**Management Information System**
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**Lecture No. # 11**
**Knowledge Management**

Start, okay. So, today let us begin with another new topic that is on knowledge management. Now essentially the knowledge management to understand what is its impact particularly in the management information systems, let us first understand what we understand by knowledge.

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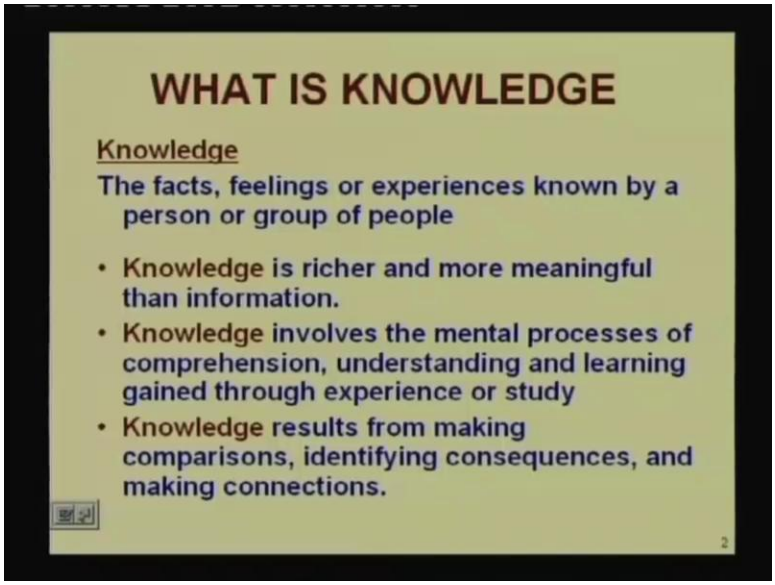


The knowledge can be defined as the fact, feelings or experiences known by a person or group of people in fact this is one of the dictionary definitions. Now we can also see that what is the difference between the data, information and knowledge. First of all we know that information is basically processed data useful to the recipient but knowledge is something more than that you know it's not just information; it is basically richer and definitely more meaningful than information.

Knowledge basically involves the mental processes of comprehension, understanding and learning that is gained through experience or study. It results from making comparisons,

identifying consequences and making connections. So, you can understand the difference between information and knowledge in this way. See, whenever we understand something some processes goes on in our mind. So, what is going on in our mind is not known to other people but the manifestations are known that we pass messages, documents and exchange. So, all these are basically information, so you see that knowledge is manifestated, manifestated through information but what exactly is knowledge that if you want to understand you have to understand the mental processes that actually goes on.

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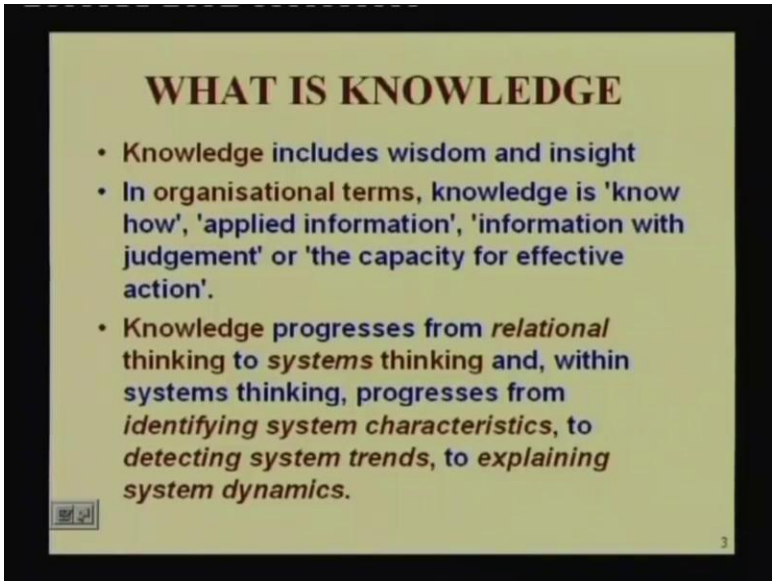


So, some people also say that knowledge includes wisdom and insight. So, you see a given situation let us say we have a business situation where we are developing information system and to be precise we are developing an information system plan. To develop an information system plan we have lot of nitty-gritties, we have thousand things to do starting with the requirements, the resources, the hardware, software people and many other things. However, apart from this a certain bit of insight should also be there, a vision should be there which is difficult to define and only an expert knows that whether this particular information system that we are going to design or planed will be actually successful or not.

How he says that what goes on inside his mental thinking processes is very difficult to really quantify or to understand but that particular thing we can actually call a knowledge. So, in other words let us say in organizational terms we may say that knowledge is know how, applied information, information with judgment or the capacity for effective action. Knowledge basically progresses from relational thinking to systems thinking and within systems thinking, progresses from identifying system characteristics to detecting system trends to explaining system dynamics. So, essentially let us try to understand what exactly is meant here. What we basically mean by relational thinking is that the interrelationships between various elements, all right.

So, when we are let us taking cue from our information system plan example, so information system plan basically has got various components, people's, processes, work practices and things like that. Now all these various work practices, the people, the information technology, hardware, software, the information processing how it basically goes on all these components how are they related. So, this is one thing but together how the whole thing will behave that we can say is a system thinking component. Going one step further we have identified all the system characteristics, we have identified all the individual elements and their interrelationships but when the actual information system plan is executed, put into practice what will be its trends, what will be its dynamics, how will it evolved, whether the hardware acquisition and the software acquisition match exactly and will it overlap with the people requirements.

So, if you have that kind of a vision if you have that kind of systemic thinking able to integrate then we say that knowledge is working, the expert opinion is taken and basically we are following an expert advice. So, you see that that basically the, is the basic difference between data and knowledge.

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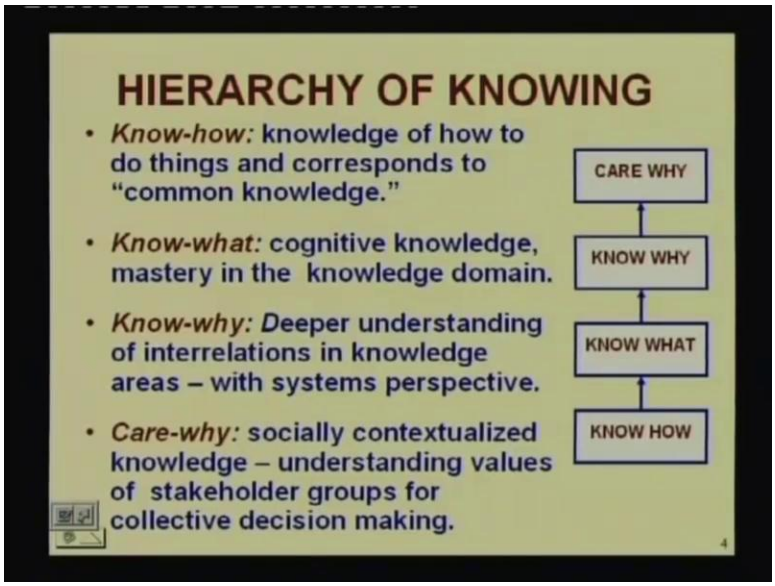


Now particularly we can in another way we can see here the hierarchy of knowing. So, you see that we have the know-how and then from know how we have the know why, know what, know what, know why and finally the care why, all right. So, these are the hierarchy of knowing. The very first thing is know how. Knowledge of how to do things and corresponds to common knowledge, all right. Know what is a cognitive knowledge, mastery in the knowledge domain. Let us try to have an example of how these things actually happen.

Say, for example we are having let us say any particular process say for example machining process. We are machining a given component using an equipment and materials, processes, the resources, various resources, raw materials, the man power and various other consumables which are important in the given context. The know how is how to do it? It is a common knowledge, every operator has to know how to operate the machine, how to use the people, how to use the various sequences, the you know the various steps that are to be followed to make the particular part. The know what is you know is little more than that is a kind of cognitive knowledge that is that you know what exactly is really happening. You have to really know the characteristics, all the details about the equipment part, machinery, resources and so on but at a higher domain we have so called the know why, know why is a much deeper understanding of interrelationships that is that why this particular equipment is able to produce this part. So, if these particular part

has a certain machining requirements, certain lubricating requirements why is that. So, you see that when we talk about lubrication naturally it means we need the knowledge of tribology all right.

So, you see that it is something more than simply knowing that we give the lubricant and the thing works but why particular things are happening, all right. We need the further knowledge of machines you know why the particular machine works in a certain way, how the design, why this particular design, we know we have to have the machine design concepts, so these are basically know why, all right. So, why a particular thing happens rather than know how at an even greater level we have the so called care why that means socially contextualized knowledge, understanding values of stakeholders, groups of collective decision making, stakeholder groups and collective decision making. You see its even one step further if a particular machining has to take place, we know that machining is a basic process but these basic process requires people, these basic process requires management. When we have management we have people you know they have different value systems.

