**Organization of Engineering Systems & Human Resource Management**
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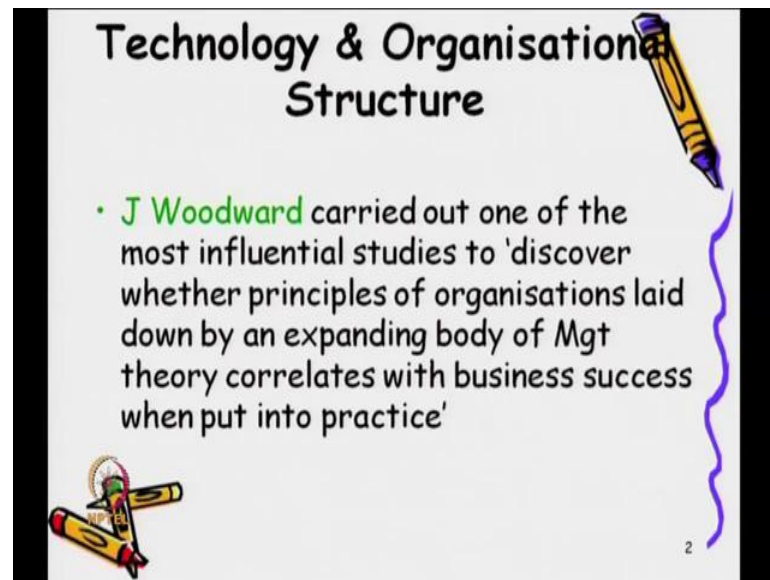**Indian Institute Of Technology, Delhi**

**Module - 2**
**Effectiveness and Performance**
**Lecture - 16**
**Socio-Technical Systems**

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Moving from the systems approach and analysis of the cybernetics dimensions to the study of socio technical systems. The approach of socio technical systems to the understanding of organization and human aspects of management of business engineering should really be a sort step. Also the word socio technical systems has been around for so long that it is simpler to communicate, but perhaps to that extent made little complex to understand. Because people may assume they know it all, when they may not actually be in full control of the implications of socio technical systems to organization theory and practice or to human resources management, well at least we can try.
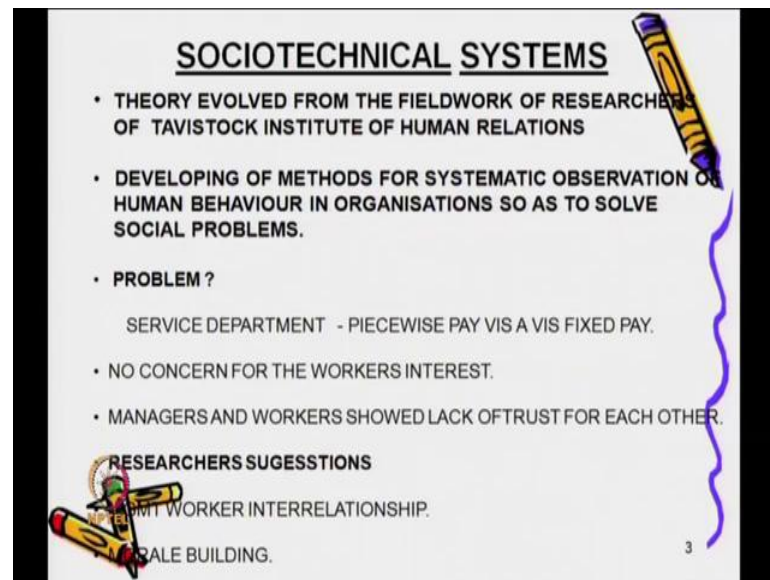
We can begin with some definitions, it is always soulful to look at definitions because once you look at definitions, then you can evoke the power of authority to say look it has been said before and at a certain level of learning. Quoting well established names is a good principle of conveying a point and in this presentation because of the much, weather beaten nature of the subject I intend to use that approach to a certain extent to convey the point better. To understand socio technical systems it is important to understand technology and organization structure.

