Sociology of Science
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Lecture - 17
Scientist as an Indexical Reasoner- Part II

Dear students, we are discussing Karin Knorr Centina's book on indexical reasoning and how scientists are indexical reasoners and this is in reference to the actual scientific research sites, where the scientist work on everyday basis. The local conditions, the lab conditions, the lab situation, the availability or unavailability of certain research material, availability or lack of availability of funds can determine the laboratory selections, can determine the choice of scientific problems ,can have a strong impact on, the final results that is produced the final papers that is published.

We started by talking about the fact that, scientist are opportunists and she says it is not a individual characteristics of any particular scientist, it is the seminal feature of scientific research process altogether, scientist whenever they get an opportunity when they whenever they see an advantage, they grab it to their advantage with.

So, that it can help them in their research, if certain materials are not available they will immediately look for a substitute, it may not be there in the textbook, you may not be you may not find such kind of discussion in any scientific textbook, that this is how you do it, this is your backup or this is your alternative plan. But scientists based on their everyday experience, they constantly negotiate with the situations, they constantly manipulate the situations, they constantly work and rework on the situations.

So, that it becomes favorable to them I have already discussed the facilities local resources and facilities, how it is leveraged by scientist I give example of a particular state of art laboratory of significant, of significant importance to the scientist who wanted to make use of the laboratory, hence they invented resource problems. So, that they can make use of laboratory, I give an example of electron microscope, a newly purchased one which would give correct reading and the which has the latest technology, it attracted the attention of the scientists who are working in that research institute.

I also give an example of how research situation research equipment's are sometimes manipulated or within quote unquote misused, for instance presser meter was easy used to study the gaps gas absorption capacity, or chemicals which were not available for a particular research, had to be substituted with whatever chemical that was available in that laboratory, which could be used in that particular experiment, sometimes also circumstantial factors play a very important role in, choice of scientific problems.

When scientists say that they ran into an idea, when scientists say this stumble upon an idea or I an idea, occurred to them all this implies the temporal and local dimension of scientific research, that is for instance the scientist is working in a particular scientific research institute, where certain instruments or apparatus have been purchased, for certain other purpose.

When you look at the apparatus, it may trigger a thought in your mind why not think of a problem, which will revolve around this particular apparatus or instrument it is quite possible that, you are interacting with your colleagues with your co scientists and during the conversation an idea hits upon you, you decides to take it up for further research. So, such circumstantial factors can also play a very important role, in the choice of scientific problem and also when you are discussing with your co scientist, you get to know that a particular method can also be done in a different way.

So, you include that, in your research strategy and you come up with a new finding and you publish that. So, this new published finding based on the different strategy, alternative strategy that you employed while research, can actually be attributed to that research interaction you had, that general interaction casual interaction you had, with some group of scientists in some other context, right?

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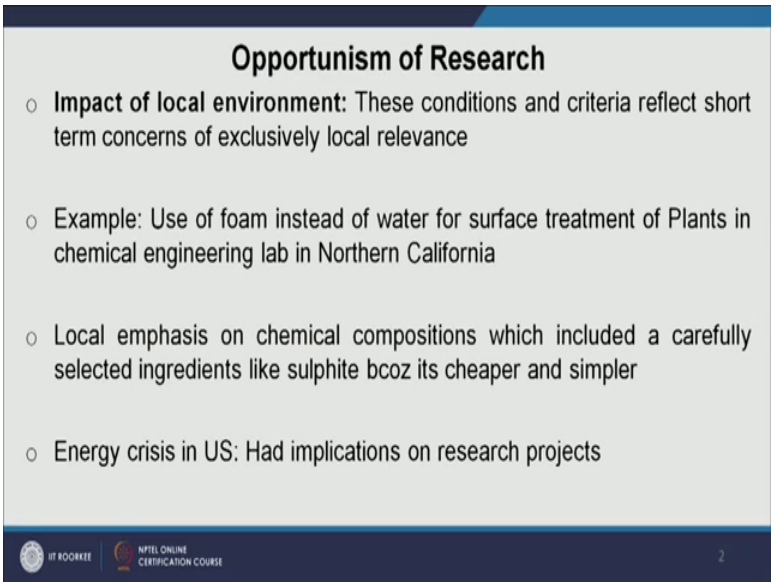

Now, I will continue the discussion further and we will talk about the impact of local environment, having a strong bearing on research the conditions and criteria reflect certain concerns of exclusively local relevance. The local environment and the conditions of the local environment; can have short term concerns of exclusively local relevance for example, when the research was undertaken by the author, who has written this book Karin Knorr Cetina in different biochemical laboratories in California.

