stability.

And in terms of roof, there has been a lightweight probably galvanized metal sheets roofing to reduce potential danger to occupants from falling roof tiles or the adobe roofs. So, when the building shakes obviously, the stones used to fell down on the people, so that is where they thought of going for lightweight materials. So, what you can see is a community building in Soritor area.

So, what they did was they try to upgrade this technology. First, they did was, they tried to construct the public buildings like schools or the community buildings so that people get some awareness of this technology and they could also train the local people, they could also train, give some training sessions or the masonry training sessions to the local people so that it can be spread out to the other places as well.

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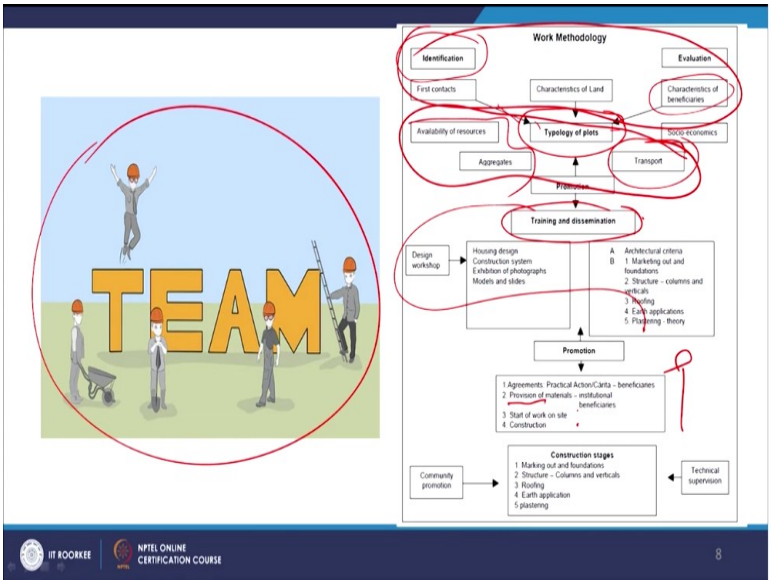


So, the way they have developed is basically, there is 20 to 40 people in a team and then they start working on, they have been got training and they have been implementing in different sites. So, this is how the methodology has been done, you have the identification of the beneficiaries and the first contacts, then you have these, what is characteristics of the beneficiaries, you know how do one figure out these beneficiaries.

This is where the socio-economics also play into the role and the damage statistics also play into the role and this is where the typology of plots and now who will supply the material resources, you know that is where they have to negotiate with how communities can also provide some resources to it. The main issue is the transport, you know like in certain places bamboo is not locally available.

And they have to transport raw materials from different places, and that is where some NGOs also are provided some kind of technical means and this is where the training and so first of all procurement happens at this stage and identification happens at this stage and the training and dissemination and that is where they talk about the implementation process.

And this is where they talk about the promotions you know, agreements with various NGOs and beneficiaries and as well as the provision of materials as well as how they have to really implement at different stages and technical supervision, how it has to conduct at different stages. So, this is how the working methodology has been developed. Now, what kind of impact?

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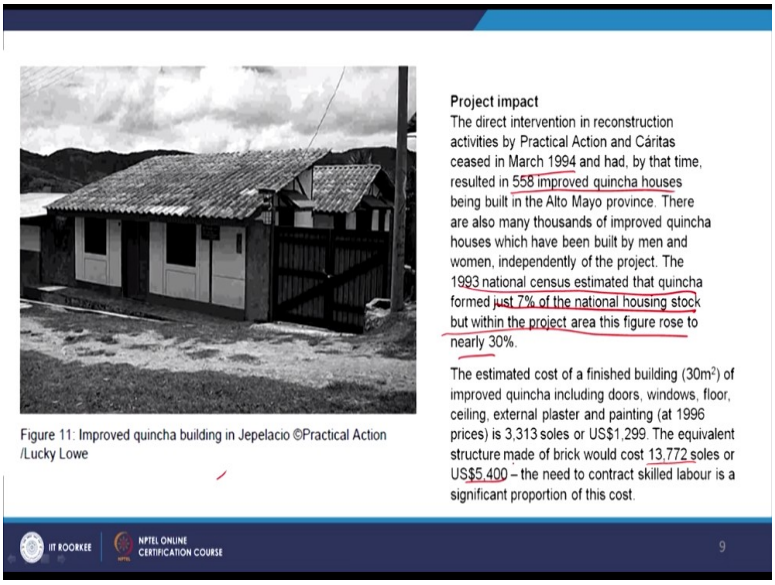

Figure 11: Improved quincha building in Jepelacio ©Practical Action /Lucky Lowe

See, this is one of the, this building what you are seeing is an improved quincha building in Jepelacio and here what is the impact, by from 1991 we move on to 3 to 4 years down the line in 1994, it has about 558 improved quincha houses within that Alto Mayo province and there are also, by taking the inspiration there are many have been built in that particular province independently by both men and women.

