

Natural Resource Management (NRM)
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Information Communication Technologies (ICT) for NRM: Introduction

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Massive Open Online Course (MOOC)
on
Natural Resources Management (NRM)

**Climate Change, Vulnerability,
Adaptation in NRM: Part-02**

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**Information Communication Technologies (ICT)
for Natural Resource management: Introduction**

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So today we will discuss about topic which is actually very relevant and also very important for Natural Resource Management and especially for communications and decision-making processes. And this is on Information Communication Technologies, in brief, we call it as ICT for natural resource management.

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Introduction

- Information and Communications Technology (ICT) is the convergence of digital and physical resources used to gather, store, process, retrieve, generate and transmit information.
- The term is generally accepted to mean all devices, networking components, applications and systems that combined allow people and organizations (i.e., businesses, nonprofit agencies, governments and criminal enterprises) to interact in the digital world.
- ICT encompasses both the internet-enabled sphere as well as the mobile one powered by wireless networks. It also includes antiquated technologies, such as landline telephones, radio and television broadcast -- all of which are still widely used today alongside cutting-edge ICT pieces such as artificial intelligence and robotics.
- ICT is sometimes used synonymously with IT (for information technology); however, ICT is generally used to represent a broader, more comprehensive list of all components related to computer and digital technologies than IT.
- ICTs can reconfigure electronic and physical access to four inter-related resources: *information, people, services, and technology*

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So let us have some very fundamental basic idea about ICT. Many of you may be already aware of what information and communication technology could do in our life, in our profession. So today we will be discussing that how ICT can be actually utilized for efficient management of natural resources.

ICT is the convergence of digital and physical resources and this is this convergence allow us to collect information, store, process, retrieve information, generate and finally transmit it which is very important. So today, without the help of ICT, it is almost impossible to do carry out some smart exercise in the field of natural resource management.

The term ICT is generally you know, accepted to express that some devices, some networking components, application of systems which provide opportunity for the people or organizations to interact with larger audience to convey their decision or message or even sometime advertise it to the larger world. So importance of ICT in the field of natural resources is incredible.

ICT, it encompasses both internet-enabled sphere as well as the mobile one which is actually powered by wireless networks. ICT can also use landline telephones, radios, televisions, walkie talkie. These all basically today, you can combine along with other cutting-edge technology available in the field of ICT, like artificial intelligence, robotics.

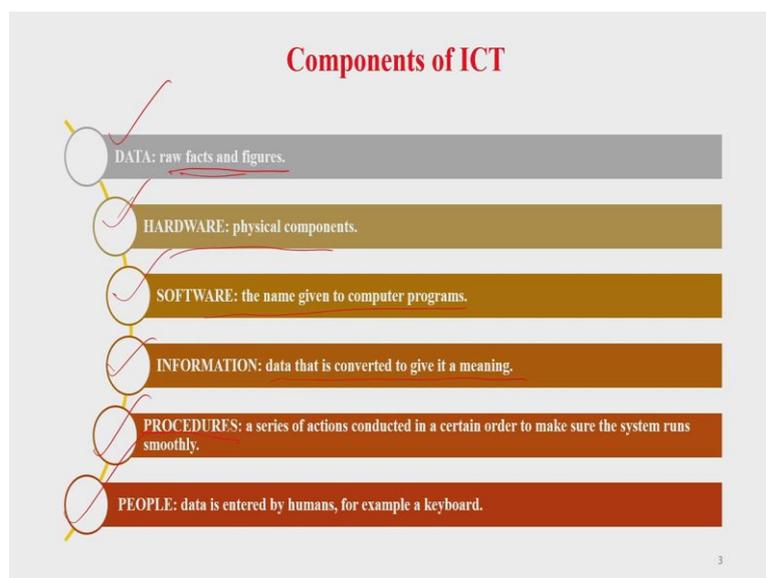
So you can actually combine. Remember, even though the advanced technologies of ICT is here today but still in certain condition, certain places our world technologies like radio, television, wireless in a walkie talkie, these are still actually quite useful.

So when we invite, welcome the new technologies for ICT revolution, we should not also forget the old ones which have served us in earlier times, and still they are very much valid in certain situation.

ICT also at sometimes, we use synonymously with IT, Information Technology; but there is a very thin line difference between these two. ICT is generally used to represent a broader and more comprehensive list of all components related to computer, digital technology, communications, radio but whereas in case of IT, Information Technology we largely mean computer and digital technologies.