So, these different value systems they can think about the particular machining process differently and therefore to get the job done in an industry setup, we essentially require that all these processes you know be put together, they all work in unison and together they have a common goal and they take what is known as collective decision making.

Now, this is a very simple example I gave about the machining of a part. Translating these to let us say to the information system plan you know we have to have the know how, we should know what are requirements what kind of people are required, what work practices and we should also know that how the information and information technology they all are coupled with one another. Then we know that what are these different information technologies, what kind of people, what knowledge they should have. Further we should know the theories we should know the theories of system analysis, system design, we should know the theory of computer programming, computer science. We should know the MIS and you know these all are basically part of the know why but even at the further level, the different stakeholder groups that are there in an information system planning you know the top management, the information architects, the

developers, the users and finally our customers and our suppliers, they all are coupled in some way or the other and their stakes are different.

So, the same thing which may be beneficial to a particular stakeholders may not be so to another one, all right. So, when we have different stakeholder groups working together and they have to make collective decisions, we should have the care why knowledge and we should see how the whole thing integrates together that is basically the hierarchy of knowing.

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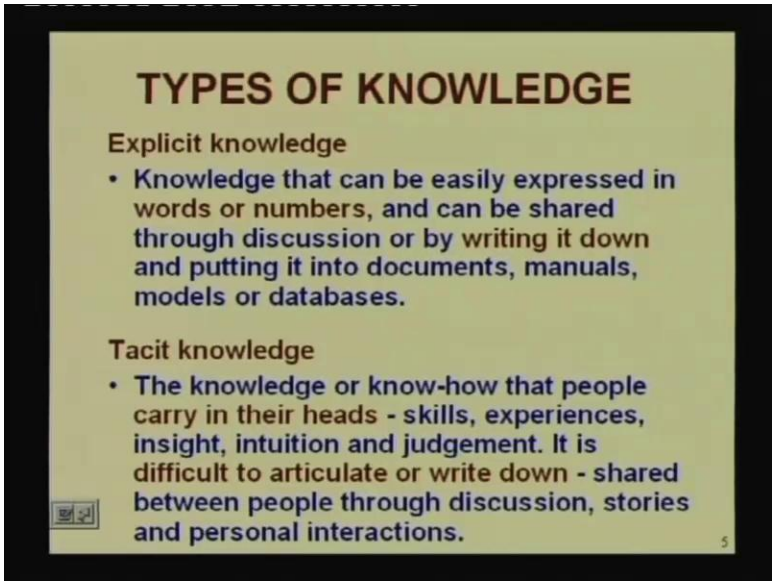


Now, there are essentially two types of knowledge, one we can call the explicit knowledge, the other we can call the tacit knowledge. The explicit knowledge the knowledge that can be easily expressed in words or numbers and that can be shared through discussions or by writing it down and putting it into documents, manuals, models or data base. So, it is that part of the knowledge you know which can actually be written down all right which can actually be written down. So, it is you know it is the kind of wisdom, kind of thing which you get from books, from documents, from data bases, from internet from all the knowledge sources. You know this is a kind of things all the primary, secondary and tertiary data which you can actually collect but apart from explicit knowledge more important is the so called tacit knowledge. The tacit knowledge is a knowledge or the know how that people carry in their heads, it's the skills, experiences, insight, intuition,

judgement all those things which are difficult to articulate or write down, so which are basically shared between people through discussion, stories and personal interaction.

So, the tacit knowledge is something which is not written down which is there in people's heads all right and it is also basically difficult to write down. How, suppose you ask to an information system expert how do you make the best possible information system plan? He can give the procedures and probably those procedures are available in MIS or information systems text books. So, that's not enough because everybody has read it in an MIS course, everybody has gone through those kind of things, there is something more but those something more they are not same all the time, situation to situation, from one company to another the information system plan is not going to be the same.

It is the inner feeling of the expert that what kind of information system plan will work in what kind of organization that's what you know makes distinct from an explicit knowledge to a tacit knowledge. So, it is a kind of tacit knowledge that is with the expert and it's not so easy to basically extract it and put it down in a book or you know document which then can be shared by all and probably we can think of replacing the expert and have somebody else who can actually do it from the organizational side.

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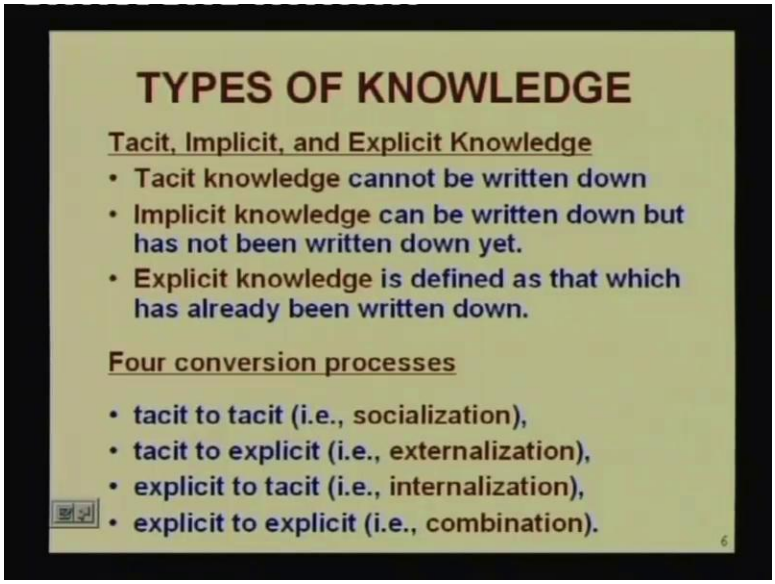

So, this is simple way of differentiating the tacit knowledge and the explicit knowledge, some experts define or distinguish between tacit knowledge and implicit knowledge. Tacit is, tacit knowledge is something that cannot be written down, implicit knowledge that can be written down but has not been written down yet. So, this another differentiation is made that okay some part of these can definitely be written down but not, has not been done. That's they are calling as implicit knowledge, differentiating this with the so called explicit knowledge which is the, you know the kind of knowledge which has already been written down. So, something has already been written down, something that has not been written down but could be written down and something that cannot be written down. So, that's the kind of differentiation we can have tacit knowledge, implicit knowledge and explicit knowledge. So, the implicit knowledge is also definitely is a kind of tacit knowledge you know the very fact that's not been written down and it is you don't expect that it is anybody can write it down, it's not so simple.

So, it's basically says that all tacit knowledge is not really you know so tacit that cannot be converted to the so called explicit knowledge. Some part of tacit knowledge can be converted to explicit knowledge but not all of it, all right. So, that brings us to basically four different conversion processes, the first one is tacit to tacit what we call the socialization then we have the tacit to explicit so called externalization, explicit to tacit, internalization and explicit to explicit, combination. So, you see these gives a very interesting conversions we have talked about the so called externalization process that tacit knowledge to be converted to the explicit knowledge that's very important because something that is in the minds of the experts has to be converted to explicit knowledge, so that this is can be used for the use of the organization. That's what everybody would like to do but why should we also consider explicit to tacit, why should we internalize?

You see the so called explicit knowledge which is already been available in books, they are available very good but in a given situation that particular theory may not work exactly. You see that scientific progress, academic progresses they are all going on essentially what is the process, it's a process of enquiry and these enquiry process is really possible because we are you know going through the available literature, the explicit knowledge that is with us, so we are internalizing them and after internalizing with our additional knowledge and mental models

which are already available in our mind, we are converting it to further tacit knowledge. It's like that we have the knowledge of all different aspects of MIS, we have the knowledge of computer theory, computer science, networks coupled with our knowledge of the organizations in which we are working and you know when all these knowledge we are putting it together, when we are integrating we are probably able to gain further tacit knowledge. So, it's a kind of internalization process all right. So, that's also important because it's a kind of feedback loop, we are converting our tacit knowledge to explicit knowledge and further explicit knowledge we are internalizing to make further tacit knowledge and the process goes on.

The other process is the explicit to explicit combination you know various explicit knowledge you are combining is one another kind of conversation. Finally, tacit to tacit the so called socialization process, all right. This is basically happening that you have one expert, you have another expert, the two experts they have their own tacit knowledge, they are exchanging information in a certain way and these information is essentially increasing the tacit knowledge of one expert with the help of the other expert.

