Organisation Theory/Structure and Design
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Module - 17
Lecture - 17
Technology - II

Welcome to Organization Theory/Structure and Design. Now, we will talk about module 17. So, as you can see from this slide, module 16 and 17 are dedicated to studying and understanding Technology. So, we have done module 16, now, we will start with module 17 and let us see what are the things that will be covered in this module.

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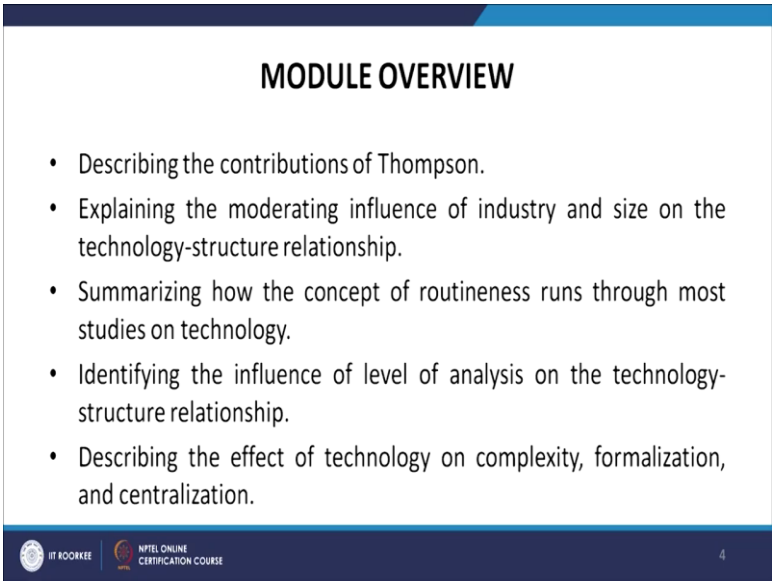

So, we will start with describing the contribution of Thompson. Then, explaining the moderating influence of industry and size on the technology-structure relationship. Then, we will talk about summarizing how the concept of routineness runs through most studies on technology. Thereafter, identifying the influence of level of analysis on the technology-structure relationship and then, we will describe the effect of technology on complexity, formalization, and centralization.

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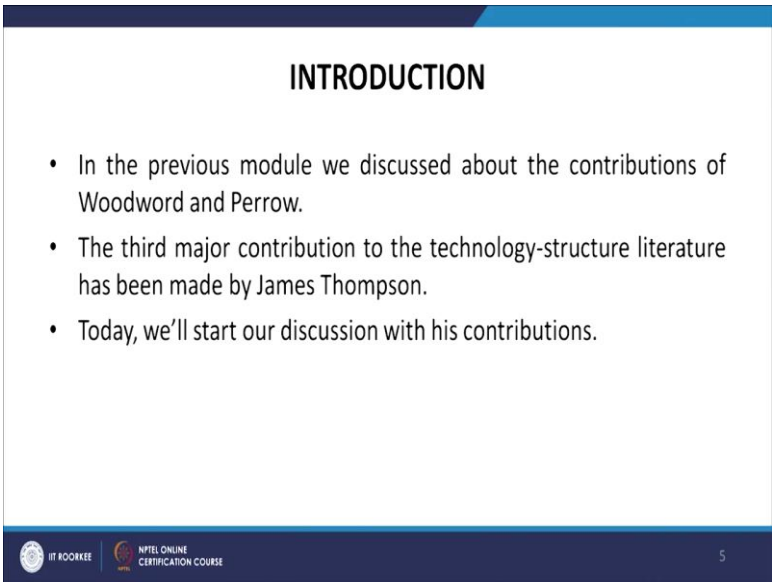

To start with, in the previous module, we had discussed about the contributions of Woodword and Perrow. The third major contribution to the technology-structure literature has been made by James Thompson. Today, we will start our discussion with his contribution.