In this study of technology and organization structure would require recognition of some contributions from John Woodward who carried out one of the most influential studies to discover. Whether principles of organisations laid down by an expanding body of management theory correlates with business success, when put into practice a very fundamental dilemma. Do principles of organizations as understood and practiced have a correlation with business success? It is something like asking such a fundamental question that the whole edifice could be pulled down if it was proved wrong. Will John Woodward studies themselves gave the answer to a certain extent.
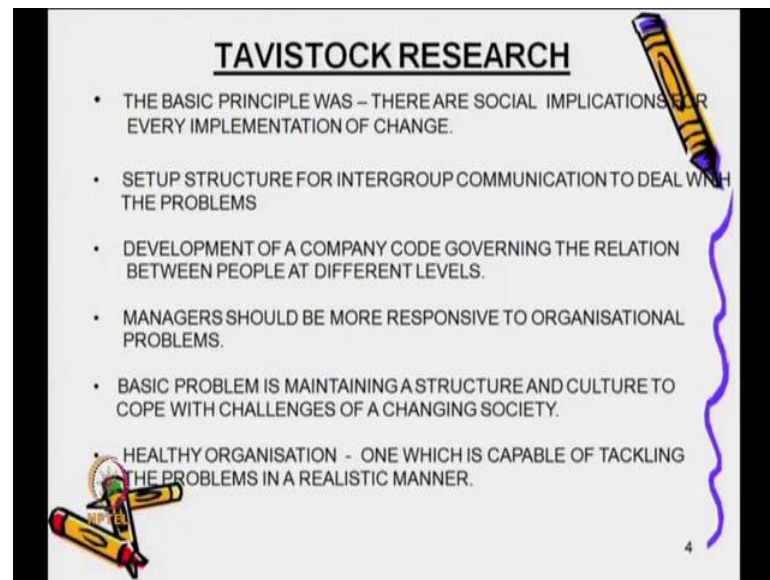
The socio technical systems theory evolved from the fieldwork of researchers of Tavistock institute of human relations. Developing of methods for systematic observation of human behaviour organisations was attempted, so as to solve social problems. What was the social problem of the organisations and what was the fieldwork of researchers from this institute, which was devoted to human relations, but made its mark more by looking at the technological variable affecting human relations? The problems which they tried to tackle was in the service department, the piecewise pay dividends vies a vies fixed pay or does fixed pay produce better performance as compared to piecewise?

There were other questions, does showing no concern for the workers interest, yield results or the opposite of it, does showing concern to workers interest yield results? Managers and workers showed lack of trust on each other. Now, is lack of trust more conducive to work performance or creation of trust is more conducive to work performance? Researchers suggested a whole range of possibilities in interrelationships and a lot of effort was done for morale building. We will look into some of these as we go along.
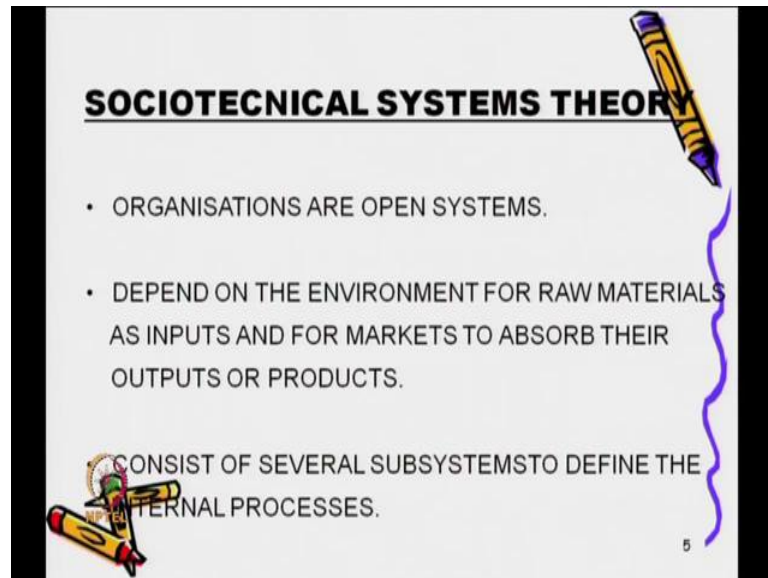
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The Tavistock research, the basic principle was there are social implications for every implementation of change. Now, this was a basic principle on which Tavistock people researched. It was suggesting that you cannot have change without having social fallouts, especially technical change. Setup structure for intergroup communication to deal with these problems, we need modification; because the structure which has been set up for inter group communication may not be conducive to handling the issues of change. It also felt that one needs to have a company code governing the relationship between people at different levels.