So, what is really happening that you have tacit knowledge with one expert, he talks with the other expert and the second expert is able to gain further tacit knowledge with the help of the tacit knowledge of the first expert. So, you see the expert is very important here, if you are not an expert even if you mix with the other expert probably you don't you are not able to gain much. So, here the particular conversion that is the socialization conversion is useful only when you have an expert to expert exchange in a given scenario. So, you can see that knowledge conversion, the conversion between tacit and explicit knowledge are particularly important only by tapping into tacit knowledge can new and improved explicit knowledge.

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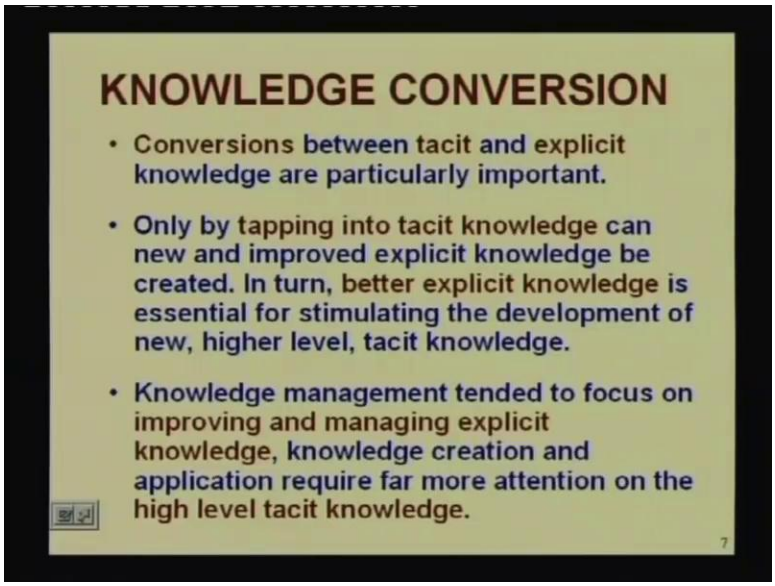


We created intern better explicit knowledge is essential for stimulating the development of new higher level tacit knowledge. Knowledge management tended to focus on improving and managing explicit knowledge, knowledge creation and application required far more, application require far more attention on the high level tacit knowledge. So, these are the important tasks about in the knowledge management exercise.

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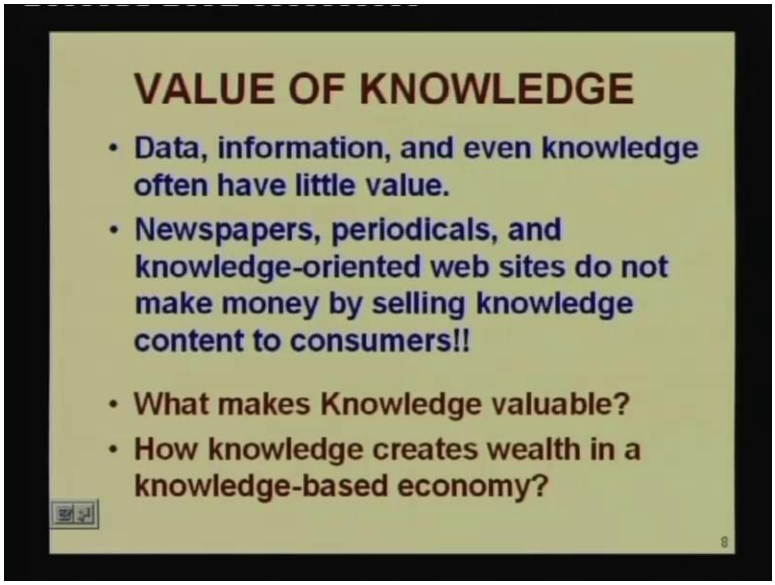

The value of knowledge, you see the knowledge also has a value. Sometimes, you see the data information and even knowledge often have little value. Newspapers, periodicals and knowledge oriented web sites do not make money by selling knowledge content to consumers. You see how do they make money, they make money by advertising which is basically making other peoples information available. So, they are also giving information but that particular information per say is not enough for them to make money, they have to advertise other peoples information to make money. So, the essentially this two important questions what makes knowledge valuable and how knowledge creates wealth in a knowledge based economy, these are the two things that are definitely we need answers.

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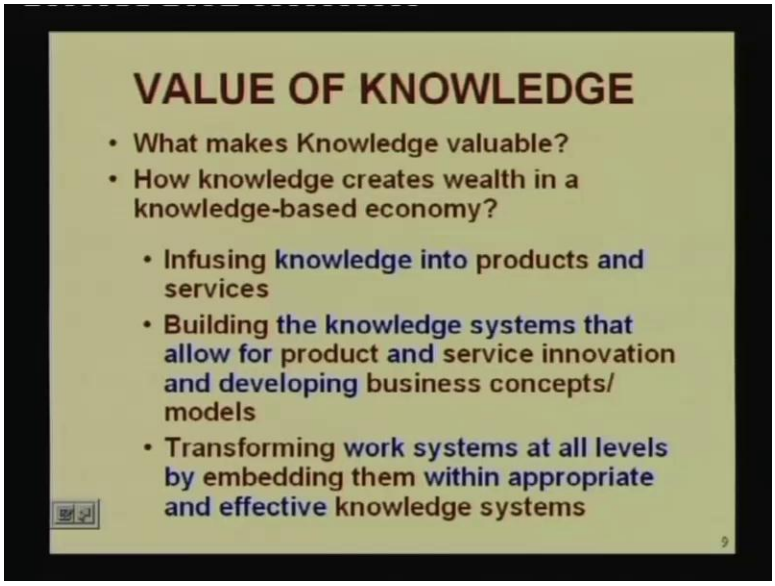


The answer lies in the four things, infusing knowledge into products and services, building the knowledge systems that allow for product and service innovation and developing business concepts and models, transforming work systems at all levels by embedding them within appropriate and effective knowledge systems. So, you see that the knowledge that we have that must be translated into products and services and we must use that knowledge systems to for product and service innovations and developing business concepts and models. And finally we should transform our work systems in such a way so that you know they become more appropriate and effective. So, these are the ways we can have value of knowledge.

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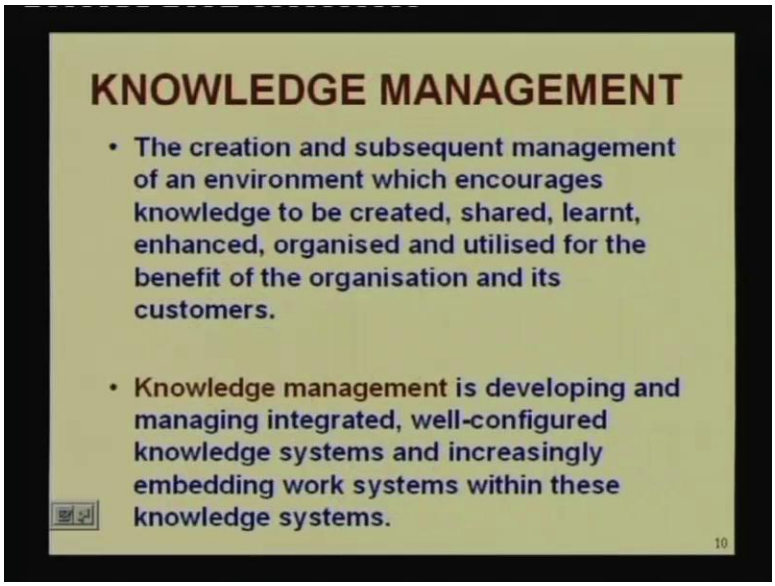


The definition of knowledge management therefore would be like this, the creation and subsequent management of an environment which encourages knowledge to be created, shared, learnt, enhanced, organized and utilized for the benefit of the organization and its customers, all right. So, how this can be done? How we can have so called developing and managing integrated, well configured knowledge systems and increasingly embedding work systems within these knowledge systems, so how this you know this basic objectives can be served.