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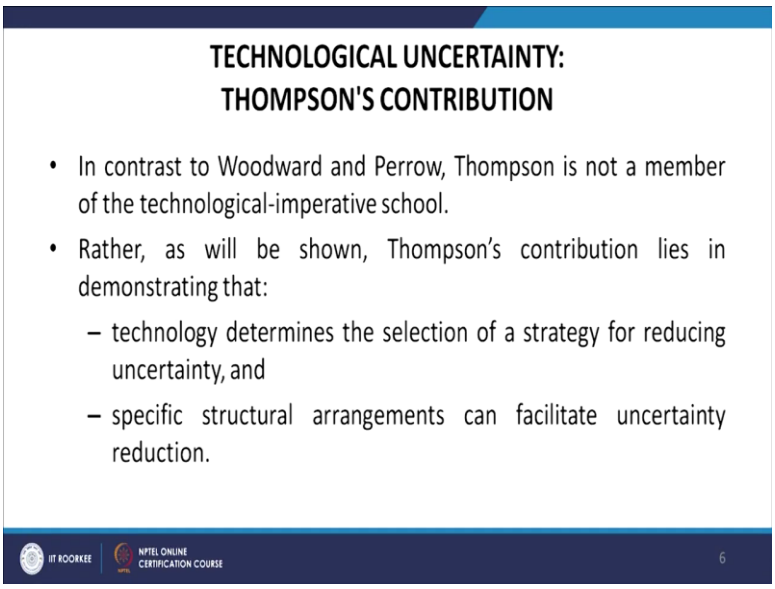

So, now we are talking about technological uncertainty and Thompson's contribution in that. In contrast to Woodward and Perrow, Thompson is not a member of the technological imperative school. Rather, as will be shown, Thompson's contribution lies

in demonstrating that one, technology determines the selection of a strategy for reducing uncertainty and its specific structural arrangements can facilitate uncertainty reduction.

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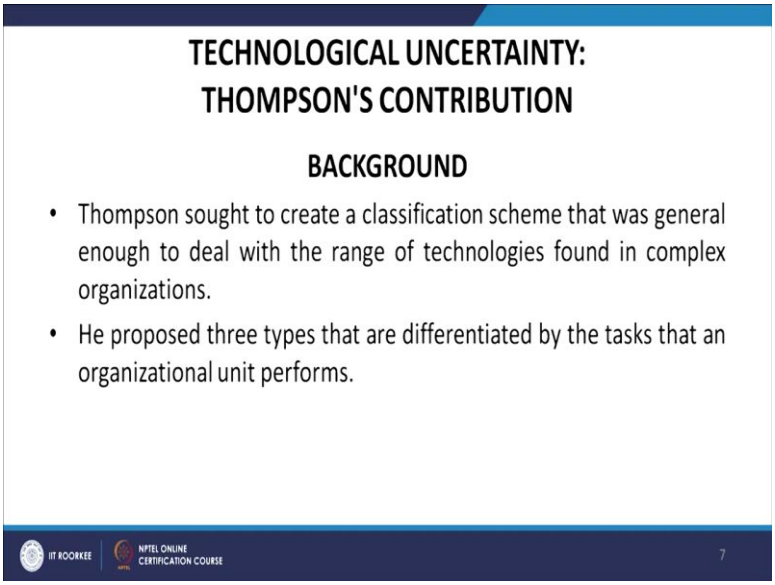

Now, the background of his study was that Thompson sought to create a classification scheme that was general enough to deal with the range of technologies found in complex organizations. He proposed three types that are differentiated by the task that an organization unit performs.

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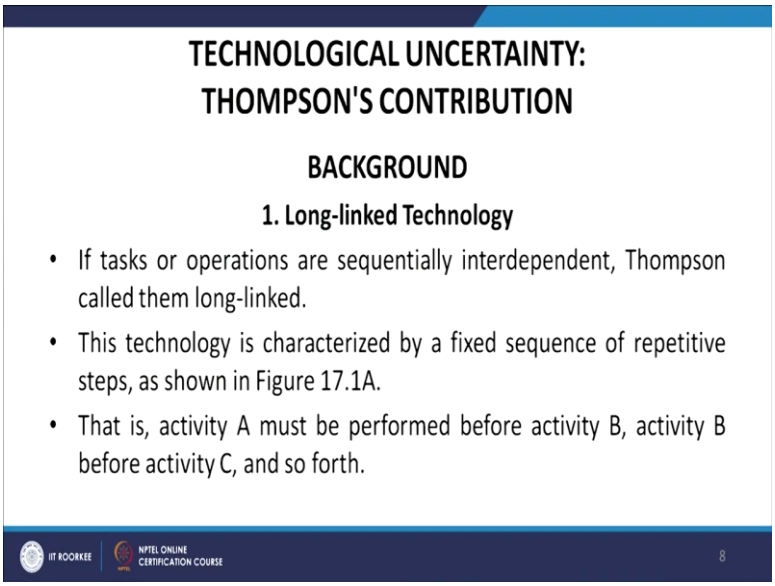