There was the energy crisis in California, there was a severe water shortage, such local environmental factors, such as water shortage had a bearing on the particular researches that were being undertaken which made use of lots of water. So, the scientist many of the scientists in their experiments, in that time period in that geographical area, they were using foam instead of water, for surface treatment of plants in chemical engineering lab in northern California.

So, in this northern Californian, chemical engineering labs instead of water, they were using foam, why were they using foam? Because there was water crisis severe water shortage in that area. Now, this kind of look change in the research strategy, can lead to different finding altogether. So, the scientist may get a credit for coming up with a new finding for the actual reason maybe the local water crisis, which forced him to use foam instead of water. The local emphasis on for instance, on chemical compositions which

included carefully selected ingredients like sulphite, because it is cheaper and it is simpler.

She also gives example of another lab, where sulphite was used in laboratory experiments because, it was cheaper it is easily available it is easy to procure sulphite and the very uses of sulphite may makes the those particular experiments, that they were doing much more simpler then no complex takes steps arrived involved in such a process.

So, here things that are easily available, which is cheaper can also be used in place of the original ingredients. So, there is such local emphasis on certain material, because at lab let us say those research institute, has certain fund it cannot go beyond that. So, you have to undertake complete your research, within that stipulated time frame, within that your marked budget. So, maybe you will be forced to buy things which are simpler, chemicals which are some which are cheaper and easier to procure.

So, that is another example of impact of local resources, local environment on scientist research process of the scientists. So, there can be another example we can give here, is the energy crisis in the us during the time of Karin Knorr Cetinas research, during which had implications on the very research projects, that were being undertaken for instance. Ferric chloride was used in heat coagulation method of protein recovery apparently to save energy, to save energy ferric chloride was used, in protein recovery and the method that was used was heat coagulation.

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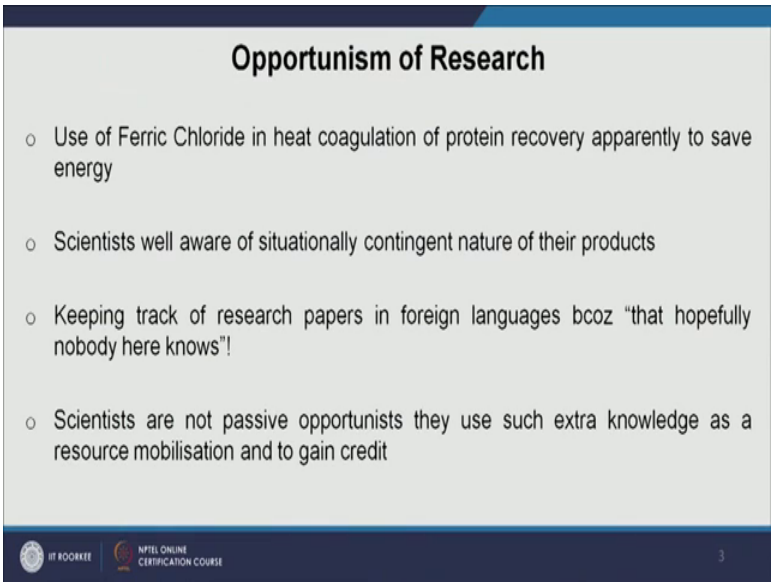

So, in order to address this problem of energy crisis the scientist that is had to make use of certain chemical compositions. Now, scientists are very much aware of such situational contingencies or the situations, that they have to depend upon in their local conditions, in their local labs, in laboratory conditions and they constantly negotiate manipulate with the situation, to their own favor. Now, sometimes the scientists say that they are keeping track of foreign languages, publications in foreign languages journals in foreign languages, because nobody here knows about it probably.