And in fact, in 1993, the national census estimated that the quincha formed just 7% of the national housing stock but within the project area, this figure rose to nearly 30%. So, that kind of inspiration it has motivated them and about 1300 US dollars it used to take construct a 30 square meter house and if it was taken by a brick or concrete house, it would have taken more than nearly, thrice the amount which is about 5400 dollars because which needs a skilled labour, skilled contract.

But here, the benefits for these particular community was because the skilled labour was also easily available in that region number one and the material resources many of the resources bamboo and all, they are also available in that region. So, the timber was available, the resources was available, the skill was available. So, in that way, it has come, the cost has come down and people were able to participate in much progressive way.

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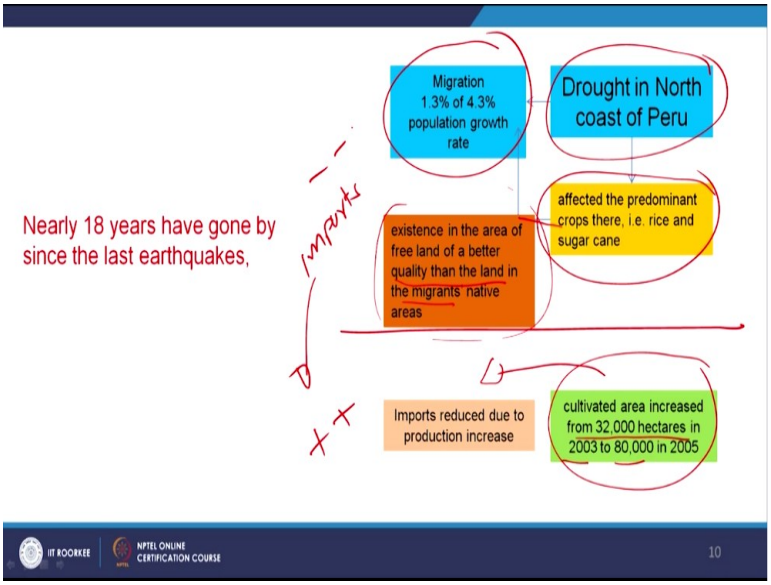


So, the same caves 18 years after, you know, when the authors have investigated, so what changes they have looked at? Now, one is gradually, the drought in North coast of Peru have been consistently occurring and that has caused the affecting the predominant crops like rice and sugar canes which needs more water and also there is, also impact on the water resources and that is where that is one aspect people tend to migrate to other places.

And here, again in this particular Alto Mayo region, there is an existence in the area of free land of a better quality than the land in the migrant's native area. So, in the North coast area so they are getting you know instead of 0.5-hectare land, they are having about 2 to 3 hectares land of it. So, that is how people tend to migrate and about 1994 when we see the migration, out of 4.3% of population growth, 1.3% have contributed for the migrant population.

And considering this conditions, the government has motivated to and encouraged to enhance the production of the feasible cultivated areas. So, that is where they have also promoted certain schemes and they also developed and encouraged the people to work on the possible cultivated areas. So, that is worth from 32,000 hectares in 2003 has become 80,000 hectares in 2005, so it has more than double.

And that has actually, the production has increased and obviously, the productions and the imports from other places has been decreased. So, this is one of the important considerations because and people are getting a better economic status. So, they are able to, now in the

beginning though initially, it has started with a very participatory approach but now because the economic status is making them independent and they are able to take some decisions.

And earlier local government was not playing but now, gradually local government also have taken part of the whole process and the economic status is actually, supporting to that.
But, when we talk about the public areas, they are often neglected except a few main squares was what you can see is a main square in Alto Mayo.

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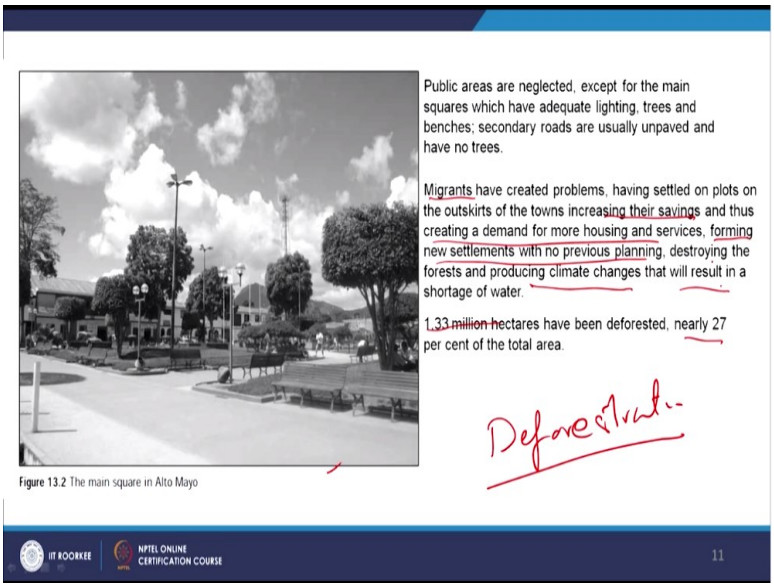


And which has been you know, you can see the secondary roads are not normally paved and they do not have any trees or plantation except for the main squares they have not concentrated much on the public spaces. So, they also the migrants have also created problems, you know they started settling down on plots and outskirts of the towns increasing their savings and thus creating a demand for more housing and houses.