A protocol as it were establishing social relationships and establishing some kind of unreturned, unstated understanding total approve the same thing as saying that they were reluctant to state it in as many words. But relationships between people at different levels need to be governed through a code; mangers should be more responsive to organisational problems. Now, this is a truism, this can be said at any time, but that was not what the research was supposed to explore.

The research was supposed to explore was the level of responsive to organisational problems and some very interesting findings came. Basic problem is maintaining a structure and culture to cope with challenges of a changing society, again a truism. Healthy organisation is one which is capable of tackling the problems in a realistic manner.

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There researches established that socio technical systems are determined by the character of the organisation and the character of the society. You will recall by presentation to you on organisation design where I gave you a circle the four pillars showed to you how organisation structure was at the heart of it. What were the variables in the organisation and then I went on to explain to you a different elements of systems theory, but here was a theory which said organisations are open systems. It felt organisations are open systems because the boundaries do not really apply when people enter the organization, they carry the culture off the job and make it culture of the job.

Now, if the culture off the job is made culture of the job, then it cannot be a closed system. Now, clearly you will notice that in management theory and practice, there are variations in positions propounders of theory take, which is essentially a way of saying that there is no such thing as a right theory or a wrong theory, the best theory is the theory which works. Very often you will be asked to take a position on these different theories depending upon your own life experiences, be that is it as it may.

So, should technical systems theory assumed that the environment for raw materials as inputs and the markets to absorb their outputs or products also make organizations an open system? Because organizations depend upon environment and environment is from where raw materials come and that is where output or products are absorbed, it consists of several subsystems to define internal processes. Now, again this is the perspective

from socio technical systems theory and those of you, who recall will find that there are other propositions which called organisations a closed system.

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Now, here is a schematic diagram of the organisational system which helps you to see the relationship. And the interplay amongst various elements which affect an organisation, which constitute an organisation and therefore are basic, to determining whether the organisation is a closed system or an open system? It is possible that in certain incarnations organisations are called closed systems and in certain incarnations organisations are open systems.
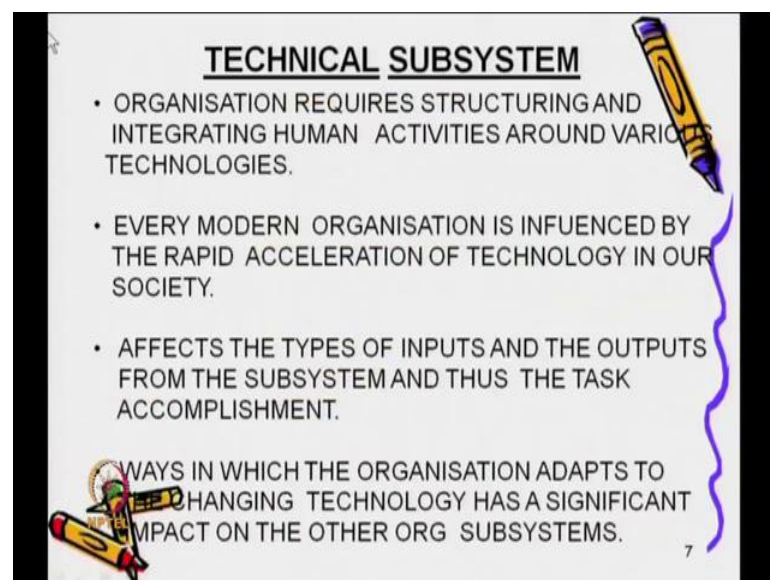
Let us go along this in an clockwork mode, in a clockwise fashion, the technical systems consist of task requirements, knowledge, techniques, layout of facilities, machinery and equipment, information, these are the technical systems of an organisation. The structural subsystem consists of tasks, workflows, work groups, authority, information flows and procedures. Now, in a manner of speaking we have covered much of this, so we know what the technical system quantitates.