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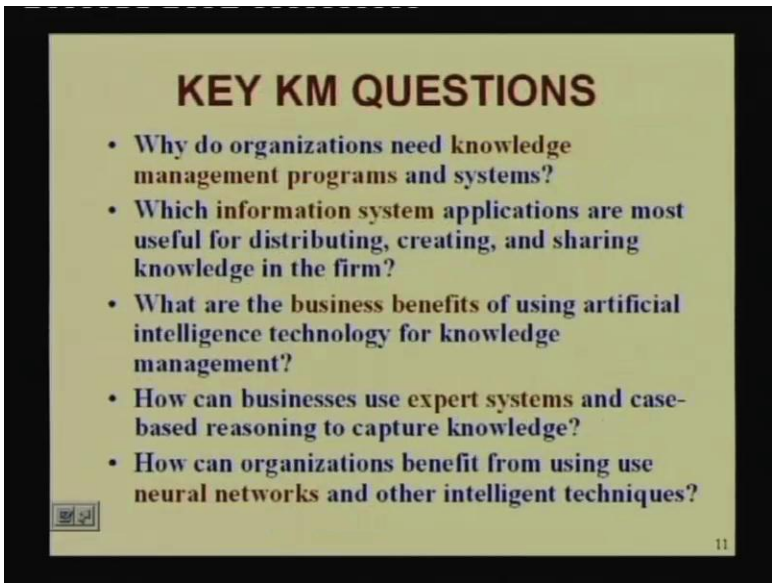

So, these following objectives are useful here or you know we may call it key knowledge management questions are the following. Why do organizations need knowledge management programs and systems? These we have already answered basically to translate the tacit knowledge to further tacit knowledge the so called socialization process or externalization translating the tacit knowledge to so called your explicit knowledge. So, that we can go for product and service innovations and we can have better designs, better concepts, better organizations and better work systems.

So, which information system applications are most useful for distributing, creating and sharing knowledge in the firm? So, we have to develop information systems by which knowledge can actually be disseminated. What are the business benefits of using artificial intelligence technology for knowledge management? We should be able to use artificial intelligence technology in the best possible manner. How can businesses use expert systems and case based reasoning to capture knowledge and finally how can organizations benefit from using the use of neural networks and other intelligent techniques? So, these are some of the key knowledge management questions and in the next half an hour or so let us see how this key knowledge management questions can actually be answered in an organizational context.

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First let us try to understand the organizational learning. See, I have deliberately not focused here about a very important topic that is called learning organization. Learning organization is an extremely important concept and these particular things the learning organization concept we shall devote in our next lecture, right that will be our next lecture. The organizational learning is basically for creation of new standard operating procedures and business processes. And knowledge management in this context is set of processes that creates, gathers, stores, maintains and disseminate knowledge.

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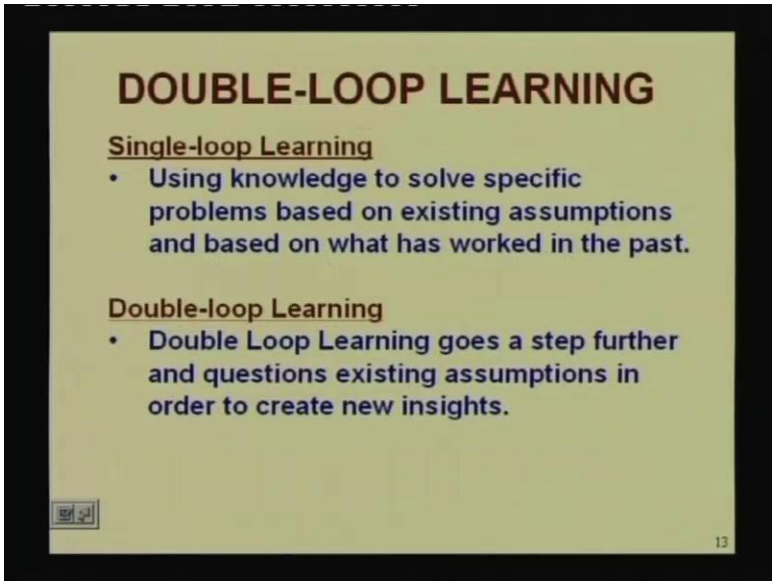


Now organizational learning essentially happens in so called two ways, the single loop learning and the double loop learning. See, these are very interesting. The single loop learning is using knowledge to solve specific problems based on existing assumptions and based on what has worked in the past. So, it is a usual kind of learning that something is a cause an effect, something as happened and the cause is known, the effect is also known, so we tried to do something about the cause and try to understand the situation it's a kind of learning. But double loop learning goes a step further and questions existing assumptions in order to create new insights. You see that what we are calling as cause we have to dig further. Is it really a cause or it is just you know we are saying it's a cause? There the real cause maybe somewhere else, so something like this how do we prevent earthquakes from killing people.

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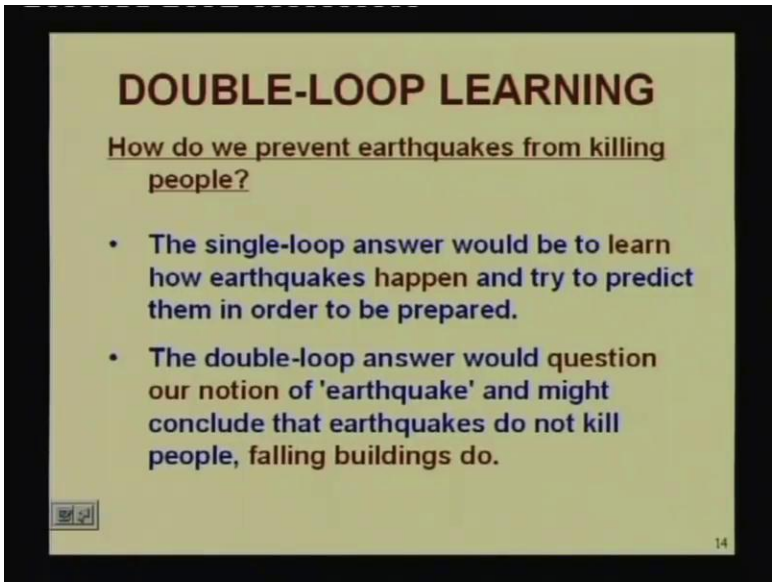


Let us say this is a key question. The single loop answer would be to learn how earthquakes happen and try to predict them in order to be prepared. So, it's is well known that there are earthquakes and when we have earthquakes, we have people getting killed and therefore it's very natural that we should really learn how earthquakes happened and try to predict them in order to be prepared. So, it's a kind of effort an effect which we are essentially going to try. The double loop answer would question our notion of earthquake and might conclude that earthquakes do not kill people falling buildings do.

You see the focus now changes, initially the focus was how earthquakes happen and we predict that okay how earthquakes, when it will happen and we become better prepared but the double loop thing, it questions the basic assumption that yes earthquakes do happen. But what exactly kills people? It is the falling buildings. So, how can we do something so that buildings do not fall and how do we better design our buildings. So, in this regard let us take one more example, that is a tsunamis, you know the recent tsunami hits that has killed a very large number of people all over the Asian countries.

Now here essentially most of these countries including India, they are now trying to develop scientific instruments going for scientific endeavour, spending lots and lots of money to predict

why tsunamis happen, when tsunamis happen and trying to understand the nitty-gritties from a scientific point of view. It's an extremely important thing that the countries are doing and we must praise for their efforts and for the noble cause but all said and done it is still a single loop answer. The double loop answer would be that you see that tsunamis kill people. So, basically what exactly kills people, it basically kills people because we are not well prepared. And how do we improve our preparedness to face tsunamis, all right. So, this is where essentially the question comes that even if you know that a tsunami is going to be hit in one day time from now, will you be able to evacuate people, will you be in a situation after the tsunami is hit you can rebuilt the place, can you bring the supplies and the essential requirements to people who are affected by it. So, all these important questions are more important than predicting the tsunami itself. Obviously, predicting tsunami is very important but these answers to these questions are vital, right.

So, if you are prepared if you can evacuate people quickly, if you can bring the supplies to the affected people quickly and if you have a preparedness you know exactly what should be done, when the particular disaster really works. Is extremely, these are extremely important in the context of disaster management, almost in any disaster management, is a very important to predict the disaster but much more important to understand how to control the disaster and how to act once the disaster happens, all right. So, unfortunately we are not seeing much progress with regard to the second part that is the double loop answer, right whereas we should have increasing focus on these particular aspects.

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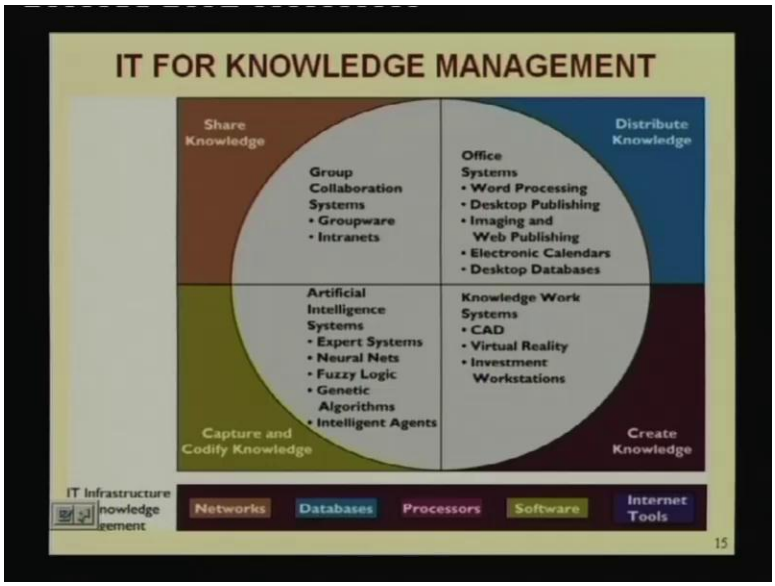


Now here is a diagram these basically shows what should be the various information technology support for so called knowledge management. Here, you can see that essentially there are 4 dimensions, the dimension, the first dimension is create knowledge, create knowledge you can see here the create knowledge is basically through the knowledge work systems. There could be computer aided design CAD, the virtual reality investment workstations and so on, various knowledge work systems which are available for creating knowledge. Then we have the capture and codify knowledge. How do you capture and codify knowledge by using so called artificial intelligence systems. Examples could be expert systems, neural nets, fuzzy logic, genetic algorithm, intelligent agents so things like that then we have what you call the share knowledge.