ICT can you know reconfigured electronic and physical access to four interrelated resources. And which are those? Information, people, services, and technology. These four interrelated resources can be actually utilized in a very nice manner through ICT.

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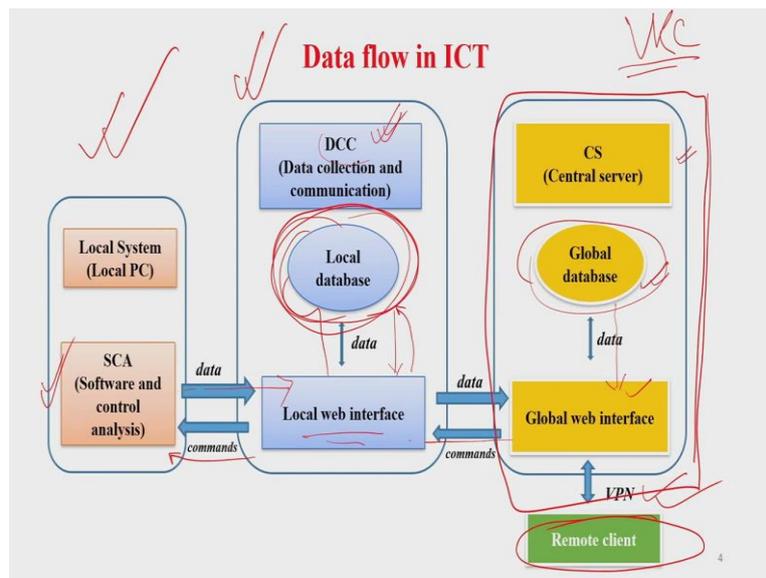


Now let us see that what the components of ICT are. ICT is basically built of data, which means raw facts and figures. Then hardware where do you actually mean the physical components- the machines, the computers, telephones. Software part- information means the data which is converted into some meaningful information.

Procedure is a series of functions which you conduct in a certain order to ensure that the system runs smoothly. People, the most important part. So data which is actually coming into the system is entered by human.

So if at the stage of data entering itself, there is some problem, the entire exercise may be a failure. So that is why human in ICT is a critical component.

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Let us see that how the ICT as a system it works and what is the data flow mechanism in ICT. Remember participants, I am discussing these basic things of ICT because here among you, some may not be aware of that background of ICT. So once you understand the basic principles and working flow of ICT, then it will be easy to understand the application of ICT in NRM.

As this particular you know figure, it shows that how data flows in ICT from one system to the other.

Local databases- Suppose you are working in a village and your the hub is a village Knowledge Center, call it VKC. Now the data actually come to this local database from local web interface and also from local database it can go to local web interface.

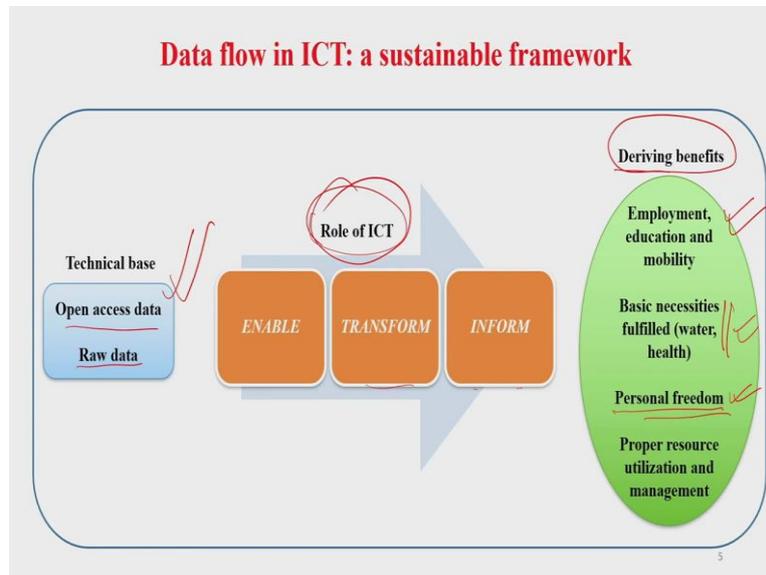
You collect data also through various you know communication system. You can collect field data, all those things actually remain in this local database and then it is passed to the local web interface from where this data can go to global web interface, to global database then central server. The other way from global database also, the data may come to global web interface and can go to our local interface and in turn to our local database.