Because the more migration has started coming up and that is where the demand of housing and services and which means they are forming new settlements without any previous planning and this is one of the important aspect is deforestation, it says 1.33 million hectares, have been deforested with these migration process and nearly 27% of the total area which comprises 27% of the total area has been deforestation.

And now, that is where we are talking about the indirect impact on the climate change aspects, which may result in the shortage of water, which will again turn into a cycle of having an impact on the agricultural impacts.

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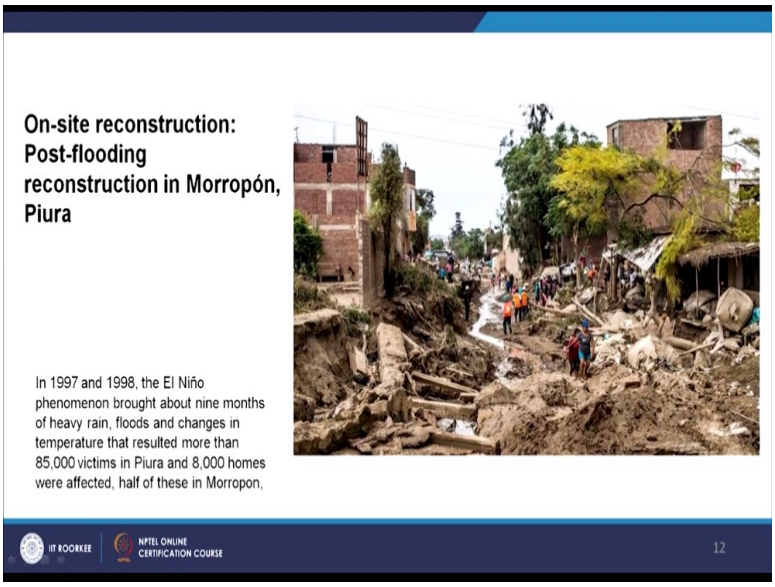


So that is the brief about the Alto Mayo constructions and the second one is about the on-site reconstruction, post-flooding reconstruction Morropon in Piura region. So, again in 1997 and 1998, there is El Nino phenomenon which about 9 months with heavy rain, floods and changes in temperature that has resulted more than 85,000 victims and Piura and 8,000 homes were affected.

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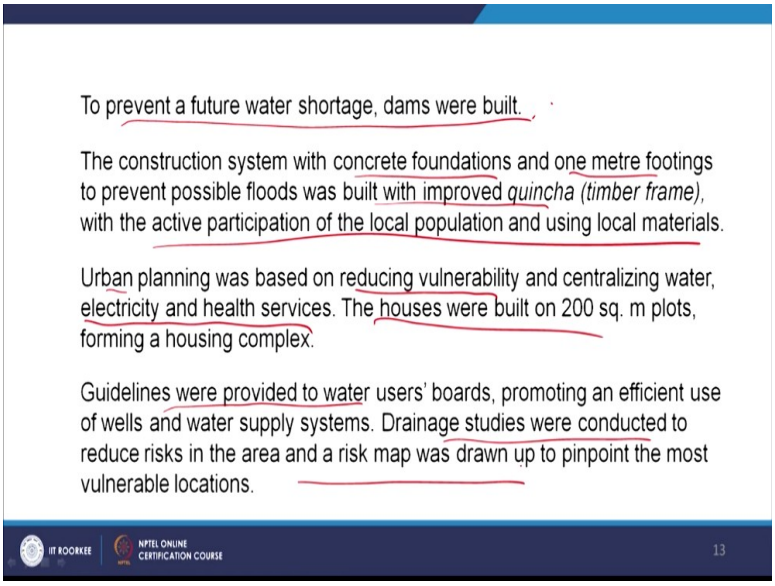


So, because being an agricultural sector, this particular region is rich in its agricultural sector, so one is in the reconstruction process, they looked at how to prevent the further water shortage and dams have been irrigation projects have been built and also from the housing the construction system with concrete foundations of 1 meter footings to prevent possible floods was built an improved quincha.

Again, they use the quincha timber frame with the active participation of local population and materials. So, even here, the participation has been incorporated and getting the local materials. Now, here being agricultural family again the whole idea of urban planning is to reduce the vulnerability and the centralizing water and services and this is where all the housing complexes are built in about 200 square meters plots.