Once you have that particular knowledge which you have captured or otherwise are codified, you should be able to share the knowledge through so called group collaboration systems, so you should develop the groupware, you should develop so called intranets. Then we have distribute knowledge, these could be done through office systems through word processing, desktop publishing, imaging and web publishing, electronic calendars, desktop databases and so on. Now out of these, the last two activities that is sharing knowledge and distributing knowledge essentially falls in the part of the general information systems, right that if you have some, if you have already captured and codifying knowledge then it basically gets translates to information

and we have to share it whether in a group or otherwise whether through intranet, extranet or office automation, word processing, publishing are very important databases. But we have already, we are going to discuss them in our subsequent lectures in a big way but in this particular lecture let us concentrate specifically to the knowledge work systems and the artificial intelligence systems essentially how to create knowledge and how to capture and the codify the particular knowledge in a given context.

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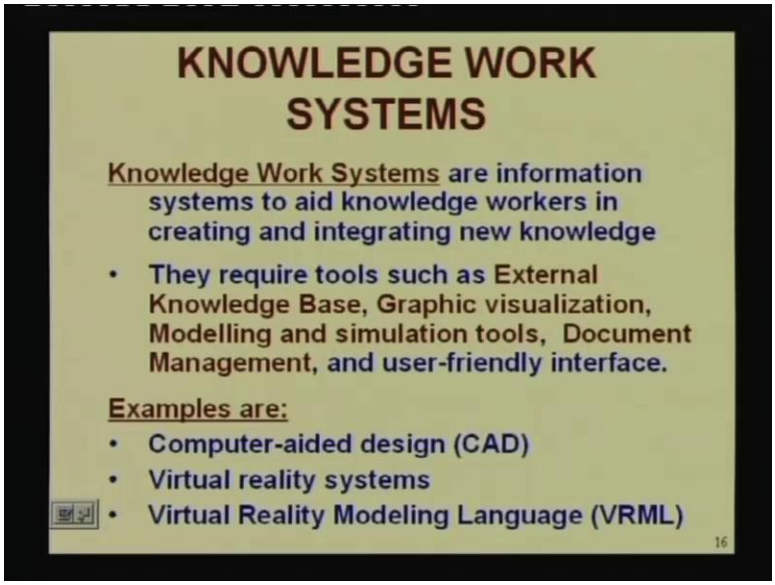


So, various knowledge work systems are essentially information systems to aid knowledge workers in creating and integrating new knowledge. They require tools such as external knowledge base, graphic visualization, modeling and simulation tools, document management and user friendly interface. Some examples computer aided design, virtual reality systems, virtual reality modeling language like VRML and so on different kinds of work stations and so on. So, what exactly you need? You need external knowledge base, you have modeling and simulation tools and you should also have facilities for visualization through graphical means and they should be document management tools and user friendly interfaces to back you up. So, these are basically part of various knowledge work systems.

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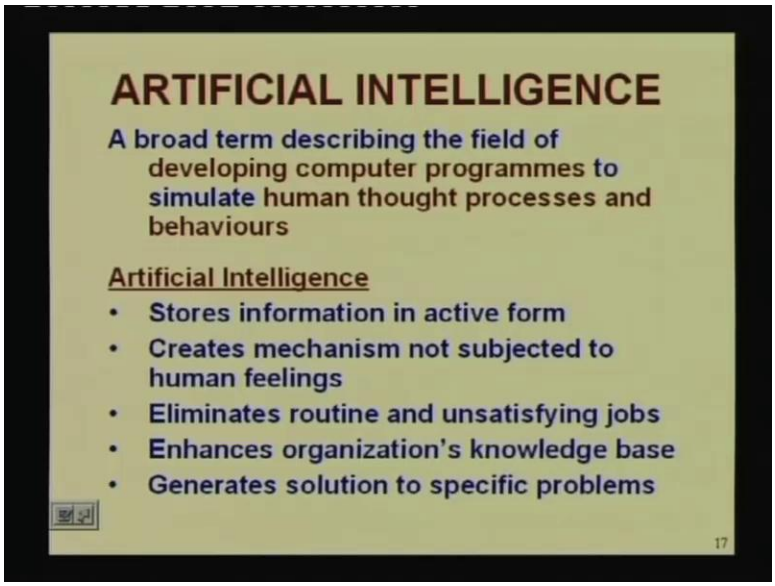


Now apart from the knowledge work systems, the artificial intelligence is a broad term which basically describes the field of developing computer programs to simulate human thought processes and behaviours, all right. Artificial intelligence stores information in active form, creates mechanism not subjected to human feelings, eliminates routine and unsatisfying jobs, enhances organizations knowledge base and finally generates solutions to specific problems. So, essentially what we mean here by artificial intelligence is that we have the knowledge with the experts, we capture the knowledge of the experts and we should be able to simulate these human thought processes by developing specialized computer programs, all right.

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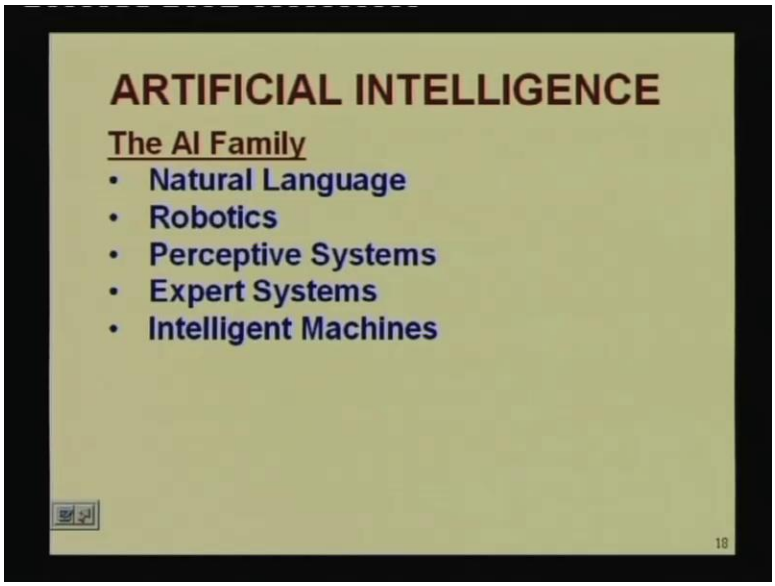


So, lot of work is being done, some examples of artificial intelligence, natural language, the robotics, perceptive systems various kinds of perceptions like vision, touch and so on. The expert systems which we shall discuss in some detail and the intelligent machines say so called intelligent agents and so on.

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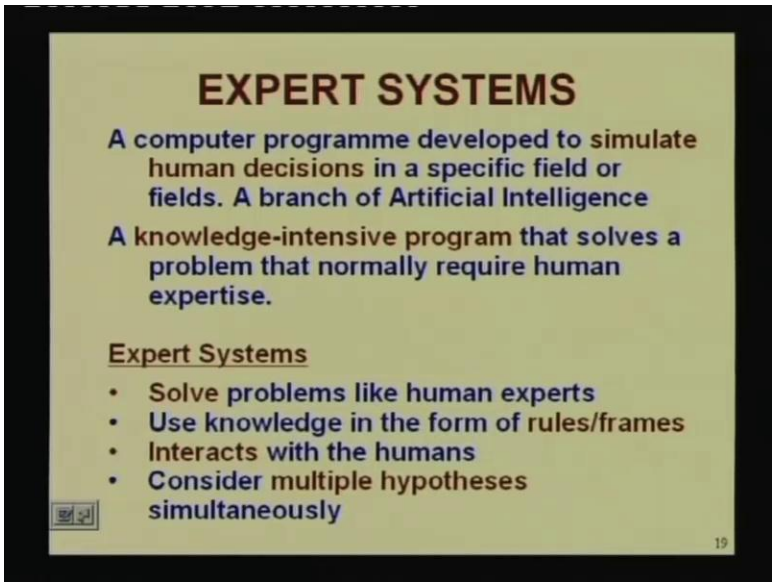

Now essentially these are various kinds of artificial intelligence family. Let us discuss out of this in some detail, the expert systems. Expert system is a computer program developed to simulate human decisions in a specific field or fields, it's a branch of artificial intelligence. A knowledge program that solves a problem that normally require human expertise. So, solve problems like human experts, use knowledge in the form of rules or frames interacts with the humans, consider multiple hypotheses and simultaneously, all right these are some of the use of the expert system. Let us try to understand how some of these things happen.