See they know, that if they can find something new in a article written in a foreign language, published in a foreign country, they can always take that to their own advantage, they can always convert it into an advantage of their own, because they think that they would do something new and they will get credit for that, they will get published (Refer time: 12:00) and here nobody would know that, it has been inspired by your influenced by or stolen from a foreign journal.

So, scientists are not passive opportunists, they use such extra knowledge as a resource mobilization. So, why are they doing this? Why are they interested in knowing things? Which are outside the country in a foreign country? Because they know that if they can make use of something new, which has been published in a foreign journal that, will give advantage to their own research, it will help them in mobilizing their resources. They

will know about a new methodology, they will know about a new way of doing research and in the process, they will gain credit sometimes scientists also mentioned that it is.

So, difficult to get articles written by others, you put a request in the library, but the lib your local library would find it difficult to procure it, you send a request through email or through a post to those authors who have written these articles, but you do not get a reply, you do not get a reprint from them, what do you do? You have to continue a research, you have to have some information, you need to have some additional knowledge, but even if you try it library, even if you tried talking to the authors writing to the authors directly, you are still not getting any response.

What do you do you mobilize your resources, you make use of your contacts and those contacts and get you those articles, because if you know a professor who knows that particular professor, who has written that article through them probably, you will be able to procure the book or the article. So, such kind of resource mobilization is nothing new to the scientist, they have been doing it for their own advantage, to complete their research projects. Now, will come to another heading of the subject, that is local idiosyncrasies that is local peculiarities how the local peculiarities local oddities, have a bearing on scientific research.

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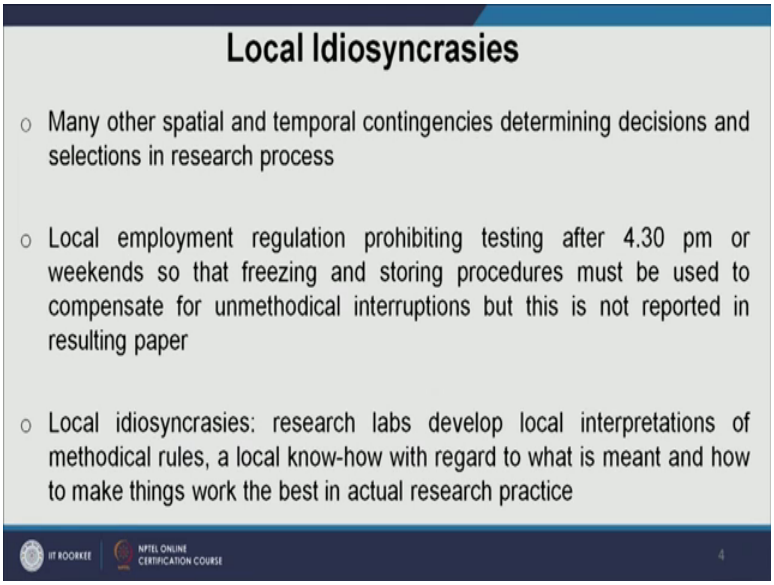

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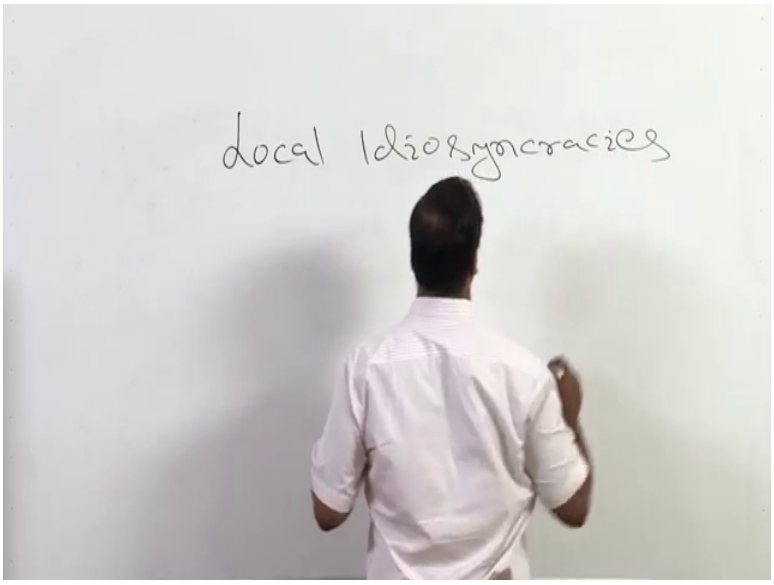