So, there have been also provided with certain technical guidelines, how to use water and you know promoting an efficient use of wells and water supply resources and risk mapping has been done on the drainage studies and they also identified certain vulnerable locations, so, there have been also communicated to the people. This is how mostly emphasized on the water segment and the irrigation services as well.

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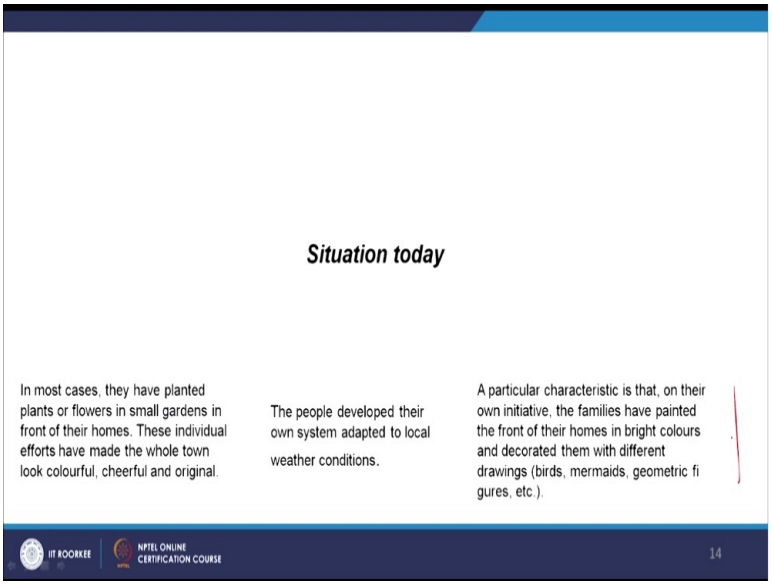


Now, what happens here? Today, the situation here, is very colorful and very cheerful. One is, people have planted flowers and make the small gardens and they also develop their own system adapted to the local conditions, so because they had tin sheets basically, with this advanced I mean upgraded quincha system, they also adopted certain local techniques and they try to modify their dwellings.

So, that is where in any response personalization is a very natural response to either to climate aspects and as well as the cultural deficiencies. So, the fronts have been taken care of because they have painted with various murals with drawings like birds, mermaids, geometric figures, so this actually shows you know, they made them private gardens into it, they looked

into the green concerns of it. This shows that you know the community's self-esteem has been considered very much.

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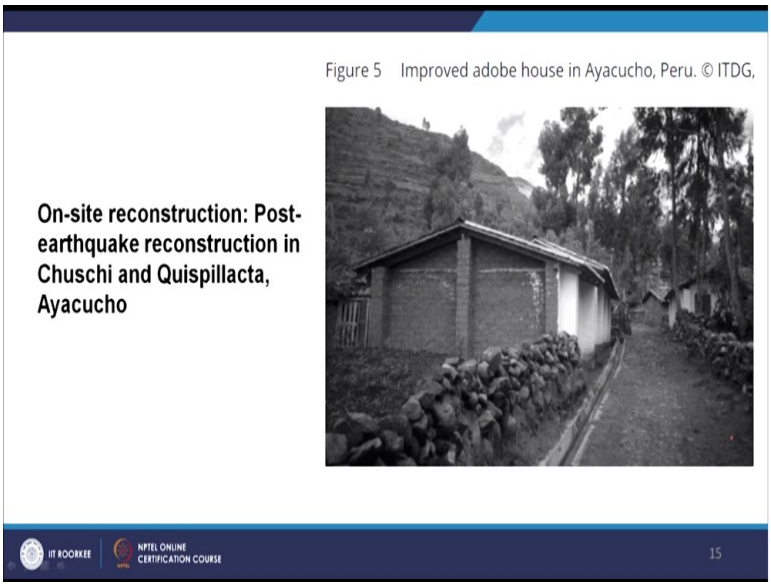


And that is how the participation have ensured that they have taken the self-esteem forward. I will also discuss about the third case, which is an on-site reconstruction again and post-earthquake reconstruction in Chuschi and Quispillacta Ayacucho. So, this is an adobe house, so what they did was they have adopted because being in all these 5 or 6 settlements, the poverty is one of the common factor.

And here, what they did was they tried to train them making adobe square blocks and train them in making this adobe houses.