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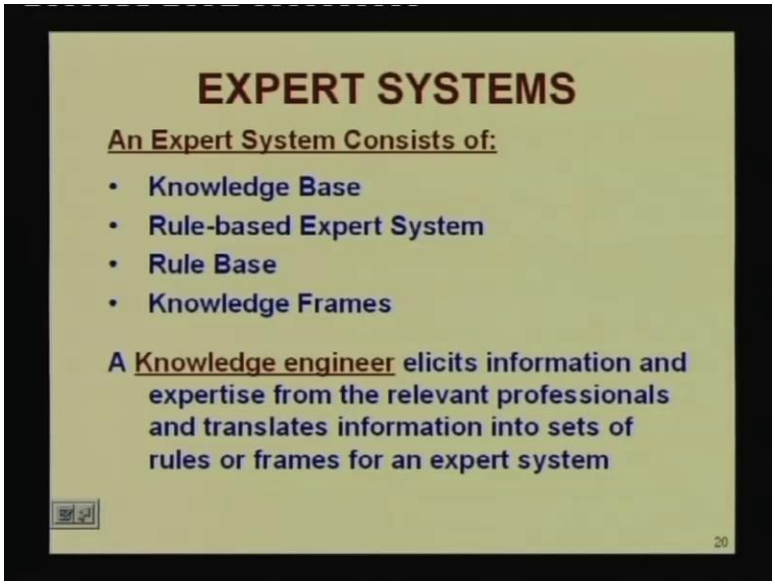


So, what are the various components of expert systems? You have the knowledge base, you have the rule based expert systems, you have the rule base and you have the knowledge frames. Knowledge frames and a knowledge engineer usually elicit information and expertise from the relevant professionals and translate information into sets of rules or frames for an expert system.

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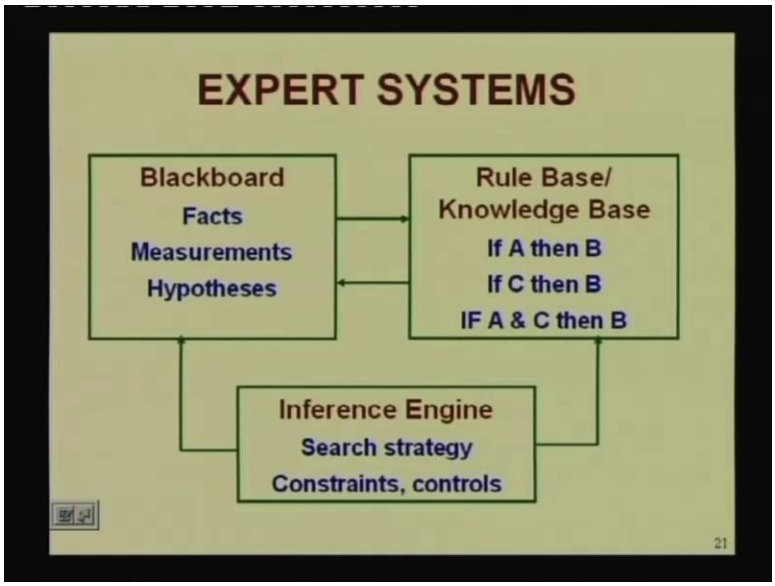


So, to understand this let us look at this particular diagram. The first thing what we call as the blackboard. The blackboard is usually is a storage where we keep the facts, the measurements and the hypotheses all right various facts, measurements, hypotheses about a given situation. The second part is a so called rule base or the knowledge base which has got various rules which you can call is like you know our knowledge. For example if A then B, if C then B, if A and C then B, I mean simple rules have been written. This is the second part where the rules are actually given.

In the third part we have the inference engine. The inference engine is a search strategy the strategy that should be used by making use of the blackboard as well as the rule base or the knowledge base and using the constraints and various controls. So, let us try to understand this in a given situation, how exactly it should be. Let us take a very simple example to begin with, it may not be a good expert system, it could be just a nitty gritty type of system. Say for example a given organization would like to find out that whether to send a given employee to a conference all right and if so whom to send, all right.

In so called black board we have different facts. What are the facts? The facts could be that there is going to be a conference in a given city on a particular topic all right, may be on computer you

know on expert systems let us say a conference is being held. The other facts are let's say there are various employees x is an employee, y is an employee, z is another employee, w is another employee these are all facts. There are other facts like x is interested in expert systems, other facts like y is actually working on expert systems, other facts like x is willing to go to a conference, y is not willing to go to a conference. There are hypothesis that if you go to expert system conferences then our company may gain, our other hypothesis our company should develop expert system technologies.

So, these are all part of facts, measurements, hypothesis which are stored in our so called black board. The rule base or the knowledge base will have certain rules something like that the company should sponsor an employee to a particular conference, if the employee has completed 5 years of service, all right. The company would pay not more than 10,000 rupees for a given conference. The company would sponsor an employee only if the conference is being held within a certain distance from the headquarters. So, you see all these various rules and regulations about the conference, about the people, about the service rules they are part of the rule base or the so called knowledge base.

Now, we try to you know apply all these rules with the help of the facts, measurements, hypothesis. That is the job of the inference engine and finally come out with that that whether the company should send someone to the conference and if so to whom and for how many days and periods. So, these are the basically the nitty-gritties of this simple expert system.

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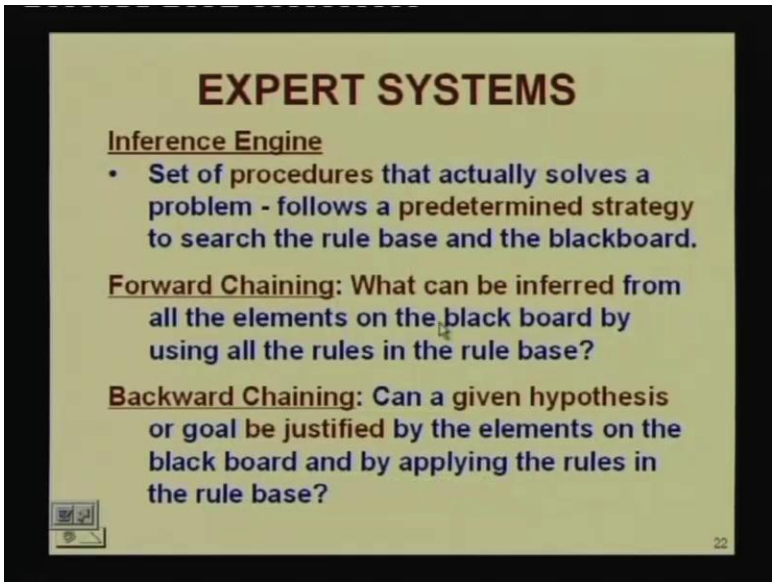


So, you can see here the inference engine is a set of procedures that actually solves a problem, follows a predetermined strategy to search the rule base and the black board. Now here there are two very important basic strategies they are being used, one is called forward chaining, the other is called backward chaining. The forward chaining usually is what can be inferred from all the elements on the black board by using all the rules in the rule base, all right. What can be inferred from all the elements on the black board by using all the rules in the rule base. So, it's a forward method we have all the facts, we have all the rules, we apply all these facts and all these rules, can we infer something is called forward chaining.

Backward chaining can a given hypothesis or goal be justified by the elements on the black board and by applying the rules in the rule base. Suppose, an hypothesis x is to be sent to these conferences all right. Can we justify these by all the elements on the black board and by applying all the rules of the rule base that is called backward chaining. So, through this forward chaining and the backward chaining process, we actually execute an expert system kind of a situation.