What are idiosyncrasies certain peculiarities? Uniqueness which sets you apart from others, these peculiarities or uniqueness or idiosyncrasies are attached to the local laboratories or local towns or local situations. I shall give you some examples so, that you can understand it better. For instance if there is in a particular town, there is a local employment regulation, which prohibits any experiment, any testing after 4.30 or it prohibits any experiment or testing in the weekends, then what do you do? You have an ongoing research, there is a chemical reaction which is ongoing and it is already 4.30, you have to stop it, you have to interrupt it, because that is what the local employment regulation dictates, but you cannot do that.

So, what do you do? You have to you cannot leave the chemical reaction as it is, you have to freeze it you have to store it so, that when you come back next day or you come back and the on Monday; if it happens to be a weekend. Then you can resume from there itself. Now, such freezing and storing may not get reported in the final paper, but that can have a bearing on your ultimately on your research and your findings and your result.

So, the newness the novelty that you may, report in your research can be due to such un methodical interruptions, because of local idiosyncrasies that for example, that the (Refer time: 17:00) local employment regulation prohibits, any testing after 4.30 or there is a rule in any particular institute, that there cannot be any work in the weekend.

So, the scientists have to take into account, have to factor in such methodical interruptions and that can have a bearing on your final research output. The newness that

you report and the credit that you get, can also be given can be attributed to the local idiosyncrasies, there can be another example of local idiosyncrasies. Karina Cetina reports that, in a particular town when a scientist arrived at a particular research laboratory, he found that the tests are done, but retests are not done.

The report the finding the readings just after taking one test, now for that scientist it was unusual that they are not retesting it, because if you do not retest he felt that without retest, precision is impossible and precision is impossible without replication, without retesting. So, he insisted upon replication of the same test. So, that he can be doubly sure about the final readings, but that was not how it was done, in those labs in that particular town testing was done just once and the readings were reported.

So, this is an example of the clash of locally developed interpretation of scientific rules, of methodical rules a local know how with regard to? What is meant and how to make things work. It can differ from one town to another town, from one lab to another lab and the for that particular person, without replication there is no precision, but for that lab where this test was tests were done once, it was considered that standard analysis of chemical compositions, without replication carried no risk or uncertainty.

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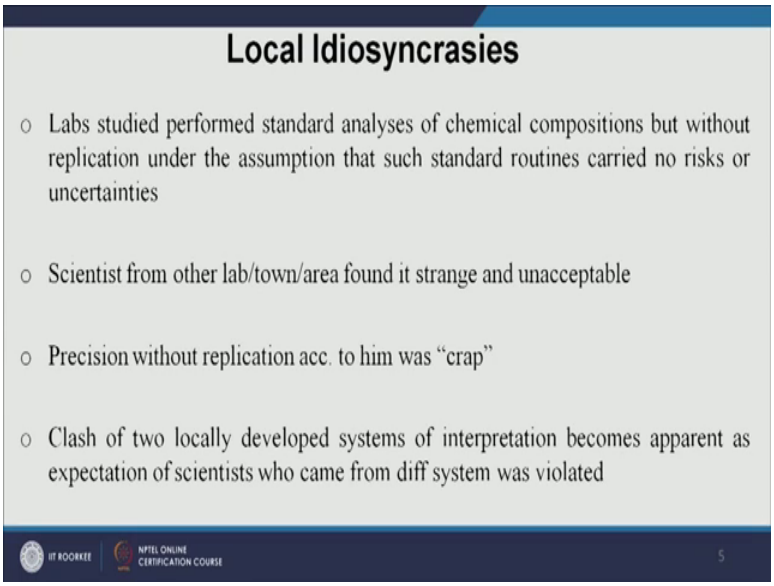

So, you test once that is fine, the reading is reported and it carries no uncertainty or risk. So, here we can have a clash, because of locally developed rules regarding scientific procedure, again I told we can tell here that these are not reported in scientific textbooks.