We have also covered much of structural subsystems; we have looked at task, workflows, authority and more. Then there are the psychological subsystems which we have earlier called social subsystems, it consists of h r, attitudes, motivation, leadership, influence systems. Finally there are goals and values subsystems of culture, philosophy, overall goals and individual goals. Now, just as earlier we integrated the organisational

variables and the social variables into management role and function, here we integrate these two boxes, if it can be so called and these two clusters, if they can be so called into the managerial subsystem.

What does the managerial system subsystem then consists of? It consists of goal setting, which we have repeatedly maintained is where it goes back too. If you look at the creation of an organization the reason of (( )) an organization, planning and planning follows from goal setting, assembling, managing resources, organising activities and implementation. Now, this is an organisational system. I will leave it there briefly, so that you can absorb the new answers of the same to carry the subject matter forward.

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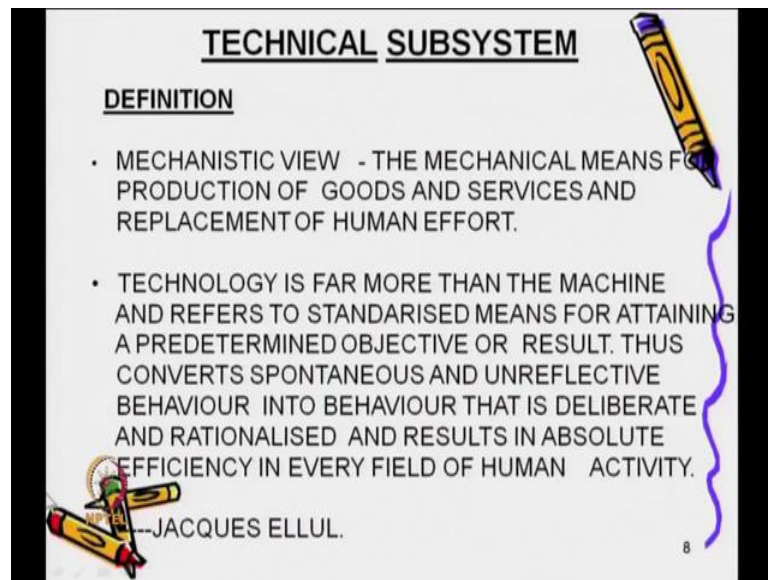


The technical subsystem has certain manifestations; organisation requires structuring and integration human activities around a variety of technologies or various technologies. Every modern organisation is influenced by the rapidly acceleration of technology in our society. It affects the types of inputs and the outputs from the subsystem and thus the task accomplishment, ways in which the organisation adapts to the changing technology has a significant impact on other organisational subsystems.

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Now, in the presentation that I have made with you so far, it becomes necessary therefore to get some definitions again right, thus technical system subsystem as a definition. The definition includes a mechanistic view; remember we had already talked of view organismic view, now we talk of the mechanistic view. The mechanistic view determines the technical system, the mechanical means for production of goods and services and replacement of the human effort is the mechanistic view.

Technology is far more than the machine and refers to standardised means for attaining a predetermined objective or result, thus converts spontaneous and unreflective behaviour into behaviour that is deliberate and rationalised and results in absolute efficiency in every field of human activity. This is Jacques Ellul talking one of the classical figures on organisation, management in fact some of you may have heard of his book, a semi classic or perhaps a classic in its own right.