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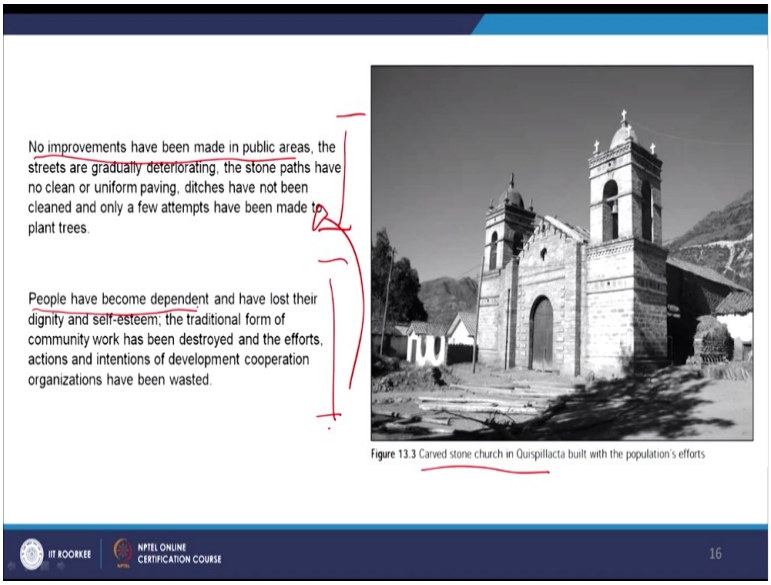

And how to make some improvements on it and again, here also they consulted the people what kind of beneficiaries and they make involved and all the people in making these houses and everything but what we see is there is not many improvements have been made in public areas, like you can see the streets have been gradually deteriorating, the stone parts have not clean and uniform paving and ditches have not been cleaned.

So, which means, this is where, there is a negligence on the public space itself but one interesting thing is people have invested the time and effort to actually to make this particular carved stone church in Quispillacta built because this is how one positive sign of it but somehow it has not been taken into the overall scheme, you know, how the same energy could have well better used here in making this well.

So, this is one thing we can learn from this. So, why does it happen like this? Because people have become dependent and have lost their dignity and self-esteem because state institutions have been providing them whatever they need it, so in that way that participation aspect have gradually come down and they are almost becoming mostly dependent yes on the state institutions support and either they are looking for any kind of external support or a cooperation.

And the traditional form of community work which is called of 'Ayni' which is a kind of give-and-take process in the South American continent. They have this traditional system, so that has gradually destroyed and the efforts and actions or intentions of the development have been wasted. So, despite of having this kind of energy, we are unable to, they were unable to invest that in holistically.

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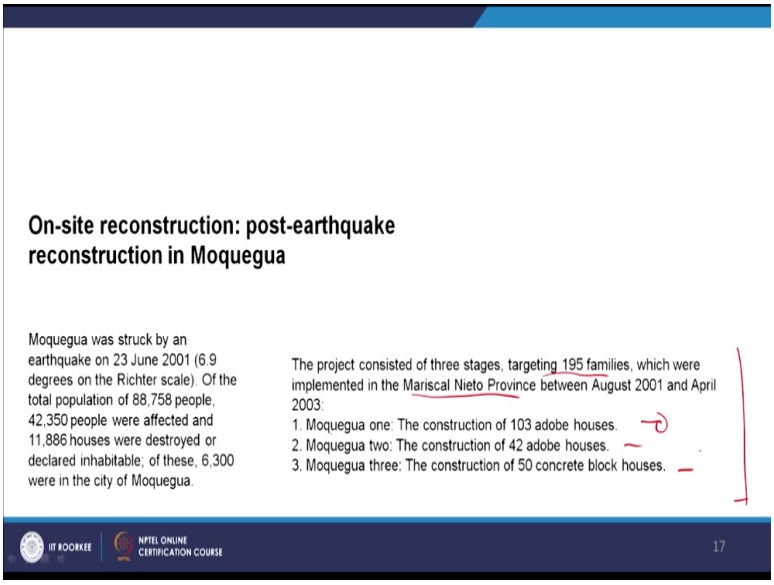


Similarly, in on-site reconstruction, post-earthquake reconstruction in Moquegua, here, it is also struck by in 2001, it is about 6.9 Richter scale, it is struck by an earthquake and almost 11,886 houses were destroyed and declared inhabitable and here, what they did was again they did about again in all the cases the NGOs are coming into the picture and they are working with the local governments and the local leaders and they are able to map what are the lists of the beneficiaries, how to provide.

So, the 3 stages, they targeted 195 families, which is implemented in Mariscal Nieto Province between about 2001 and 2003. So, in Moquegua one, they constructed about 103 adobe houses and this is again 42 houses in stage two and in the last one is a 50 concrete block houses.

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So, here, what happens is they also looked at involving the community in the recovery process and they also made some modifications according to their needs but what you can see here is this has been very successful.