How to go about research, many about many aspects of research will not find any universally accepted interpretations, what you have is locally interpretation local interpretation of rules and that, can vary from one person to another person, from one lab to another lab, from one town to another town and that can have a bearing on the research, that is undertaken then there can be regarding local idiosyncrasies.

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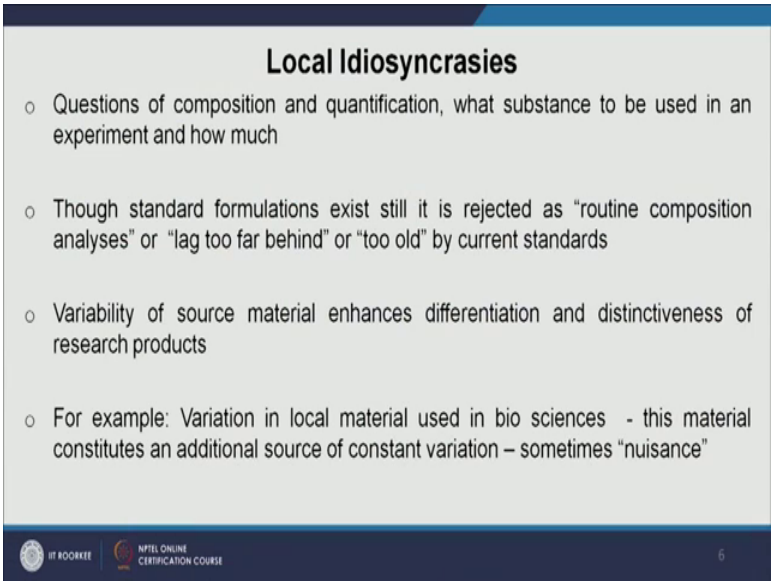

So, gives examples of question of composition and quantification regarding what subs substance, to be used in an experiment and how much? Those she says standard formulations exist, in most of this scientific laboratories, research laboratories in many places the standard practices. So, you have manual of how to go about research, in most of the labs, but many of the labs she found they rejected these manuals, as these are routine stuff, we do not do it this way or this lag too far behind that, whatever you are doing.

Now, is completely new and latest way of going about our research, what this manual says is old, archaic it is by our own standard, hence there is a different interpretation of this manuals, of this standard rules which is found in many of the research laboratories, based on our ethnographic work carrying out certina said that she found different interpretation of this standard manuals, in many of the labs on the ground that, on the pretext that the lag too far behind that, too old to archaic they just routine we do not do it this way.

So, these are these are other examples of the local interpretation of standard rules, how it can affect the scientific research output? Now, there is another example that she gives is that, of variability of source material which enhances, differentiation and distinctiveness of research product. What variability we are talking about? And what source material?. Let us say the plant organism, if there are some research on plant protein, then for those research unit plants and mostly the laboratories make use of the local plants; which grow in particular soil, in particular climate can this can have lot of variation, from place to place.

If such local plants are used, for protein research regarding a plant protein research, then we can always expect different results, distinctive results and that can be a source of credit for many of the scientists, because of the very fact that they were using different kind of plants for the protein research.

So, this variation in the result and the papers that is published the variation and the findings. It constitutes an additional source of variation constant variation; additional source of advantage it can be an advantage for some, because they can report something new and get published and get credit, it can be a nuisance. The very fact that the when you are doing protein research and plants, you have to use local plants which vary in terms of their in terms of their characteristics, it can be a matter of nuisance it can be a interrupting process and the research. So, the two ways in which it works.

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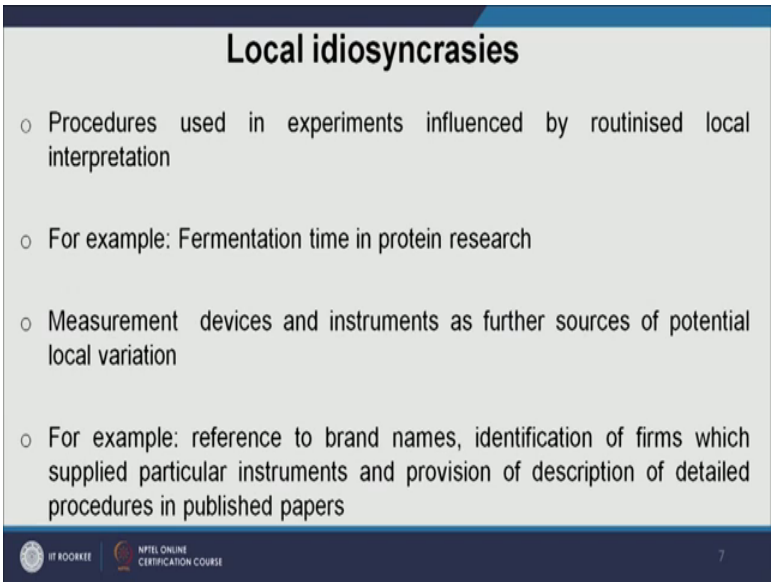