The changing culture of a work factory, the definition which Jacques Ellul gave has to do with a proper understanding of technology, which is not confined to just the machine, but also standardised means for attaining a predetermined objective of results. So, the concept of the word technology has undergone expansion, a standardised means of attaining a predetermined objective, this convert's spontaneous and unreflective behaviour into behaviour that is deliberate and rationalised and results in absolute efficiency in every field of human activity.

To take it forward, one will have to grasp elements which are accelerating technology as well as the dangers of technology and that together will put the discussion on socio technical systems perspective in order. What are the factors accelerating technology? Gradual substitution of human effort by technology, because science and technology has become pervasive in modern society and if nothing else the concept of a robo, which carries out most of the functions, which require movement of the human body in the name of reducing drudgery is perhaps best answered by the phenomenal rise of fitness shops.

So, on one side the chores are cut down to reduce human effort and on the other side the expenditure is raised in the name of raising the levels and the standards of living. Everyday life is made more expensive by going to fitness shops to indulge in workouts and get exercise. One wonders whether there is not a case for creating a daily schedule which is a little more balanced, so that the gadgetry does not take over our lives as completely as it has in certain ways and nor is it necessary to waste money working out what would have been a natural exercise of the body, if we did not adopt so many labour saving devices.

This has impacted the social structure and culture, lifestyles have changed, the meaning of entertainment has changed, and even the setup boxes undergo a change periodically. So, you go on spending electronics has taken over music in a manner unprecedented. In

fact, one wonders how long a Sithara or a Tabla or for that matter the humble Harmonium itself will prevent the onslaught of the electronic decimination of the sound, perhaps at the moment it sounds a comment in a light of vain, but the possibility which cannot be ruled out totally. The relevant implication of that for the presentation which I am trying to share with you is; that acceleration of technology has affected lifestyles.

The socio technical system is not just a matter of organisations anymore. The socio technical systems is a matter of everyday experience, automation has been replaced human decision making even in the control phase. Effective utilisation of technical technologies require the development of complex organisations and this is the result which we can see in organisations of the coming in of the socio technical systems in a large way. To put it quite simply, the socio technical systems has generated a new breed of organisations, a new characterization of organisations, organisations as we know today are not the organisations which existed twenty years ago.

The technological variable has not only replaced the human variable in very many ways, but a lot of the thinking has become programmed up to a point, where the human element had been almost declared redundant. Declaring it redundant has its own dangers because a newer possibility beyond the boundary of the programmed set of options is ruled out, so it drives out the humanistic and the social considerations. The total integration of man into technical systems, which is the socio cultural structure at times threatens the identity of the human resources in decision making. The challenges (( )) are changes in values and goals as a result of this, there will be challenges to profit from its opportunities and it has its own dangers.

Interaction between the technical and the psychological systems is a determinant of relationships between technology and society. Therefore socio technical systems has a much wider connotation than what we found when we were taking a look at the design of organisations. We were thinking of combining the social and the organisational variables through managerial role and behaviour. This leads us to a very important thought, what is the classification of technical systems? The basis of primary schools, hospitals, unions is a classification which has often been used to draw its features from the technical system with which it operates, because the technical system is made its basis.

Industrial organisations also have been classified on the basis of technical subsystems; small batch, mass mass production and continuous processes whole have been incorporated. But there is a definition of Thompson which comes to mind, which I think is worth noting in this context. It is of the view that long linked technology involves serial interdependence between various production units, which is perhaps best illustrated by fully automated assembly lines; this is the long linked technology. Then there is the mediating technology, the mediating technology involves joining of clients and customers, otherwise independent.

For example, banks may be joined, banks may be joined with customers, banks may be joined with the corporate, it can also apply to post offices and the lists of mediating technologies are large. Then there is the intensive technology, the intensive technology deals with specific problems and this manifests itself in r and d situations, in the way progressively hospitals are working.

