Disaster Recovery and Build Back Better
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Lecture – 19
Diffusion of Disaster Preparedness Technology: What Pioneers Contribute?

Welcome to the course, disaster recovery and build back better, my name is Ram Sateesh, I am an Assistant Professor in Department of Architecture and Planning, IIT Roorkee. Today, I am going to deliver a lecture which has actually been prepared by Dr. Subhajyoti Samaddar from Kyoto DPRI, Kyoto University. So, because of his non-availability, I am trying to learn from what he has worked.

And I am going to prepare, I mean present you about his work and Bangladesh and that is on diffusion of disaster preparedness technology and what pioneers contribute. So, this is what I am going to talk about.

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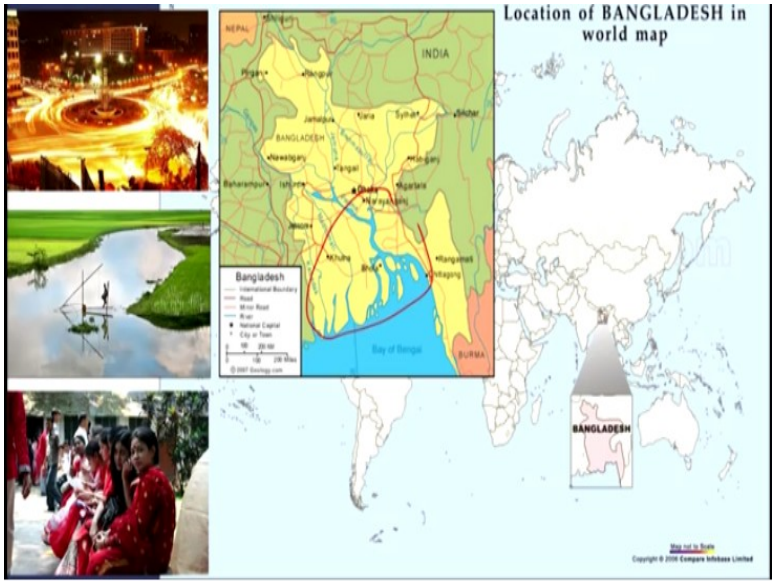

First of all today, we are going to talk about the Bangladesh, and many of you understand that you know in Bangladesh has been recently, not recently but at least from 1971, they got the independence from Pakistan and what you can see here is a heritage laid in a very rich ecosystem of the Sundarbans, and this whole part is you have all these backwaters, and much of this area has been prone to the floods, and part of it is on to the coastal side and as well as the backwater areas.

And it has a very rich cultural importance, one is being an Islamic nation and also partly it has some because it has been splitted from the Bengal; the larger part of the Bengal so, it has a very rich cultural traditions of both what you see in the West Bengal and at the same time as the Islamic as a nation.

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And this Bangladesh after becoming independent from 1971 and till 1980's, a lot of development programs has been worked, and UNICEF has been working with the Bangladesh government sector in order to promote various vulnerable situations in the flood-prone areas and as well as the disaster affected areas, and one of the major concern here is the water and the drinking water risks.

Because especially, in the coastal Bangladesh, the provision of drinking water because of its saline content and how various tribal communities and the coastal communities survive and what are the difficulties they face, so that is where many of the agencies and also different efforts have been kept forward in order to provide them the hand pumps, groundwater resources and as well as some kind of they rely on the surface water which is basically on the pond or river water resources.

But from 1980s, in the 1990's, due to various other factors with the climate change or the industrial aspects of it, this is where they have faced with 2 important problems, one is the arsenic contamination which is evident from the groundwater resources and the water salinity so, how the saline water is not you know, it is not good for consuming for a domestic purposes, okay.

It can be used for different purposes you know but for a daily needs, you know this is one of the important problem which the Bangladeshi community especially the people who are living in the coastal areas they have come across with this kind of problems. And that is where the thought of how we can address these vulnerable situations because these are going to have a long-term impacts both in terms of the physical and the mental health of the inhabitants.

One is; it can create a lot of chronic diseases, diarrhoea and you know it can have some kind of biological issues not only on the human habitation but also it can have on the flora and the fauna as well, so that is where there is a kind of innovation which came into the picture, and that is where Amamizu which is a kind of innovation as a Japanese technology, it is talks about rainwater harvesting.

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So, in Japanese Ama means river and mizu is water so, it talks about the river water harvesting. So, what they tried to do is; so they try to give this kind of tanks; water collection tanks and collecting the rainwater and they keep it for 6 months, they storage it for 6 months and then able to reuse so, this is a kind of technology which they have developed.

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And this has been one of the innovation where it was needed for that particular geographic, and the climatic conditions and the vulnerable conditions and they have tried to install in various rural villages which are been in need of this kind of technology.

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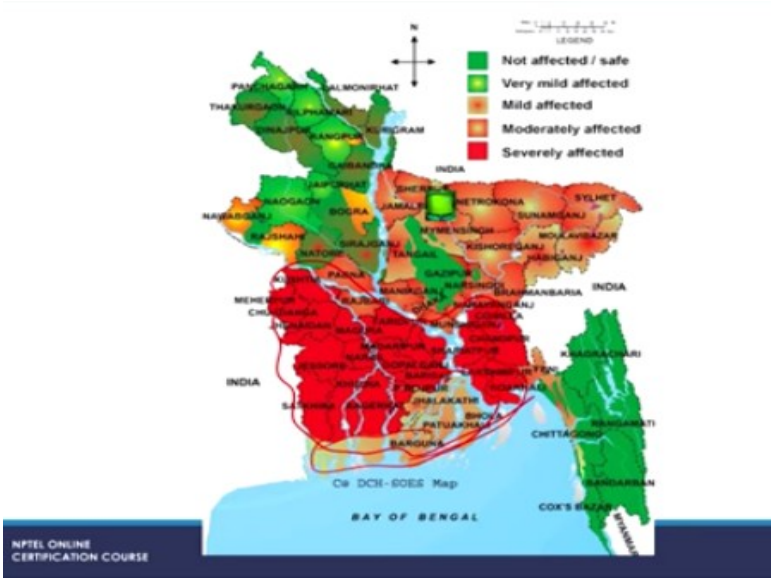