Now, the procedures also used in experiments, are also influenced by routinized local interpretation, for instance the she gives example of fermentation time, in protein research while manipulating the solution before it goes inside the fermentation cabinet, the time required to manipulate the solution before it goes inside the fermentation cabinets.

It is considered as the fermentation time in some labs, that is it is officially included in that experiment; the fermentation time is the time that is needed to manipulate the mixture, before it goes into the fermentation cabinet. In some labs, this is considered as fermentation time. So, it is part of the process part of the official steps undertaken further research, in some other labs it figures separately.

So, such different procedure used in different, labs regarding the same experiment can be attributed to local idiosyncrasies. Sometimes we can we see papers, where the brand of the equipment is also mentioned or the form which has supplied the equipment is mentioned, this some journals asked for such details, give us a brand name of the equipment, give us this supplier or the form.

We supplied this equipment's, because how a particular instrument or apparatus is designed and manufactured the same apparatus, which is being supplied by different companies or different forms, can yield different result, different reading different measurements. Hence that can also be an additional source of variation, as well as can be a source of nuisance.

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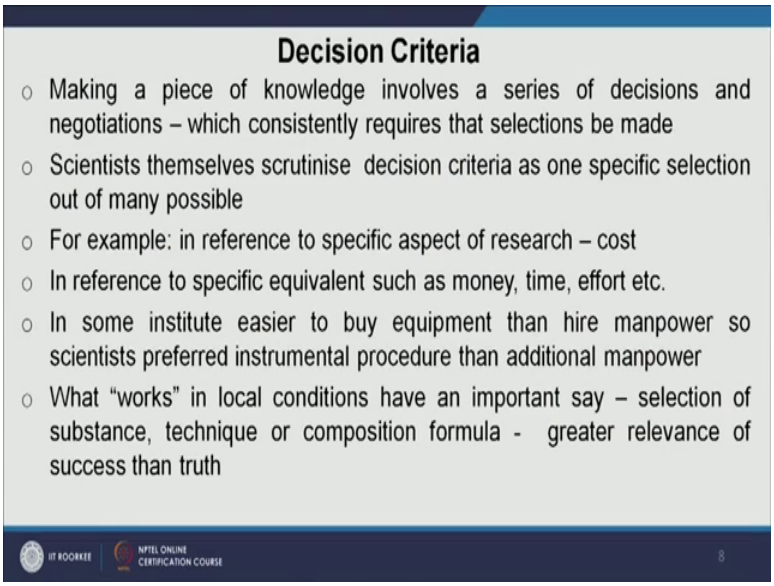

Then we come to the decision criteria Karin Knorr Cetina explains that, just as scientists our opportunists are just as the local idiosyncrasies or local peculiarities are differences in local rules, have a bearing on research. Similarly, the decisions that scientists take also has a decisive impact upon the research, that they undertake most of the decisions that they take.

Pertain to the money, pertain to the cost of the instruments, pertains to the funding of the research; it pertains to hiring additional manpower or going for more equipment's, for in the within in the research. So, all these things are based on certain decisions, when you make a decision you basically make a selection, we are basically making a choice, we are choosing one out of many other options.

So, choosing one out of many other options, has a strong bearing on the final research output she says, making a piece of knowledge involves a series of decisions and negotiations, which consistently require that selections be made, sometimes the selections are made, regarding money the kind of depending upon the funding you go ahead with the project depending upon the fact, whether you are it is easier to buy equipment.