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But the two primary dimensions to keep in mind is the extent of uniformity and non uniformity that this brings. So, what is it that is being suggested here? What is being suggested here is that it is possible, that the concept of socio technical system itself being an evolving one affects the functioning of an organisation in a dynamic mode. The socio technical systems which affected the organisation thirty years ago, is not the socio technical system which is affecting the organisation today. Therefore, there is a need for

a continuous study of the impact of the socio technical system indigenous to an organisation, on the characterization of the organisation.

Therefore, the distilling of the management principles which are best applied to the functioning of that organisation, be that as it may, it is obvious that the socio technical systems approach has deeper roots and much wider ramifications that has been widely assumed to be so far. There are certain problems in adapting to the new technological component it does not come easy and what are the problems in the technical adopting of the new technological subsystems? In production processes you find that whole set of specializations are being rendered redundant.

It is not just a principle of redeployment, redeployment can only take place when the fundamental technology involved remains broadly constant and it is a question of repositioning. But there is no redeployment possible when a whole profession has been wiped out. Like for example, to go back to everyday illustration, the entire profession of technicians who use to send telegrams are today rendered obsolete or (( )) in India. Now, there is no question of redeploying them, it is a question of reemploying them and anybody who has looked at recruitment selection knows that they will have to be given a set of skills to be employed and those skills may be very different from the skills which earned their livelihood not so long ago.

So, the problems caused by technical subsystems and their evolving, growing, speeding character of change are tremendous in terms of organisational work, in terms of the social environment where the organisations are embedded, in terms of man power planning. It is difficult to evade the conclusion that socio technical system needs to be comprehended and understood far better before one can hope to control it or work through it. Integrating and coordinating of different technologies within the organisation system is also not easy. Integrating and coordinating the different types of technologies shows a need of awareness of a very wide spectrum.

Considerable hands on experience without which the incoming of technology or that equipment in the organisation may be of little value, let me give you an illustration, though use of a computerised system even in its simplest incarnation, that is e mail is ever productive to the extent it was meant to be. If in the ultimate analysis the executive does not operate the computer himself, as I said in its simplest incarnation of receiving e
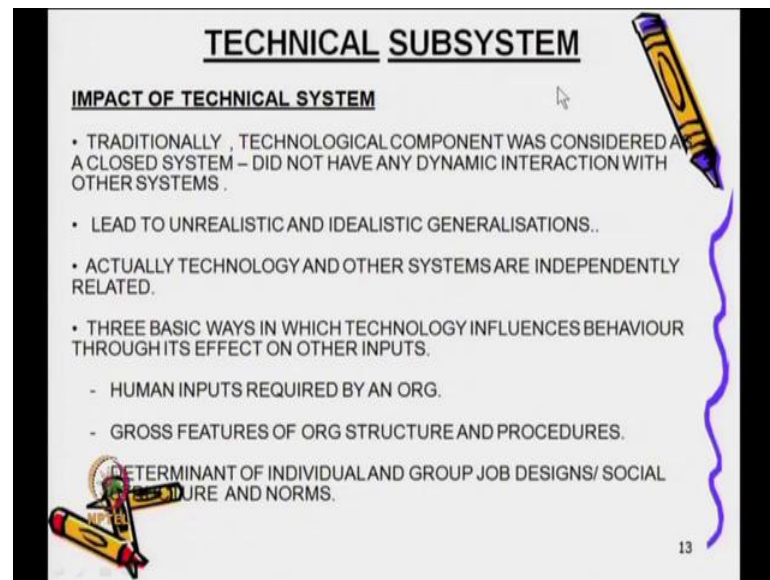
mails or sending e mails, but instead the entire e mailing activity is handled by the secretary.

Of course, one is not referring to the more sophisticated uses of computers, the desktop, the software, there need for aiding managerial decision making those require even a higher level of competency. Because if after executive, after executive has just delegated the requirement of having e mails being downloaded and that the printed version being put up to him, then you might not as well moved on to the e mail he might have stayed on with electronic typing and faxing. In either case the investment in technology would have been far less and therefore you would have had more money to use, to spend, to invest elsewhere.