And now, if you look at the map and this whole region what you can see is, these are all the severely affected areas and the moderately affected areas and the mild affected areas and similarly, we have the mild affected and very mild affected and not affected the safe sites as well but then it started with it is not just the whole country but then the challenge is how to defuse this technology to a larger set up to a larger the whole nation.

So, it is; it might start everything will start with one and but it has to diffuse further and how, who will take this, who are these innovators, who are these pioneers, who is going to take this

particular transfer of technology to a wider community so, it has; this is one of the challenge because on one side, we are talking about capturing different groups of communities and making them use of this technology and realize them.

But the challenge is to bring in much bigger scale how we can diffuse this product so, in his previous classes also Dr. Subhajyoti Samaddar have also discussed about some issues with Bangladesh.

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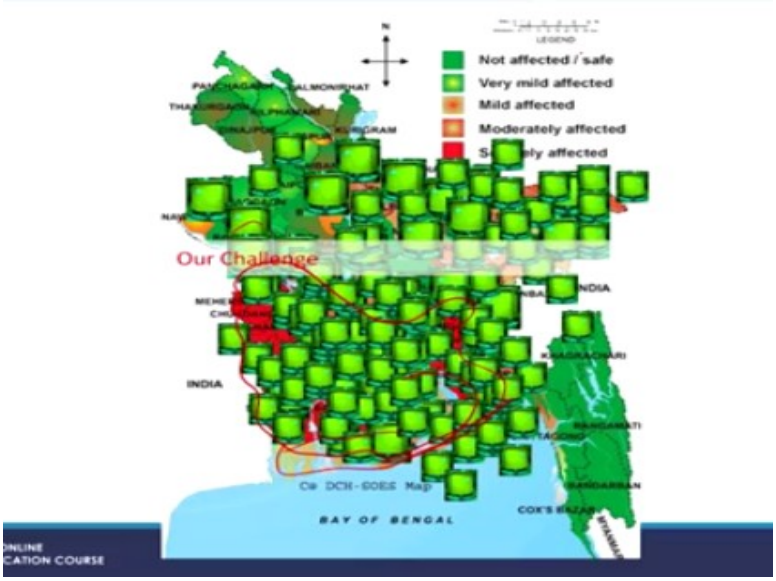

And this is also an another aspect of the arsenic content and how innovation could be diffused and what are the challenges and how one can assess it. So, in front of us, the biggest challenge is not just only an innovation but taking this innovation to the rural poor to the wider communities, okay so, how to take it further and how to diffuse this process? Now, any product whether it is a tank, whether it is an iPhone, whether it is any other remote driving car right, so any product which is coming into the society for the benefit of society, okay it is not just a tank which is collecting water.

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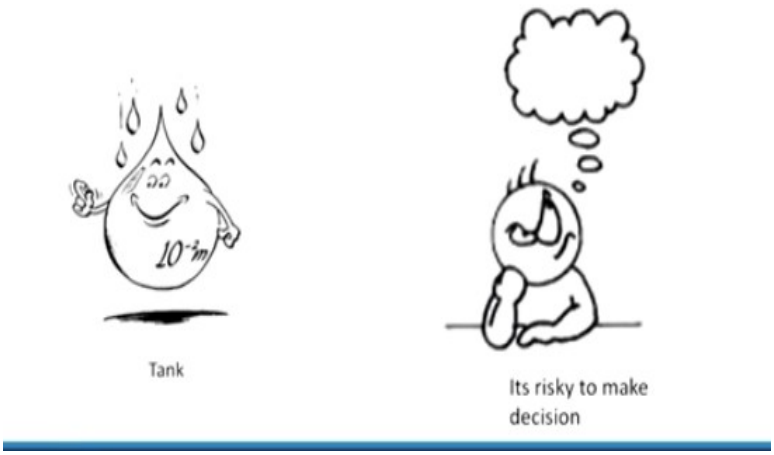

But the first thing is one has to look at; it is a very risky decision whether to take it or not. Imagine, someone has invented tomorrow a car driven with just water, not with petrol, so what happens people will start adapting because they keep putting water on it and they keep driving it, then they can save a little bit more money but then what happens to a larger ecosystem, what happens to the larger habitat?

So, a small invention can lead to a bigger risk. Smilarly, an autopilot car when subjected in an Indian roads unless if it is not properly tested so, how to take this risk to start with, the person who is starting in the beginning is obviously taking a huge risk because he do not know what is the consequences of it, it could be a drunk which is coming into the market to solve to cure a particular disease.

But then we are not sure how it is going to have a future consequences so, normally it is our human tendency, we try to see that how others have implemented, are they okay, has it been tested, forget about everything, just take a small thing, you are buying some product in Amazon, many of them I have seen when they look at it they see the reviews, they reviews how this product is, they reviews how that supplier is, what is the star ratings.