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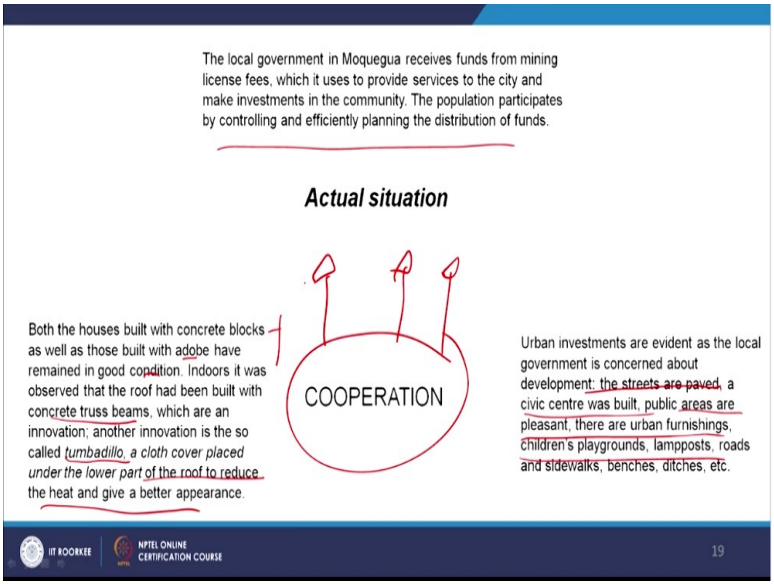


But here, because of the mining aspect, so they also the local government also received some mining fees and which again it has been in turn used to provide the city services and make investments in the community. So, the population, the community participation controlling and efficiently planning the distribution of funds. So, one is the mining being one of the richest economy, so it also supports to facilitate these services.

And both the houses of concrete blocks and as well as adobe remained in good conditions and in both the cases it has been technically guided and they remained in a good condition and this is where they also implemented one more indoors, the roof has been built with concrete truss beams, so they have this concrete truss beams which are an innovation and another innovation called tumbadillo, a cloth cover placed under the lower part of the roof to reduce the heat and give a better appearance.

So, they try to cover a cloth under the roof so that it can you know reflect the heat and it can make the indoor environment a little cooler and when people are participant in this, when the economy is giving support and the local government is technically giving support for a safer environments, so that is where you know the urban investments what you can see here today is they are improving.

The streets are paved and a civic centre was built, public areas are pleasant and children playgrounds, everything has been taken care of and this is where, we see the biggest thing is the cooperation, the cooperation from the community, this is how, how it is continuing in this process. In the earlier caves, initially they were part of it but then there has become a dependent part of it and then they ignored it. So, in this case, it was continuing.

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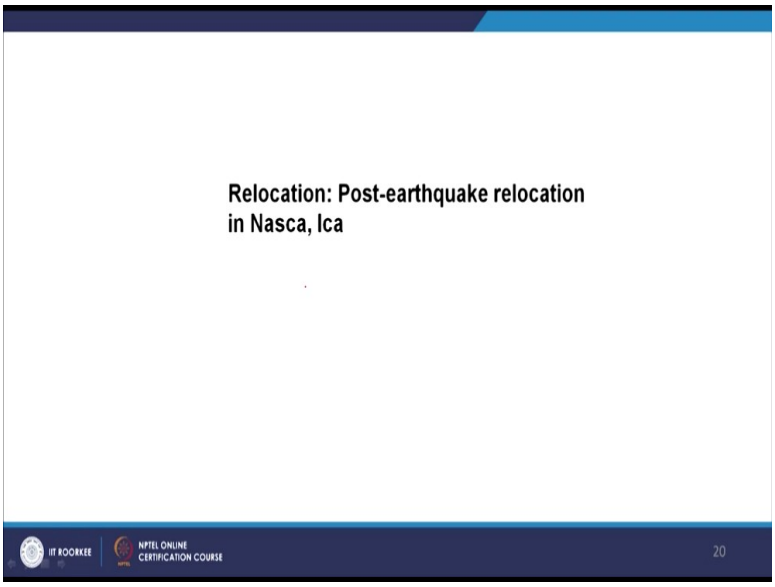


This is another case, relocation, post-earthquake relocation in Nasca, Ica. The second, the following case is also in Ica.

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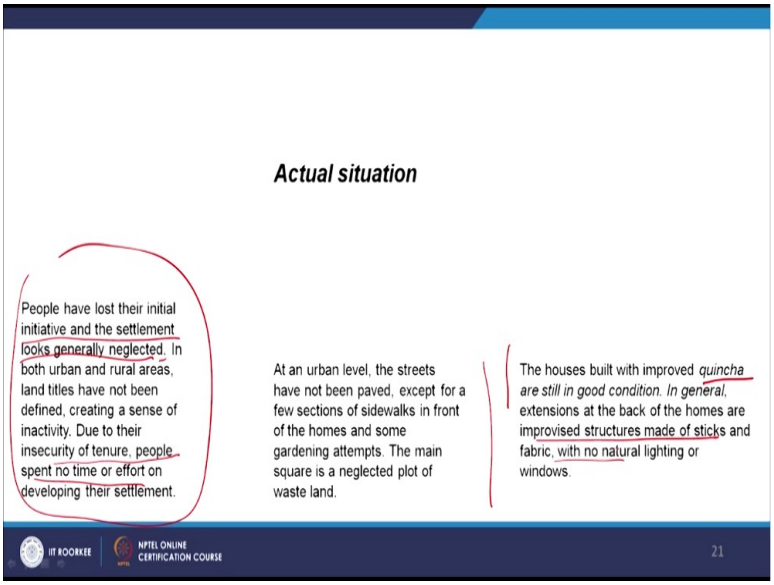


So, here, also what they did was the similar patterns have been followed and here, the people have lost their initial but today the situation is they lost their initiative and the settlement look generally neglected because mainly the promising land titles have not been defined. So, the

moment land titles are not defined that gives a little insecurity for them and that is where their insecurity of tenure, people spend no time or effort in developing their settlement.