Integration and coordinating at different technologies within the organisation therefore become a pressing deed and like everything else. Organisations may also need a technological spectrum, but we do not want to open that debate here. We are trying to look at the socio technical systems from the very limited perspective of trying to understand how?

The socio technical system impacts the effectiveness parameter of an organisation. The socio technical system is an integral part of work culture and the functioning of an organisation, that there may be problems in the technical subsystem, that there may be problems of adoption of the technology, that there it may require a very different type of skill formation. Our questions apart, but these are necessary concomitants of the analysis of the socio technical systems.

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Let us look at the technical subsystems and let us look at the impact of the technical systems. If you have looked at the impact of the technical system and read through the slide, the debate which seemed to around the corner has erupted. If traditionally the technological component was considered a closed system, that it did not have any dynamic interaction with the other systems, this is no longer. So, an indication of the changing times, but if this was so it would have lead to an unrealistic and idealistic generalisation.

Actually technology and the other systems are independently related, at times beyond the organisation. Take for example, the satellite and the beaming back of images to earth, that can be used for imaging; this can be used for various scientific purposes I do not want to get into that. But the relationship of that technological system is not only at an inter organisational level, that technology transcends the organisational boundaries and are independently related. The three basic ways in which technology influences behaviour, thoughts and other inputs are as the diagram shows.

Human inputs required by an organisation, gross features of organisation structure and procedures and determinants of individual group and job design is therefore the focus goes back to the human inputs. We shall be paying more attention to this, features of organisation structure and procedures, which we have been studying at considerable

detail and determinants of individual and organisational job designs which we have also studied in detail. So, what is the position now we are taking?

The position we are now taking is, vilinely the socio technical systems affects and gets affected by human inputs, the structure and procedural aspects of the organisation, the job designs and the social structure and norms of the organisation and indeed in turn is affected by it. If that is so, then the socio technical systems is indeed a dimension of organisational studies and human resource management analysis of far greater ramification and dimension, than it has been hither to (( )) in organisational studies.

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This requires that classification of technical systems be done with reference to the sector, with reference to the basis of making technical systems as the core, with reference to industrial organisations of size, small batch, mass production, continuous process and the possibilities of classification are endless. The implication of this for our purposes is to recognise a simple dimension. No classification of the technical systems is all pervasive, no classification of technical systems responds to all requirements; no classification of technical systems is beyond questioning.

Then the question arises how to go about it? The way to go about it is to realise that classifications may vary, classifications are relevant only to the extent that they fulfil an organisational need. Identification of the need therefore, is the most important precursor steps before a classification of technical systems can be undertaken. This is what I call

looking at technical systems from a managerial perspective for developing their classification.

The managerial dimension becomes the determining factor and makes it both a challenge and an extremely satisfying operation, if it can be done satisfactorily. But the news I do not know whether it is good or bad you do not have a choice you will have to classify organisations. Also by technology and that cannot be as per a pre described standard formula.

Thompson for example, long linked technology as a factor of involvement with a with a series of interdependencies between various production units. Now, if we link technology in with a situation which involves serial interdependence between various production units, then full automation assembly line is a major revolution. Yes a way of classifying technology, but to my mind a simplified one, because it narrows down the problem only to the production aspect. You heard me talk earlier on of the mediating technologies, which involves joining of the clients and the customers, otherwise independent ones also get linked.

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It is important to realize that technical systems leave an impact upon structures. I would like you to read this slide carefully to understand how the researches of Joan Woodward were used to understand technical subsystems better and what is the impact they made upon structures? The message which comes out is clear, the direct correlation between

technology and organisation structure according to Joan Woodward was established. The consequences was length and line of command was increased in vertical levels, the span of control was also increased salaries and wages went up, the managers per ratio increased, staff worker ratio larger, supervision level higher.

So, socio technical systems if adopted as the correct purpose of designing and operation of an organisation was affecting many factors six of which are limited here. In fact even the system of production would require a different structure and that is the real implication of the socio technical systems for work situations. We will carry the discussion further.