And nowadays, I have seen even when you go to your doctor to hospital, people are also looking at the feedback because that feedback process was telling you whether it is a good doctor whether the hospital is treating well or not so, this is how you know we are relying on a source of informations or a tacts of information coming from different networks.

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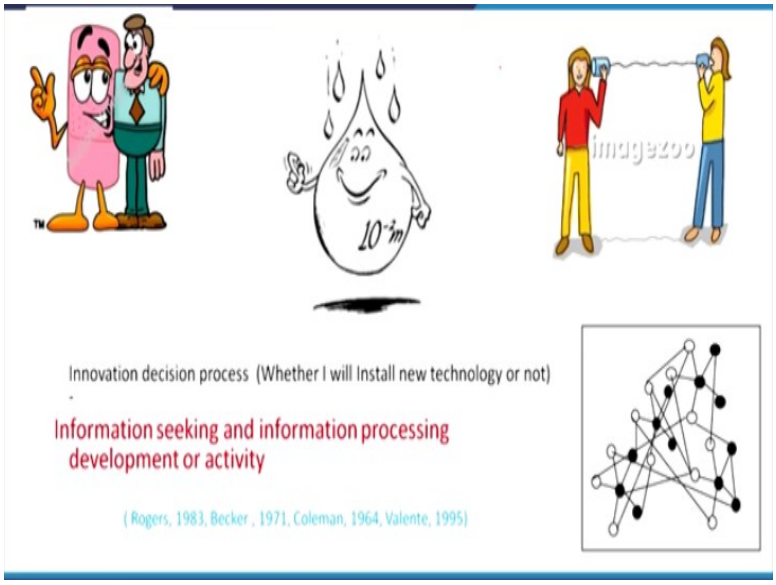

So, this is where the information seeking, we are able to seek some information and we are able to process it development or activity so, this is a very important decision making process whether I install new technology or not because it is a very risky, you do not know what is the consequences and we try to relay on this information seeking, you know that how we seek for information and we process it, we develop it, we make our own analysis of whether we should go further or not.

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In order to implement these tanks, one is sharing information on innovation whether someone's feedback, someone who have used it that can also reduce some risks, you will become familiar with certain risks which someone else have faced it or they have encountered also you will get some familiarity about the uncertainties, from an early adopter to the late adopters now, how information flows?

It is a kind of Bell graph, which I will discuss in the further lesson where how the early adopter he takes a high risk because he does not know anything what is going to happen next. Individuals are influenced by others, learn from others and eventually, change the decision. So, someone wants to buy this, they were initially very fascinated to buy this product or to take this to implement this product but then they learn that this is the after effects of it, there is a side effects of it and that is what they might change the decisions.

And nowadays, in the social media we are getting a very unreliable data, is difficult to say there are many much of contradicting data, with lot of information we are also getting into a confused state.

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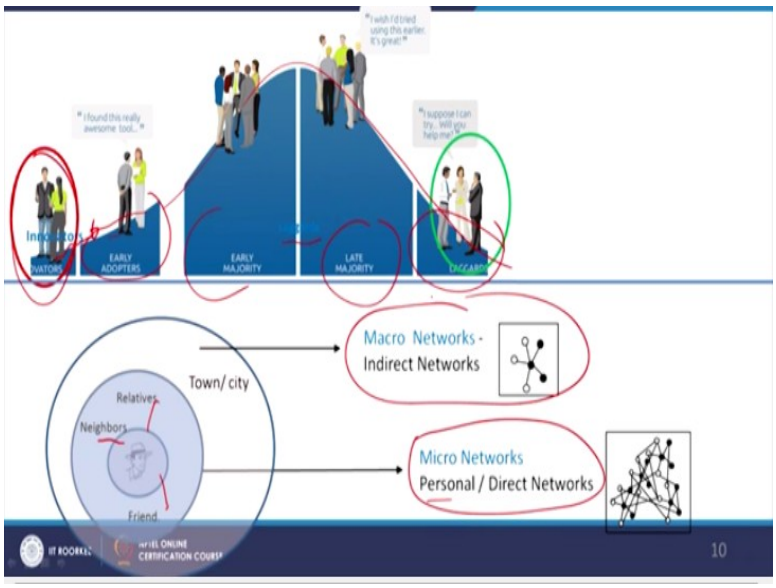

So, the earlier innovators, we call them as innovators because these are the first people who started using it, they might have taken a high risk to take this as how this particular product is going to work and then this is how the feedback have reached to the early adopters, so then the immediate network whether it is a friend, whether is a neighbour, whether it is the relative that is about a kind of micro level networks through their personal or a direct networks.

And then this is what we said about is going to have a bell graph and then there is another group who comes at the end, they try to see at how people have adapted to it and then the finally, they are more in a conservative approach and these after having a serious testing of this understanding how this has been tested option, so that is where they try; then they try to

decide upon it, they are referred normally as laggards, or there is also these early majority and the late majority.

Here, we are talking about I found this really awesome tool because they will just tried it but then you know at this stage I wish I do try it using this earlier, it is great so you know, they sometimes repent, better we have not tried it before it has been a successful you know, so like that these laggards, this is how there is also we talked about the micro level network which has to do with the personal and direct diffusions.

And the second one is with a macro level networks which has an indirect networks, how from what we are using in Delhi and how it is spreads to different cities or different communities across and this is where the macro level networks, it goes along with a very different indirect networks as well.