When you know, that the tenure is not with you, how will you dedicate some amount and effort to make that place better and similarly the streets have not been paved and the main squares has also been neglected and but the houses which here also they use this quincha technique and they are still in a good conditions and there also extension of the homes which you see in the other cases as well.

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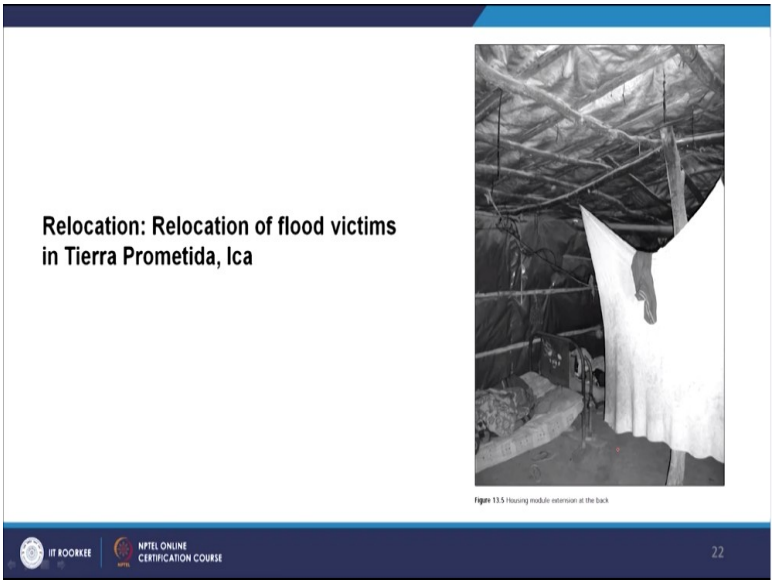


The last one is the relocation, in relocation of flood victims in Tierra Prometida, Ica. So, here, the church was involved, the missionary is also involved in the relocation process. So, what they did was they initially have been supported the kind of temporary shelters and the transition shelters.

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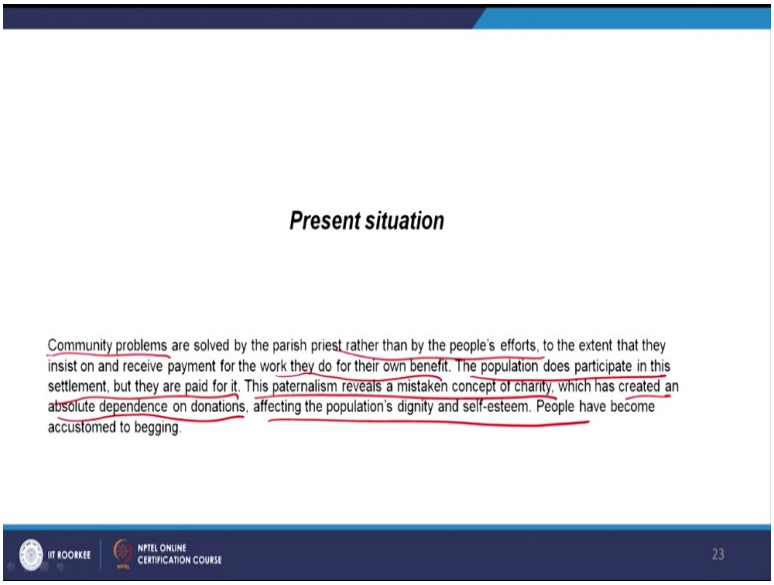


And then later on, the church play an important role in negotiating and providing certain helping hand to make their houses you know, in a better way but then here, if you look at it, it is not the community who have not solved it, it is the priest or the church who have solved their problems by receiving a payment for the work, they do for their own benefit. So, which means the population does participate in the settlement but they are paid for it.

So, it becomes a paid process and this paternalism reveals a mistaken concept of charity, which has created an absolute dependence on donations, affecting the population's dignity and self-esteem. So, here, instead of making them involved and realize the self-esteem character of it, here, they have become dependent because they are getting paid for that own work.

And in that process, what happens is they almost accustomed to kind of begging, tomorrow any problem comes they are expecting someone will support them. So, this is one lesson which we need to learn from this last case study.