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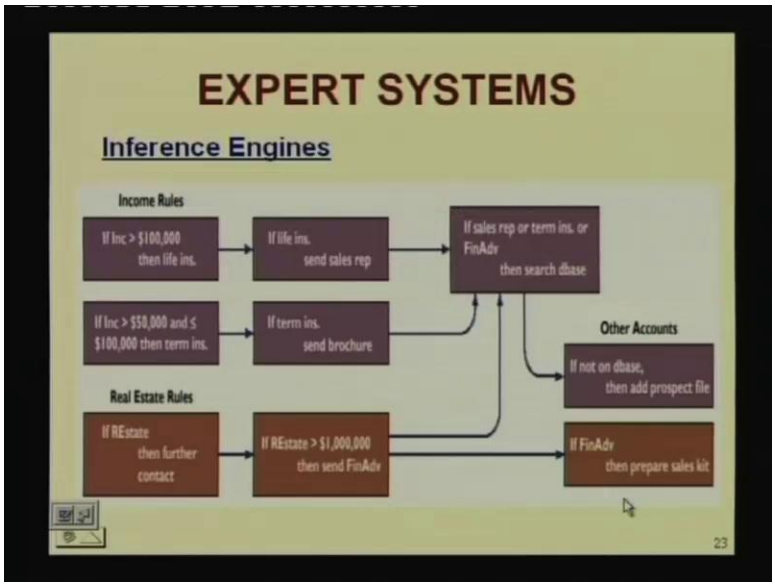


So, it is an example I have taken of an inference engine about, so here you can see we have some income rules and we have some real estate rules, the income greater than a certain value then life insurance if life insurance sends self-representative, otherwise if the income is within a range then term insurance and if the term insurance send brochure. Similarly, real estate rules, if real estate then further contact and if the real estate value is above a certain thing then send financial advisor.

So, if self-representative or term insurance or financial advice then search data base. So, this is a particular thing about an inference and if not on the data base then add in the prospect file, if financial advice advisor then prepare sales kit, all right. So, you know these are an inference engine how the whole thing happens one after the other.

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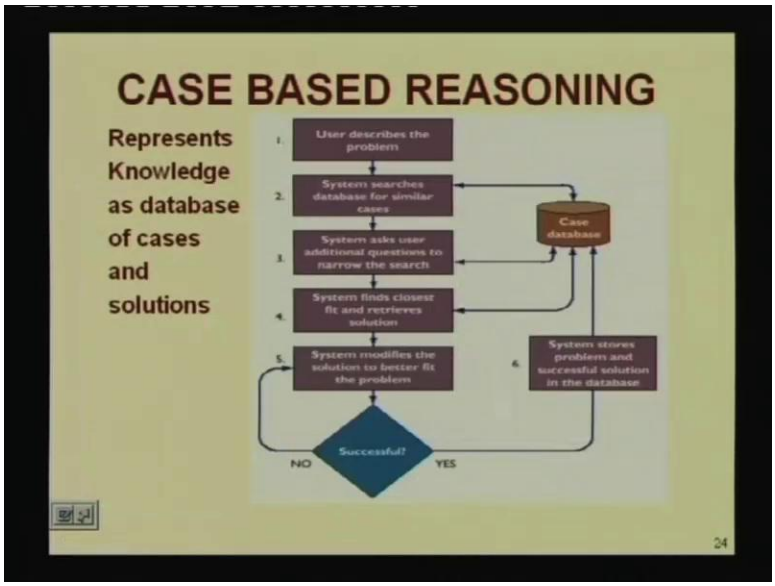


Now, this is another simple example, this is called case based reasoning. Case based reasoning represents knowledge as data base of cases and solutions. So, here you can see a particular case is given, the user describes the problem, system searches data base for similar cases, system asks user additional questions to narrow the search, system finds closest fit and retrieve solution, system modifies the solution to better fit the problem and if it is successful then system stores the problem and successful solution in the data base in the case data base, if no then the search will go on and system will modify the solutions to better fit the problem, all right.

So, this a case based reasoning, it is like if you have successfully developed certain kinds of information systems then you store them. Say for example a given information system company have developed a large number of payroll applications. So, all these payroll applications can actually be stored and definitely there has been differences. The payroll application for company a and company b may not be the same but both would become a case study as far as the company is concerned, all right. Now when it gets another payroll application then it can actually compare what has happened in case a and in case b and if it matches well and good but if it doesn't match it's definitely can do something, can change the procedures and when this particular development actually takes place, it can actually use it as case c.

That is how you actually develop your case data bases and these case data base can actually be very useful later on when you process or you are in the market place for further development of information systems. In fact this is how the large companies in the Indian context, large information technology companies are way ahead then let us say the start of ventures because they have their expertise, they have their knowledge and which they have very meticulously documented and kept as cases and that is where from, that is where they get their strength from, all right. So, this is another example of case based reasoning.

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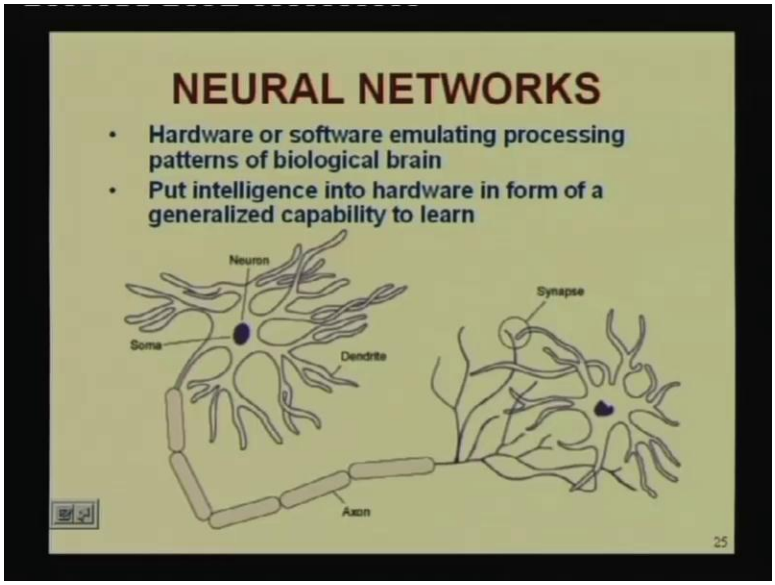


Let us try to understand two more things that is neural networks and the fuzzy systems. In very simple words the neural networks is hardware or software emulating processing patterns of biological brain put intelligence into hardware in form of generalized capability to learn. You see in human systems what happens, we have the neurons and the neurons are connected through axon and we have those dendrites and those dendrites, the axon is connected you can see that axon is connected to the dendrites of another neuron and synapses occur whenever we see that between you know the two neurons there the dendrites come into contact, there are small gaps.

So, you can see here this is a synapse where you know this is one neuron having its axon and soma and dendrites and here this is another neuron, so the dendrites of this neuron and the other

neuron, they are in contact here and these there is a small gap between the two and that we can call as synapse. So, what really happens in the synapse? In the synapse an electrical signal actually passes from one neuron to the other, all right. Now the question naturally lies that these small electronic or electrical signal that passes from one neuron to the other, is it sufficient to excite the second neurons? It's a very important question, so it actually goes through a threshold.

Now, these threshold warriors are not exactly the same all the time. So, if it does cross the threshold then second neuron also gets exited all right and please understand that human brain has got billions of neurons and some of them are in operation whenever something, some specific things are coming up. So, you see suppose let us how we do a task that of a simple addition say 2 plus 2, 4. So, when you hear 2 and you hear 2, certain neurons get excited and these neurons excite other neurons all right which essentially returns a value 4 from memory. So, it's all about the you know that whenever you hear the word 2, certain neurons get exited, you hear the 2 again certain other neurons get excited and these excitements of these different sets of neurons excite further neurons and these neurons return a value of 4. So, you see these if you therefore recall is extremely fast, extremely fast it happens just through those synopses but the question is will this particular signal excite the other neuron or not.

Say you are recognizing a particular person. When you are recognizing a particular person essentially you are getting cues from the face of that particular person. So, you get thousands and thousands of cues and those cues may be exciting some of your neurons inside your brain. Now the question is how much is the excitation? If the excitation is sufficient then it returns a value, if the excitation is not sufficient it doesn't return a value, so essentially that is how it happens.