Then hired manpower you go ahead with a research, which will make use of equipment's rather than additional manpower, because you know that it is difficult to procure manpower more research associates in this institute, because of the bureaucracy or

administration administrative procedure that is involved, hence you undertake the research which relies upon instruments. What works in local conditions, whether it is the selection of substance or technique or composition formula, has greater relevance in terms of scientist, success than truth.

What it implies that, what is important? What works that is more important for the scientist rather than that, absolute truth that they are seeking. What is important for them is, success in the research project rather than the absolute truth and to attain success, they make lot of decisions they make a lot of selections regarding money regarding funding.

Let us give a very short example from IITs, in IITs the PhD program is of 4 years, you have to have 1 year of coursework, comprehensive examination, oral examination, research proposal presentation then, you have to formulate your problem research problem do literature survey, then you go for the field, then you come back in social science particularly, then you come back.

Write your research it gets revised, modify, it corrected, then you make a research proposal, a final proposal presentation and you submit. Overall, what we have seen over the years is that, you do not get more than 6 months for fieldwork in social science. If you are a social science PhD student at IIT, a part of humanities and social science department, you do not get technical you do not get more than 6 months. But, we know in social anthropology the ethnographic work, ethnography fieldwork can be more than 3 years 4 years can be more than one year. So, what do you do you have to squeeze your research, you field research into 6 months, because you have to complete everything within 4 years or 5 years.

So, you have to make a selection, you have to make a decision, that has a bearing on the kind of research, you have to instead of 1000 persons you may have to interview just 200 or 300 persons, because that is a compulsion of your research. Now, we come to the final part that is the variable rules and power scientists are human beings and when group of scientists are working in any institute, there will always be interpersonal relationship, the element of power negotiation that will come into play.

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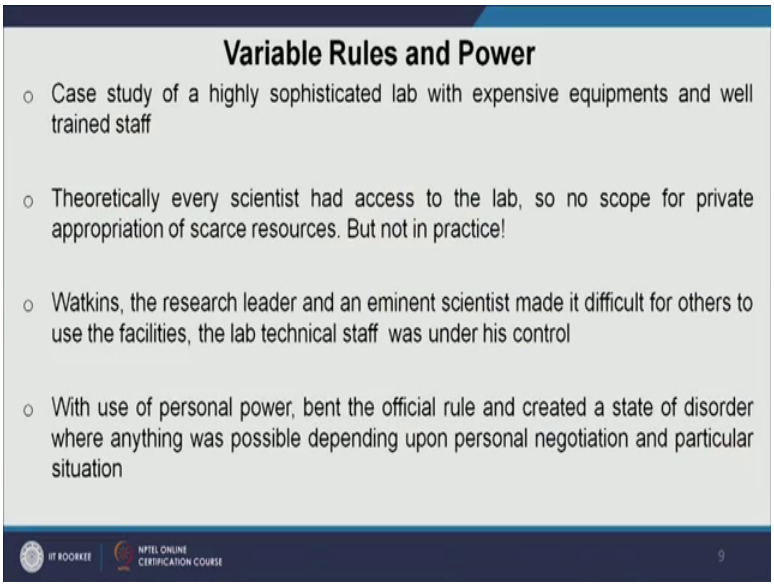

See that is Karina Cetina quotes echoes a case study here, where she says that 2 scientists 1 person, who is in charge of a laboratory a powerful person and a junior scientist, who wanted to work in that particular lab, which has been within quoted quote owned by that scientist. They had to undergo series of negotiations and bargaining the junior scientists had also had to manipulate, circumstances to suit his research initially the senior scientist agreed, because it is something new and in the process. He and his lab mates his colleagues, would get to know about the new method, but the condition you can always work in my lab, but I will be the co-author fine accepted.

Second time, when the person junior scientist wanted to retest some of his methodology, he did not want the involvement of the senior scientist wanted to do it on his own. He was not allowed on the pretext, that the lab will be used for this time period by some other people. In the third set of negotiation and manipulation the scientist, said that she just this the paper which I am about to publish, based on our first collaboration I just wanted to do some additional experiment.