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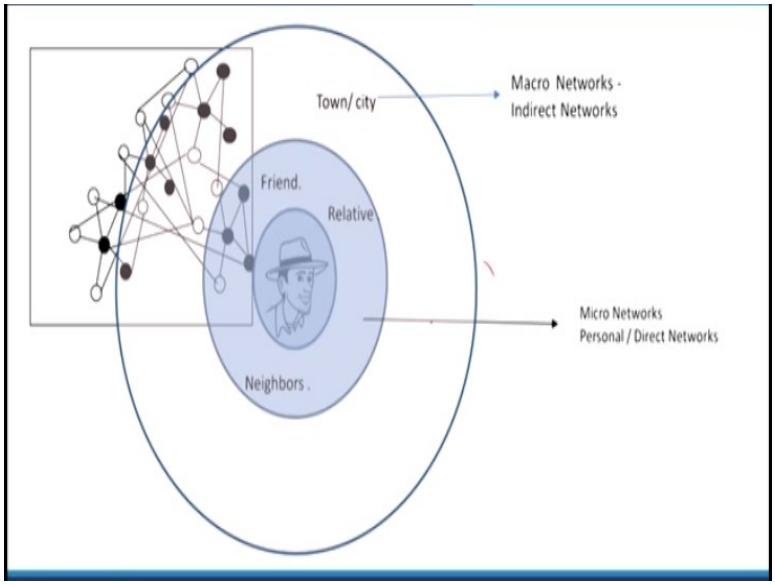

So, this is what we talked about but these two you know contribute at different levels of diffusion, one is in a very close in a more reliable so because someone can come and check it even in a place like IIT, I am living someone is buying a computer so, I keep getting calls that you bought that that how is the feedback so, shall I take it, what is the prize, how did you; how this facility is there or not there so, all this aspect has been discussed.

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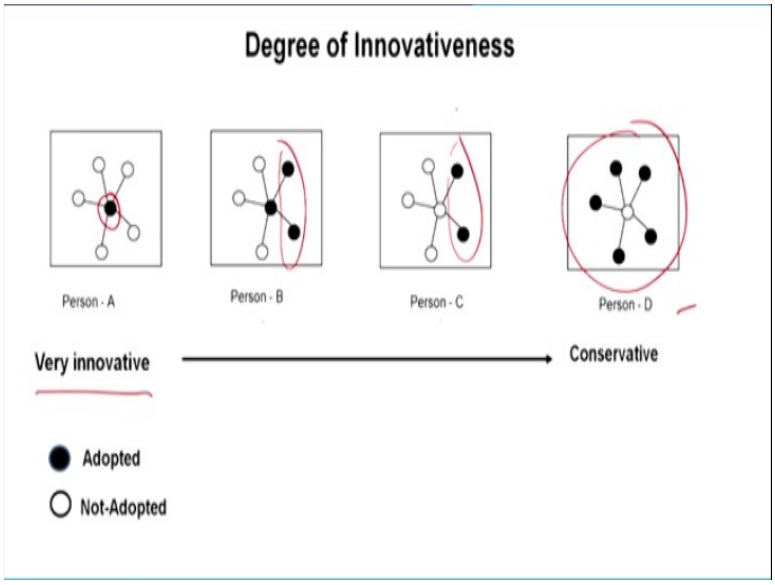

So, similarly when you are looking at a larger picture that is again the macro level networks whether it has been implemented in Delhi, whether implemented in Roorkee you know so this is how we looked at it. Now, if we take the perception of the most innovative and the conservative, if you see an example now, here a person A who have a group of 5 friends and he is the one who have actually taken the risk of starting it.

And then, whereas in the person D, he is still in a conservative but his; all his surroundings still relying on his own ways of thinking though his network have started erupting, he takes time to think about it, so that is where we talk about who is more innovative, the one who immediately you know takes that risk to test it and the person B and person C again they comes in you know here again, in this case, it is also looked at how other people have already adopted and either this person have influenced others, so that gradually changes.

And despite of other friends still he is being stable you know but this is how the very innovative level to a conservative level.

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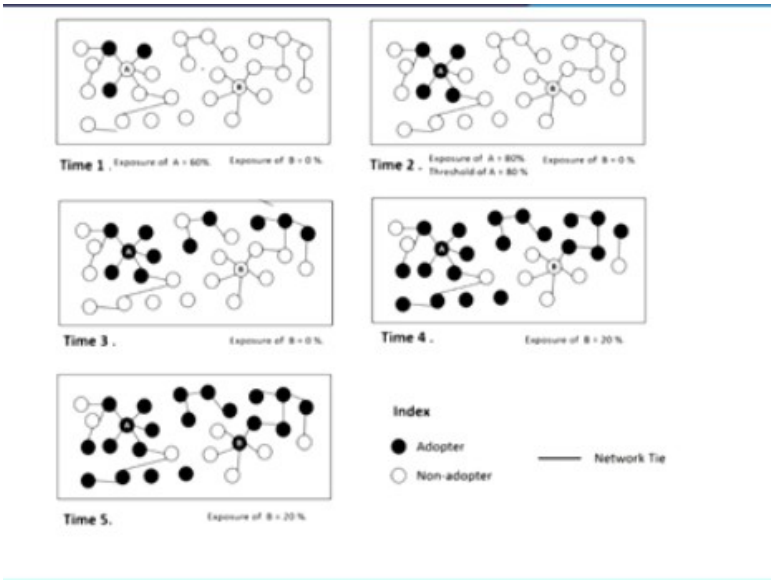

There is also the second argument of it is how in time, how the exposure and the threshold you know how it varies, in time 1, like you have that there are 2 reference points which we are referring in this small example, one is A and one is B. And A has again the 5 friends and B has 5 friends and they have their own networks and this we can see by this diagram, we can see it is a kind of a community network.