This right-hand side part is basically outside the your local system and this walkthrough you know some remote client like VPN. On the left-hand side, you have local PC, local system, suppose you are sitting in a Village Knowledge Center in a village.

So from your local web interface that information will go to the software control system software and then from software control system, this information after which is processed it

will come back to the local web interface and go into the local database. So this is how the data flows within a standard ICT system.

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Now look at the sustainable framework of ICT data flow system, how it actually works. So you have open access data or raw data collected from the field and here you have the you know, different system installed in the local hub, that is your Village Knowledge Center.

So this ICT system, it enables, transform and inform about this data to the user group, to the policymakers, all the stakeholders. So how ICT basically helps different stakeholders? It helps by deriving various you know providing various benefits like it provides information on employment, education, mobility, basic necessities like water, health.

It also talks about information on personal freedom, like if you want to have some kind of own platform information, like blogs, etc that you want to make, you can do that. Proper resource utilization and management. So there are various you know, kind of benefits that you can derive from ICT.

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ICT and Environment

ICT has both positive and negative impacts on the environment

Positive impacts can come from:

- Dematerialization and online delivery;
- A reduction in the need for travel;
- A host of modeling, monitoring and management applications; and
- Greater energy efficiency in production and use, and recycling.

Negative impacts can come from:

- The production and distribution of ICT equipment;
- Energy consumption in use (directly and for cooling);
- Short product life-cycles and e-waste; and
- Potentially exploitative applications.

Handwritten notes:

- HR - Transport -> Energy
- Pollution Traffic AMAZON
- Toxic metals E-wastes

Now how ICT and environment are linked with each other? Now remember, ICT has both positive and negative impacts on the environment. Now what are the positive impacts? Dematerialization and online delivery- means in this case you can avoid a lot of transportation cost, pollutions, etc.

A reduction in the need for travel by an individual.

A host of modelling, monitoring management application. These things actually you know help you.

Greater energy efficiency in production and uses and also recycling.

Because when you move one item from suppose one place to the other, and then there are many things. First of all human resources, manpower, and then transport. Transport will need energy. This may also cause pollutions, traffic, many things. So this can be actually avoided with the application of ICT.

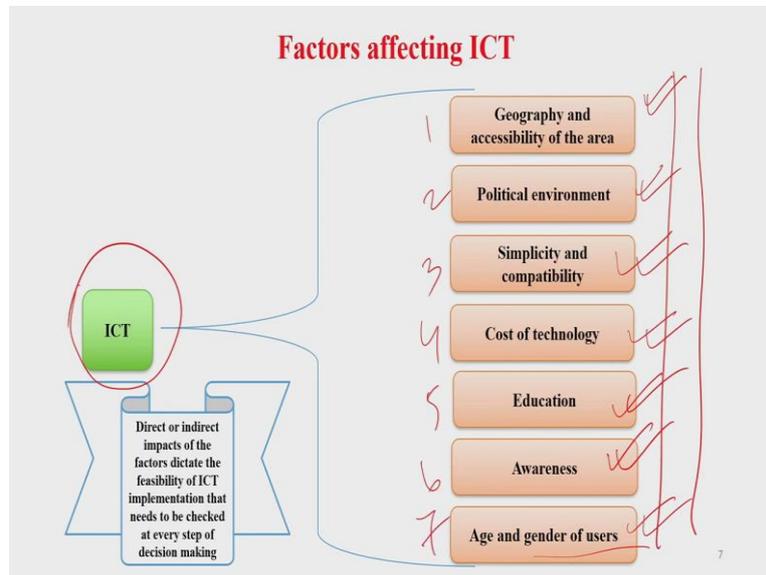
And we know that there are many players in the market of online shopping.

So but there are also negative impacts of ICT, like the production and distribution of ICT equipment which also has various toxic metals inside that.

Energy consumption in use. Because to produce those ICT equipment, you need energy. Short product lifecycle. So you generate a lot of E-wastes and this is one of the biggest you know, concern of modern day science and technology.

Potentially exploitive applications. You know, sometimes some of the instruments can explode also. We have many news is coming in these days. So there are positive and negative both side. I think we have to be with that for any kind of technology that comes into our life.

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Which are the factors that basically affect ICT functionality? That is also important to understand. See in ICT there are various factors are involved directly or indirectly which affects the know feasibility of ICT implementation at any place.

First of all, geography location- the accessibility to an area, whether you can, at all can reach there because you need to transfer certain items, equipments from one place to the other.