He was allowed, but the lab assistant who was very close to the senior scientist, he was in put in charge of the entire experiment, because the senior scientist was not there and this very experienced lab hand he could detect that, he is trying to do something new. So, he it was immediately reported to the senior scientist, hence the experiment had to be stopped immediately and the final round and the 4th round of negotiation, by then the

paper was published based on their first collaboration and the scientist the senior scientist, allowed the junior to do some research.

So, that he will get to know about the novelty, the newness the importance of these procedures which has been indicated in the paper. So, he allowed him. So, all this while the rules are standard rules is universal that, anybody can have say have access to lab. But this is the power dimension, which comes into play where a senior person, who has more power is controlling and manipulating the situation to his advantage, hence the junior scientist also has to constantly bargain and negotiate manipulate the situation. So, that he can go ahead with his own research. So, the lab and the experiment are constant.

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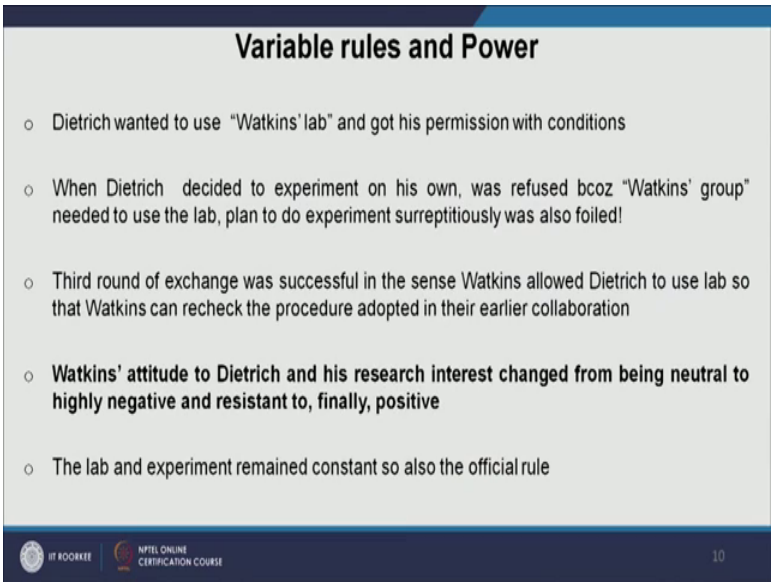

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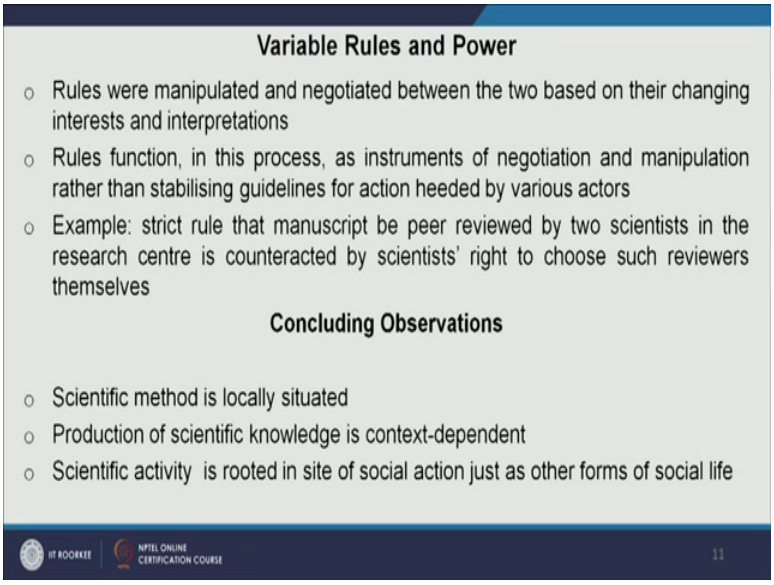

What is varying? Is this process of negotiation, manipulation, bargaining because of different individuals and their behavior pattern that is involved and the process of scientific research?

So, scientific research also has to take into account, such local conditions which include variation in human behavior. So, as we have been discussing till now the, scientific research is dependent on local situations, local conditions local environment has a strong bearing on choice of scientific problem to the processes involved, to the methodology involved, the use of certain instruments to the final research output.

So, we can conclude by saying that, production of scientific knowledge is, dependent upon particular scientific context particular social context scientific method is locally situated.

Thank you.