And this A has an exposure of 60% around him who are using these tanks and B has none so, we call at time phase 2, so by looking at his case now, A has adopted that and B still has not but when you look at the time 5, now A have adopted and it also which has spread it to the largest community but now B has adopted. There are 2 ways of looking at it; we can still call the A who have taken a risk in a very initial state, how we have adopted.

And we call; we can call him at an innovative at you know, in a whole community sector, he is the one who started that is innovative at a macro level and B could be looked in a more of a conservative level but in the other sense, if you look at it in the B, even at time 5, his none of; 4 of his friends have not still adopted but he is one who has taken a step forward. If we look at a micro level of that B as a community so, we can still call him more innovative in that context at a micro level.

So, there are different perceptions of looking at that from the time factor and the scale factor of it.

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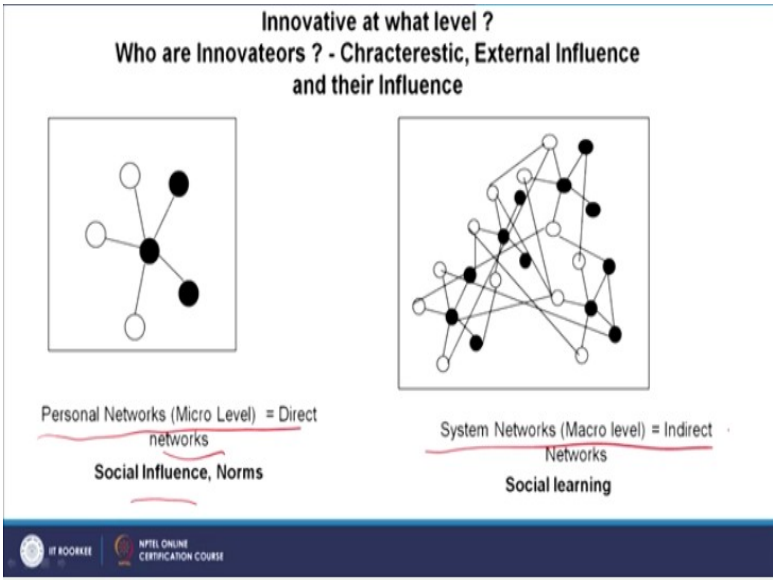

Now, till now what we discussed is the innovations at what level, who are these innovators okay and what are the characteristics of these innovators; an external influence that is where these innovators we call are the pioneers who take this information further and diffuse it further. There is a personal networks which again the micro level and the direct networks which could be with the social influence on the norms.

But the system networks which talks about the macro level which has an indirect network which is through the social learning.

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So, Subhajyoti Samaddar and his team worked as a project in some remote area of Bangladesh and how this set up of tanks have been diffused and how they did this whole survey.

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And so, these are some of the tanks which have been constructed.

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And they have done a lot of survey in that so, they have interacted with a variety of stakeholders they learnt what are the reasons, how they could learn about this product, how what is the feedback about it so; this is a variety of aspects they look at interview.

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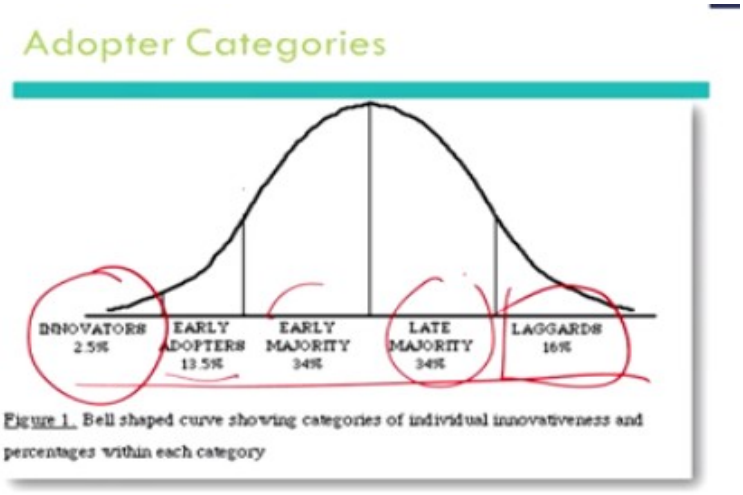

Figure 1. Bell shaped curve showing categories of individual innovativeness and percentages within each category

So, what are the adopter categories, this is a bell shaped curve which shows the individual innovativeness and percentages in each category, there has 4, 5 aspects as we discussed the laggards at the end the innovators on the front and then you have the early adopters, early majority and the late majority so, this is a kind of bell shaped curve.

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		Micro (Neighbourhood) Networks			
		Very Low Threshold	Low Threshold	High Threshold	Very Threshold
Macro (Regional) Networks	Early Adopters				
	Early Majority Adopters				
	Late Majority Adopters				
	Lagards				

And what they did was; they did both the micro level and the macro level understanding where with a micro neighbourhood networks, they set up this kind of threshold you know the which have the early adopters, early measured majority adopters, late majority and laggards and these threshold; what are these threshold; very low threshold, low threshold, high threshold, very high threshold.