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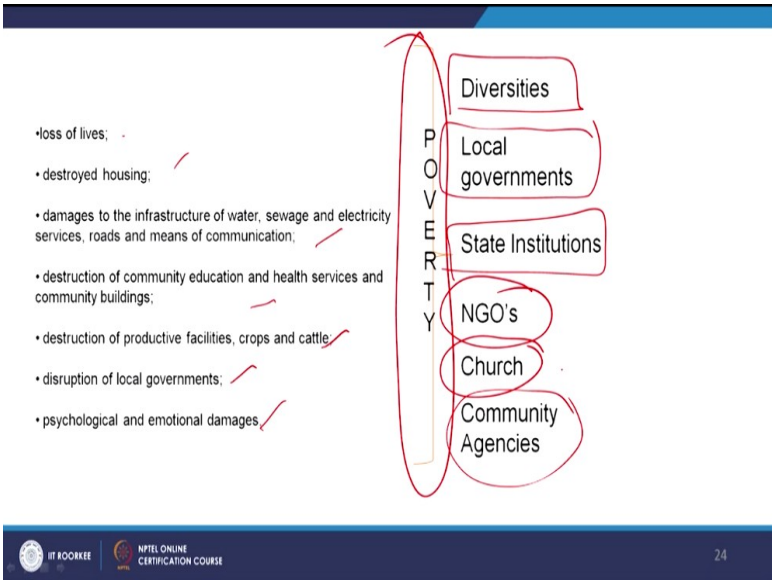


But summarizing, putting altogether is when we have these all the disaster context, we have the loss of lives which is a common context, destroyed housing, damages to services, damages to community education and health infrastructure, destruction of productive facilities, crops and cattle, disruption of local governments because in all the cases there are groups which are migrant groups which have migrated because of terror aspects, psychological and emotional damages.

But the underlying aspect, common aspect is the poverty but now in the last cases here woman played an important role in the recovery process. They have been, being a participant in different activities and they have been working leading certain groups. So, that is also one of the important aspects. So, that is where, here there is diversities, local governments role you know, how they negotiate and how they bring the people together.

State institutions, so of course, we learnt in a different way that that is also creating a dependency, NGOs, who is supporting them in the church, again, who is paying for their own work and the community agencies, who are being part of this course. So, this is all different actors working in this recovery process.

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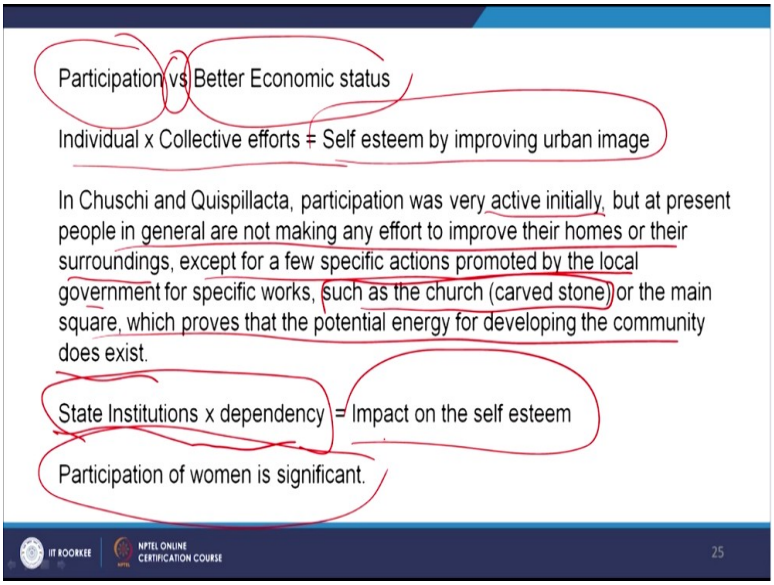


So, what are the brief lessons we have learned. One is, in the first case of Alto Mayo, we see the despite of huge participation process but related in a long run, the better economic status have dominated this whole participation aspect whereas the individual and the collective, the second case which is a more of a positive aspect and the individual and collective efforts of making their houses more beautiful and making the places more hygiene.

So, that is talking about the self-esteem by improving an urban image whereas in Chuschi and Quispillacta, participation was very active initially but the people, in general, are not making any effort to improve their homes or their surroundings. It could be because of tenure issues except, for a few promoted by the local government such as church a carved stone, example we see.

They have invested time and effort for their self-esteem of that particular project but they were not able to do it further. So, this is where the dependency aspect is seen more. Although, which proves that the potential energy for developing the community does exist. These are some evidences, which we can see that they have some energy but we need to channel them in a right way so that they can understand and they can realize and they work towards it.

Whereas the state institutions provide certain dependency aspect and this definitely have an impact on the self-esteem which in the last two cases, which we have seen and participation of women is very significant in this process, you know the change is happening, the leadership qualities are changing, the role of women is very different in this process. I hope this has given you a brief understanding of what happens in Peru in different context and

what are the long-term impacts for the short-term recovery process. I think that will help you. Thank you.