Political environment, political will. Without that it is not possible.

Simplicity and compatibility, especially when you talk about natural resource management which need to be managed largely from the rural area. Very few natural resources that we have actually, you know, inside the urban area.

Now when, most of the resources are away from the urban area, in rural area or surrounding places, you need simple technology which can be easily understood and operated. Cost of technology, another important factor. These days the buzz is low-cost technology- how you can actually come up with any technology which is having low cost.

Education, very important. Awareness, of course. Then genders, age and gender.

These also sometimes actually affect ICT uses. So we need to actually take care of these couple of important factors which can actually impact the feasibility of ICT, its application, and efficiency.

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ICT in Natural resources management

- The natural resources of most developing countries are under increasing stress, and many nations are increasingly concerned about achieving environmental sustainability through efficient use of land and water resources.
- As population is escalating very fast, there is need to take stronger step by national government to monitor their natural resources and take immediate steps to maintain these resources when being overused. *Last mile Connectivity*
- Efficient use of information and communication technologies (ICTs) is crucial for inclusive growth of agricultural sector as India. The importance of ICTs lies less in technology itself than in its ability to create greater access to information and communication in underserved populations.
- To better understand trends and causal relationships, it is necessary to combine data from different sources. Doing this requires the development of standards and protocols for describing phenomena, as well as quality control to ensure that the knowledge that results is based on facts.
- ICT can have significant affects where time lags are a barrier to achieving goals. For example, early responses to emergencies such as forest fires or pest/disease/invasive species outbreaks are much more cost effective and more likely to be successful than late responses. It can also make a difference when markets are involved

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Let us look at how now ICT act in natural resource management paradigm. Now you have little bit idea that how ICT actually works. In natural resources management in most of the developing countries, they are actually facing lot of stress including our country.

Most of the natural resources are now being exploited for rapid pace of development. Many countries are now increasingly getting concerned about sustainable use of natural resource management, how best they can use their land and their water resources.

Now ICT can play important role for managing those kinds of critical resources. Population is increasing very fast and there is a requirement for stronger step at national level to monitor various natural resources and also they need to take immediate steps to maintain these resources whenever somebody tries to overuse that. So that brings in the legal angle.

So it goes back to the previous lectures that we have discussed. Stringent rule, stringent law is also required because there are certain natural resources which you cannot allow to get abused.

Efficient use of information communication technologies is very important for inclusive growth utilizing various natural resources. The importance of ICT per se is basically less in the technology but more in accessing information or communication to the remote test people, to all kind of caste, creed, gender, regardless of gender.

The information needs to be spread to every last person that they are staying, you know, far away from the source of the information. We call it as last mile connectivity. You might have heard about this word.

So the ICT can actually help you for an inclusive kind of, you know, knowledge generation of various aspects. So you can understand how critical it could be for natural resource management.

Also to understand the trends, the various relationships between the natural resource, climate environment, it is important that you combine various data from different sources and when you try to do that, that lot of data coming from different sources, you need also different kind of standards or protocol.

Because data from source A and data is coming from source B, they might have been collected in a different way. So we need to have a standard protocol in place for data collection because data collection is the first step of generating reliable information.

So once those data collection is taken care of, then you have to have also stringent quality ensuring policy so that the knowledge that is gathered and spread among the communities is as much as possible error free.

Because we know that these days wrong information or fake information, fake data, you know, going to the public can create unwanted amount of stress and confusion. So we need to be careful about that. ICT can help us to do that.

ICT can also have significant effects where time lags are a barrier for achieving the planned goals or targeted goals. Say sometime somewhere a forest fire takes place. Now that forest fire is taking place maybe far away from the fire brigade facility.

Now this kind of emergency such as you know, this forest fires or any kind of disease outbreak, in that kind of situation immediately to send a person there on the ground may be difficult. And that kind of situation information communication technology can play a crucial role of managing these kind of you know, disasters from far away from the point of you know, event.

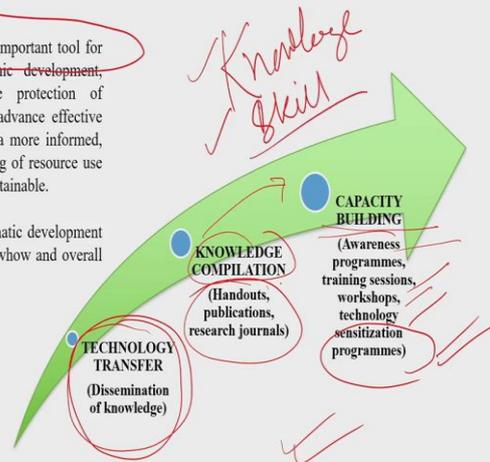
It can also make a difference when markets are involved into some activity. There are various natural resources as bio-medicinal plant, fruits, vegetables, you name it. So those things when you generate livelihood from those natural resources, there will be a linkage with the market. Again ICT can help you to access, to link the market with the produce. So as you see that ICT actually can play a very crucial role.