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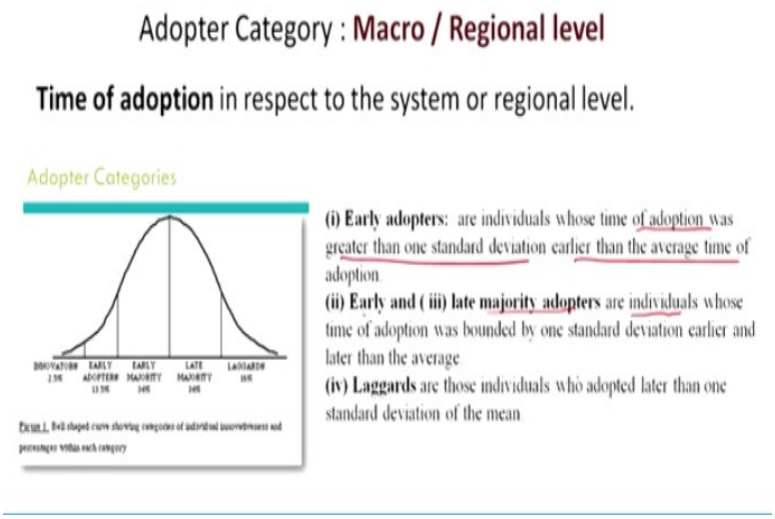

And similarly, and who are these early adopters; these at a macro level or regional level these are the individuals whose time of adoption was greater than one standard deviation earlier than the average time of adoption. so these are referred as early adopters and early and late majority adopters which is the central phase, or the individuals whose time of adoption was bounded by one standard deviation earlier and later than the average.

And the laggards are those individuals who adopted later than one standard deviation of the mean so, this is how they configured.

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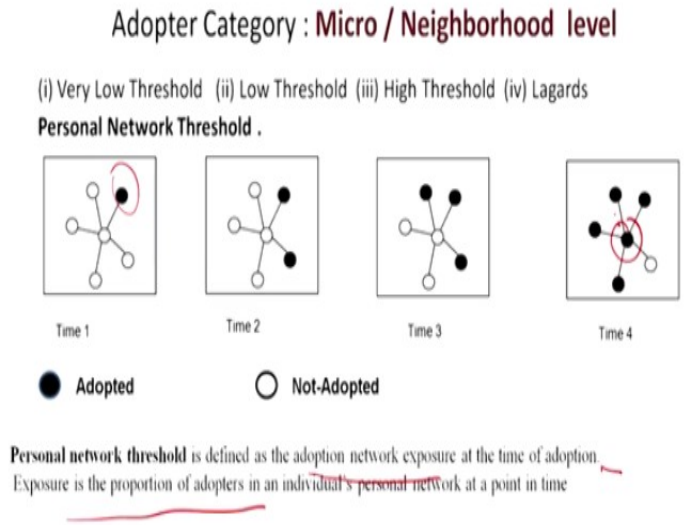

And with the micro level or the neighbourhood level, as I told you that there is a very low threshold, low threshold, high threshold and the laggards, so you have the personal network threshold which is defined as an adoption network exposure at the time of adoption, exposure

is a proportion of adopters in an individual's person network at a point of time. So, if you look at it now in all this time phases here it is only one person have 1; and then 2, then 3.

But then finally, it has influenced one (4), so it is the exposure in the proportion of adopters in an individual persons network at a point of time so, the time aspect plays an important role, how it is dynamic and how it is influencing parameters.

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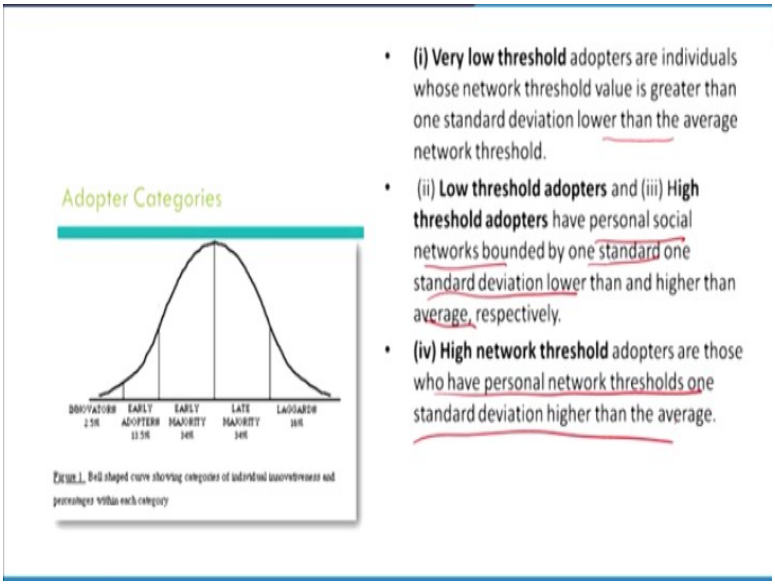

And I have already discussed about this very low threshold, again the adopters or the individual whose network threshold value is greater than one standard deviation lower than the average that network threshold and similarly, the low threshold adopters and the high threshold adopters have a personal social networks bounded by one standard deviation lower than the higher average.

Then in the high network threshold adopters where, whose personal network threshold one standard deviation higher than the average.

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Table - 1 : Tank adopters distribution at Macro (Regional level) and Micro (Direct personal network level) levels.

		Micro (Neighbourhood) Networks				
		Very Low Threshold	Low Threshold	High Threshold	Very Threshold	MACRO Total
Macro (Regional) Networks	Early Adopters	7.4 %	7.4	4.1	2.7	21.6
	Early Majority Adopters	3.4	4.1	6.1	8.8	22.3
	Late Majority Adopters	6.1	12.8	3.4	18.2	40.5
	Lagards	2.7	.7	1.4	10.8	15.5
	MICRO TOTAL	19.6	25.0	14.9	40.5	100 %

So, this is the matrix they developed in and then, the tank adopters distribution at macro or the and the micro level, if you look at it the early adopters was at 7.4% you know and how it is changing and from 7.4 and then it goes on to 4.1 and then this is how it is going in a kind of, it is changing further you know, so that is where they looked at this kind of graph and also what are the major, they also looked at what are the major influencing aspects.