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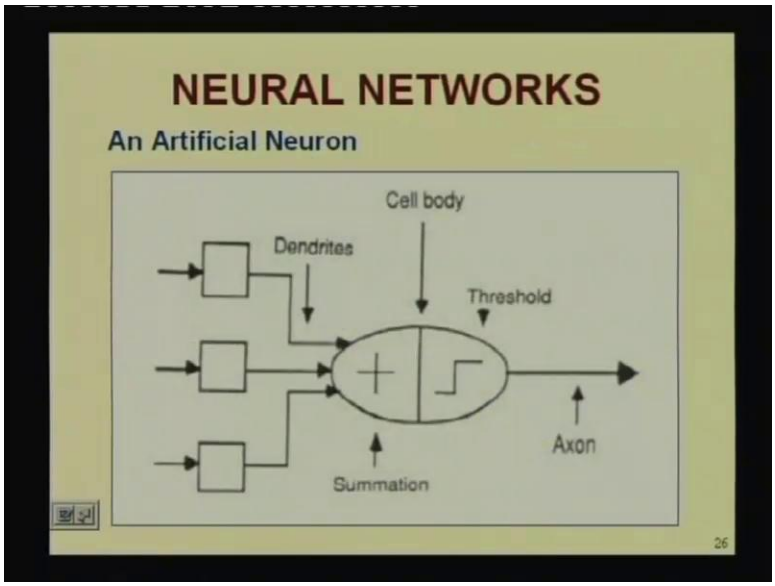


And from here an artificial neuron is thought of in this way that essentially there are two processes, a summation processes and a threshold processes. So, the dendrites are basically assumed as inputs they are coming and each input has got certain weights. So, you see these are the inputs and each input has got weight w 1, w 2, w 3 and these are the dendrites. First is the summation process is a total input that is there, this is the cell body and it goes through a threshold function usually put in the form of some kind of mathematical function. So, this is the axon, so what happens that if the signals are sufficient then the threshold is crossed and electrical signals is passed through the axon right that is how it actually happens.

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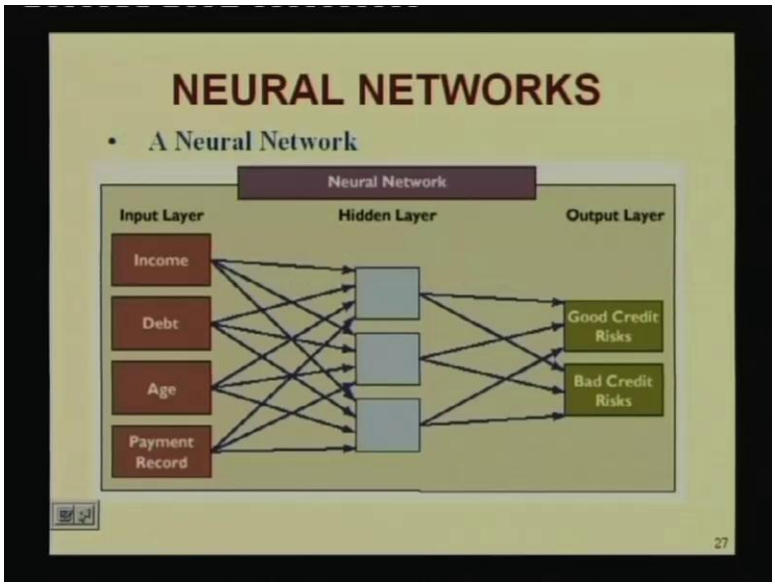


So, this is an example. Here you have an input layer, a hidden layer and an output layer in each layer you have a number of neurons and these neurons are suppose you have these inputs, date, age, payment record. So, when all these are sending certain kind of signals and that may excite certain neurons here and accordingly it may put sufficient weight to the good risks and bad credit risk. What exactly is done is these to be trained, the neurons are to be trained and with a certain number of values of income, date, age and payment record, the system is trained to return good credit risk or bad credit risk and after a sufficient amount of training through a certain amount of data, you can actually apply them to realistic situations.

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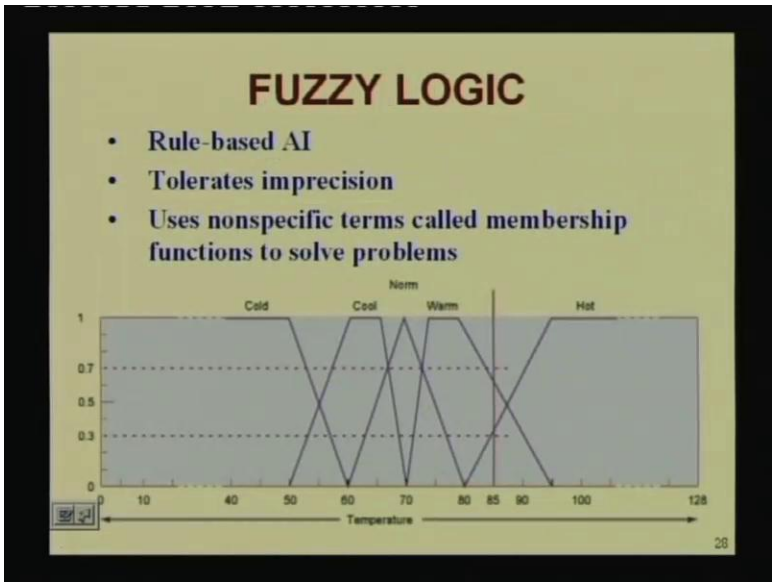


Finally the fuzzy logic. The fuzzy logic you can see that a simple example that it is also used in rule based artificial intelligence, tolerance imprecision uses nonspecific term called membership functions to solve problems. Here you can see that what is cool is the 50 degree cool or 70 degree cool in Fahrenheit terms. So, you see that 60 to 70 may also be called cool and also may be called normal all right depending on the how the particular person feels. So, what is cool to one person may be normal to another person but is normal to one person may be warm to another person that happens between 70 and 80, all right. So, between cold and cool there are also certain amount of overlap. So, this is essential you can call as fuzzy systems.

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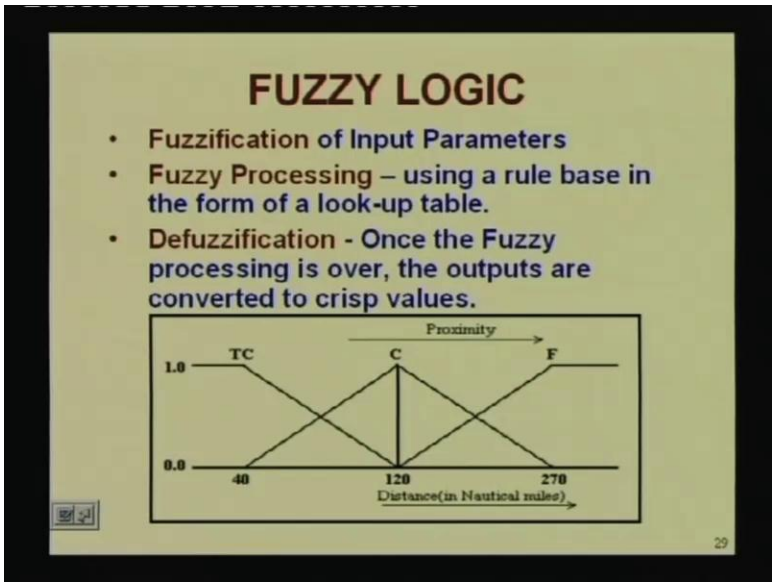


Usually, whenever we use fuzzy logic we have the processes like fuzzification of input parameters, fuzzy processing using a rule base in the form of a look up table and defuzzification, once the fuzzy processing is over the outputs are converted to crisp values. So, this is about the fuzzy logic.

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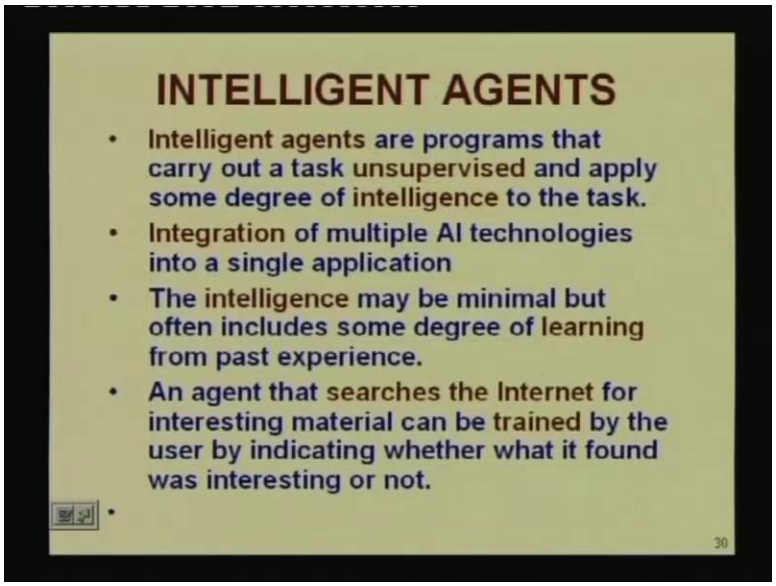

So, final slide that is about intelligent agents. These are programs that carry out a task unsupervised and apply some degree of intelligence to the task and essentially what happens they searches the internet, say some intelligent agent and if you get some interesting material it can be trained by the user by indicating whether what is found was interesting or not, all right. So, I stop here today. Thank you very much.