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ICT in Natural resources management

Technology transfer is an important tool for achieving ~~global goals~~ for economic development, biodiversity conservation, and the protection of ecosystem services. It can help to advance effective governance and rule of law through a more informed, mobilized public and better monitoring of resource use to ensure that it is lawful as well as sustainable.

Its significance in ICT lies in a schematic development of knowledge building, technical knowhow and overall sustainable management



Another aspect is you know technology transfer. Technology transfer from developed country to developing country, from central government to state government and from state government to the panchayat. So transfer of technology at each level can be made much more streamlined utilizing information communication technology.

So this simple figure shows that technology transfers or dissemination of knowledge when it starts, it passes through knowledge compilation where you actually come out with handouts, publications, research journals for knowledge dissemination and these activities helps in capacity building by increasing your awareness, training, workshop, technologies sensitization program, all these things that you carry out. Ultimately will enhance your knowledge, and develop your skill and ICT can play a very important role in that.

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ICT in Natural resources management

The ICT based tools are applied for processing, exchanging and managing data, information and knowledge management, and also having great ability to;

- Record text, drawings, photographs, audio, video, process descriptions, and other information in digital formats,
- Produce exact duplicates of such information at significantly lower cost, *Time ≈ Rs.*
- Transfer information and knowledge rapidly over large distances through communications networks.
- Develop standardized algorithms to large quantities of information relatively rapidly.
- Achieve greater interactivity in communicating, evaluating, producing and sharing useful information and knowledge.

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Now let us look at that how ICT based various tools can be applied for processing, food processing, say, exchanging, managing data, information, knowledge management, and many other things.

Now as I told that, ICT helps you very quickly gathering lots of data, convert into information, disseminated to the stakeholders. Now what it does? It record you know various text, drawing, photographs, audio, video. It processes various descriptions and other information in digital format which can be very quickly sent from one point to the other.

It also produced exact duplicates of such information at a very low cost. Remember those days when we did not have xerox machine or computer or camera or mobile. Nowadays, if you have a document in front of you and you want to send your parents who are maybe 1000 kilometers away from you or you need in college, you need a certificate, your dad immediately take a picture, send through WhatsApp. Within a few seconds it reaches to you.

So that is the power of ICT in information exchange, transfer and producing exact duplicates also because you are taking the picture and these days officially also mobile pictures of some document is accepted provided you just you know self-attest and submit it.

Transfer of information and knowledge as I just now said can rapidly over large distance can move and that has you know enhanced our quality of life and mobility. It also helps in developing standardized algorithms to large quantity of information can be processed within very small period of time.

It also helps us to achieve greater interactivity and communicating between each other organizations, districts, states, countries. It helps us in evaluating, producing and sharing useful information and knowledge in a fraction of a moment. In today's world, time is equivalent to money and ICT plays a crucial role in managing time and help you to avoid financial losses.

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ICT in Natural resources management

The management of natural resources with ICT is the most trending topic in environmental economics and management.

All natural resources, their utilization and management can be optimized with smart use of ICTs.

In terms of NRM, following are major aspects in which the use of ICT is considered:

1. *ICT for soil management*
2. *ICT for water management*
3. *ICT in agriculture*
4. *ICT for disaster management*

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The management of natural resources, especially with the help of ICT is one of the most you know talked about topic today in the field of environmental economics management. All natural resources and their utilization management can be optimized with the help of ICT.

And if you look at the aspect of NRM, these following major aspects for in which ICT plays a very important role. ICT for soil management, for water management, for agriculture, and for disaster.

Now these two- soil and water are the two most important natural resources among which the civilization probably is dependent upon and then comes agriculture. In our country even today, significant amount, highest number of populations depends for their livelihood on agriculture.

Even though, we have developed in various technology field industry but still majority of our populations, they survive on agriculture. They earn their livelihood from agriculture and then disasters. Such a big country. We have all kinds of disasters. So ICT plays again an important role in disaster management too.