You know, what are the aspects that influence their decision making process now, again here if you look at it the early adopter from 7.4%, it goes to the 2.7, so the early adopters so it gradually reduces and whereas, the early majority it goes on an increasing component.

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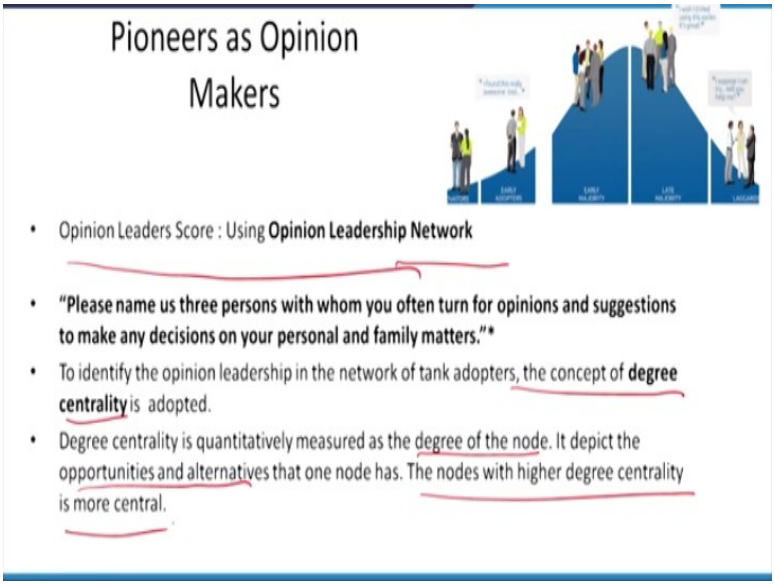

So, who are these because these pioneers how the act as opinion makers? Because that is where because their opinion is a higher value because they are the one who used it in the first

and forehand, opinion leader score; so they have used the kind of opinion leadership network so, please name us 3 persons with whom you often turn for opinions and suggestions to make any decisions on your personal and family matters?

So, whom are you more relied of it you know, who are these, so that is how, how they are connected with it. And this is where they adopted the concept of degree centrality and this is a quantitative measure technique where the degree as a degree of a node and it depict the opportunities and alternatives that one node has, as we discussed in before also how each node has have a multiple connections.

The nodes with higher degree centrality is more central so, because the more connections it have and that is where it becomes more central.

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Table - 2 : Opinion Leadership Score (In-Degree)

		Micro (Neighbourhood) Networks				
		Very Low Threshold	Low Threshold	High Threshold	Very Threshold	MACRO Total
Macro (Regional) Networks	Early Adopters	6.09	2.90	2.83	4.50	4.18
	Early Majority Adopters	16.80	2.33	2.11	1.46	4.12
	Late Majority Adopters	5.88	1.21	1.40	.88	1.78
	Lagards	2.75	00	1.50	.31	.82
	MICRO TOTAL	7.41	1.86	2.09	1.10	2.67

So, someone let us say in a community; a community leader has used that then, he is the one where the community is relying upon his understanding or his decision, so that is where that is more central that becomes more central. And this is again, we made this similar matrix to understand the opinion leadership score with the degree centrality and with both as a macro level and the micro level so, these are some of the analysis.

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Who Are Pioneers ?

So, now you can see that you know from 6, the early majority about 16.8 and then later it came down; and who are these pioneers?

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Socio-Economic Characteristics of Pioneers

Measure	
Education	1 point is counted for each academic class. A person educated up to Class – I receives point 1 and persons completed master's degree receives point 15. For the illiterate, the score is zero.
Income	Household Monthly Income . (Continious variable)

And what are the various channels, how this is disseminated? Education; now each point is counted for each academic class and a person educated up to a class 1 receives 0.1 and persons completed master's degree is 0.50 so, for the illiterate this score is 0, so like that income; household monthly income.

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Table - 3. A : Socio-Economic Characterstics of Adopters - INCOME

		Micro (Neighbourhood) Networks				
		Very Low Threshold	Low Threshold	High Threshold	Very Threshold	MACRO Total
Macro (Regional) Networks	Early Adopters	**14818**	15000	11166	18250	**14625**
	Early Majority Adopters	22800	**20333**	19666	20153	**20454**
	Late Majority Adopters	21222	12526	**23000**	17888	**17116**
	Lagards	19500	10000	18000	**27062**	**24217**
	MICRO TOTAL	**18827**	**14459**	**17954**	**20850**	**18425**

And again, here the socio-economic characteristics of the adopters, how income has played an important role, whether it has played an important role because someone has to look at the affordability aspect of it and again, if you look at it here in the late adopters, it is again at a micro level, it is going, the income has also shown a positive aspect.

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Table - 3. B: Socio-Economic Characterstics of Adopters - EDUCATION

		Micro (Neighbourhood) Networks				
		Very Low Threshold	Low Threshold	High Threshold	Very Threshold	MACRO Total
Macro (Regional) Networks	Early Adopters	**11.54**	10.09	10.33	8.50	**10.43**
	Early Majority Adopters	14.80	**14**	11.55	12.69	**12.93**
	Late Majority Adopters	12.44	12.16	**14.20**	12.29	**12.43**
	Lagards	13.50	8.00	12.50	**11.06**	**11.47**
	MICRO TOTAL	**12.65**	**11.72**	**11.90**	**11.80**	**11.96**

And again, education; how it plays and it influences the individual decision making process and if you look at it in all the cases you know like we have the early adopter stage, the lowest threshold is about 11.54 and the laggards is about 13.5.

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External Influence

- Media Consumtion
- Cosmopolitaness

And external influence; they talk about the media consumption and cosmopolitaness.

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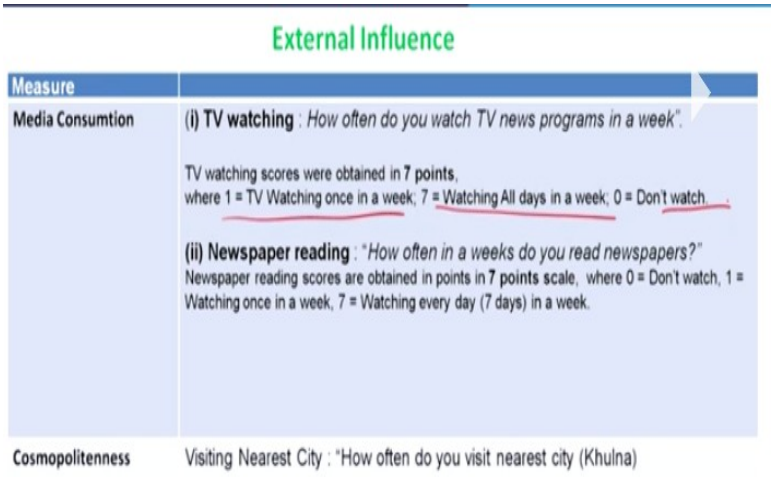

Like in TV is one channel how people know about this innovative aspect but here in this study TV has score, they have also assigned some points, how often do you watch TV news programs in a week, so where 1 point is referred to TV watching once in a week, 7 in a week, 0 is do not watch, but then in this finding, they have found that the newspaper reading has given you know the more diffusive process rather than the TV watching.

And cosmopolitaness is how visiting the nearest city, how you learn from the nearest cities.

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Media Consumtion

- TV Watching
- Newspaper Reading

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Table - 4 . B : External Influence : Media Consumtion (Newspaper Reading)

		Micro (Neighbourhood) Networks				
		Very Low Threshold	Low Threshold	High Threshold	Very Threshold	MACRO Total
Macro (Regional) Networks	Early Adopters	**5.90**	2.82	2.00	4.25	3.90
	Early Majority Adopters	5.40	**4.17**	4.11	2.46	3.67
	Late Majority Adopters	4.44	4.89	**4.60**	4.00	4.40
	Lagards	5.75	3.00	5.50	**3.75**	4.21
MICRO TOTAL		**5.34**	4.10	3.77	3.61	**4.10**

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And because media consumption, TV watching is also an important aspect but then here the newspaper reading have shown much more positive ways of communication.

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Table - 4 . B : External Influence : Visiting Nearest City

		Micro (Neighbourhood) Networks				
		Very Low Threshold	Low Threshold	High Threshold	Very Threshold	MACRO Total
Macro (Regional) Networks	Early Adopters	5.09	5.27	5.17	4.25	5.06
	Early Majority Adopters	3.80	1.83	2.66	2.15	2.48
	Late Majority Adopters	3.22	1.26	1.80	1.51	1.71
	Lagards	2.50	1.00	1.00	1.50	1.60
	MICRO TOTAL	3.93	2.54	3.00	1.83	2.59

So, like that the same matrix has been tested in different aspects.

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Risk Perecption

Measure	
Risk perception is measured based on adopters' perceptions on three aspects of drinking water.	"How do you rate your previous drinking water condition (before the rainwater tank) on following aspects – **(i) Drinking water quality of our family.** **5** = Extremely poor ..... 3 = So-so ..... 1 = Good. **(ii) Causing health issues/problems of our family members.** **5** = Life threatening .....3 =Caused some waterborne related health issues .....1 = Caused no health issue. **(iii) Daily Fetching burden** **5** = Extremely burdensome. .....3 = Little / sometimes problematic. ..... 1 = No problem at all.

And here this is where the risk perception you know that is measured based on adopters perceptions on 3 aspects of drinking water and because we are talking about how this particular tank having this tank how it has improved or not and the drinking water quality of your family, so they talked about from good to poor, causing health issues problems of our family members, so that is again you know regarding the health.

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Table - 5 : Drinking Water Risk Perception

		Micro (Neighbourhood) Networks				
		Very Low Threshold	Low Threshold	High Threshold	Very Threshold	MACRO Total
Macro (Regional) Networks	Early Adopters	**4.57**	4.78	4.66	4.58	**4.67**
	Early Majority Adopters	4.40	**4.67**	4.41	4.61	**4.53**
	Late Majority Adopters	4.74	4.50	**4.53**	4.67	**4.62**
	Lagards	4.75	4.33	4.50	**4.70**	**4.68**
	MICRO TOTAL	**4.62**	**4.61**	**4.51**	**4.66**	**4.62**

And the daily fetching burden to what extent they have to carry on this whole process, and then again they mapped everything in this kind of matrix, the perception; the risk perception has been also have been mapped so, in that way what happened was this whole innovators as we talked about the very initial uses of that particular innovation, there one of the important pioneers and they are matters a lot that how this whole their understanding of the product.

And how it has to be taken care of to disseminate to a wider communities and to a larger network starting from a very micro level network and to a macro level network and this is one of the method which they have adopted but there are different ways one can actually look at the centrality, the degree of you know and also the putting setting up the thresholds of it, the various methods of how this particular pioneers play an important role in the diffusion of the innovative practices.

Thank you very much.