The first is long-linked technology. If tasks or operations are sequentially interdependent, Thompson called them long linked. This technology characterized by a fixed sequence of repetitive steps is shown in figure 17.1A. That is, activity A must be performed before activity B, activity B should be performed before activity C and so on so forth.

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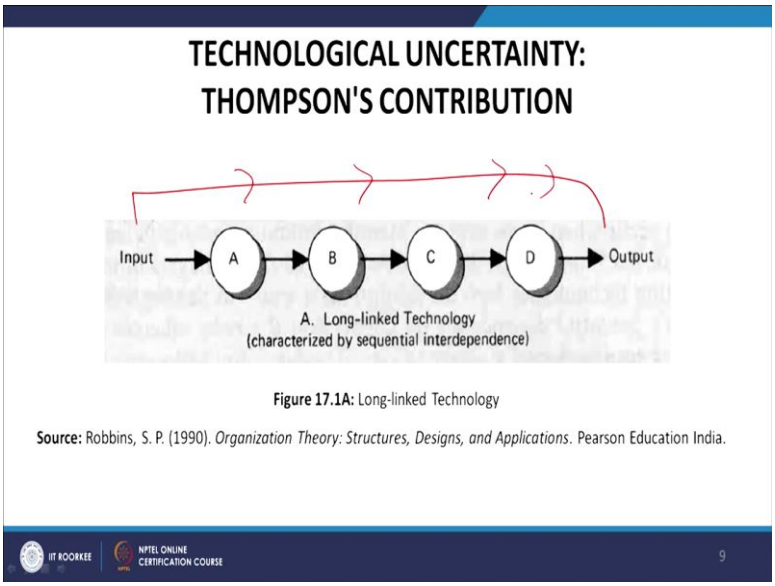

So, this is what a long-linked technology looks like. So, the input comes, it passes through A, moves on to B, then it moves on to C and then to D and maybe E and F etc. and then, this output comes passing by all these stages. So, this is called as long linked technology.

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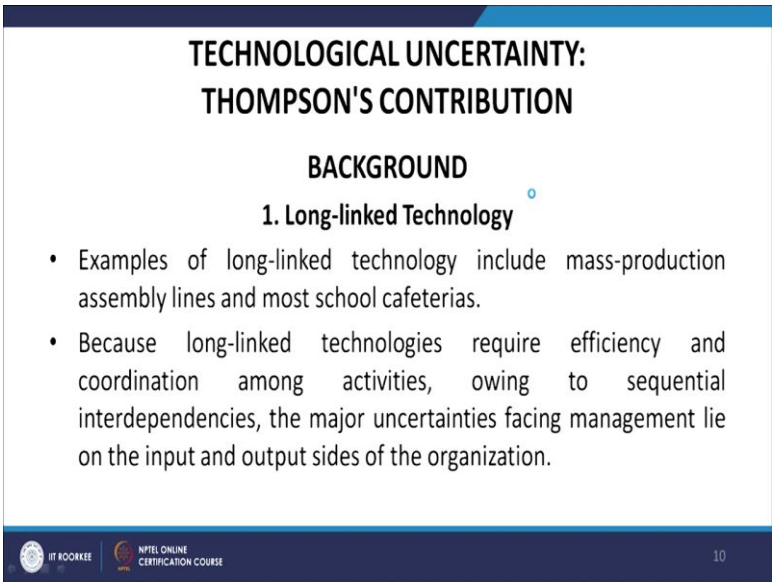

Examples of long linked technology include mass-production assembly lines and most school cafeterias. Because long linked technologies require efficiency and coordination among activities, owing to sequential interdependencies, the major uncertainties facing management lie on the input and output side of the organization.

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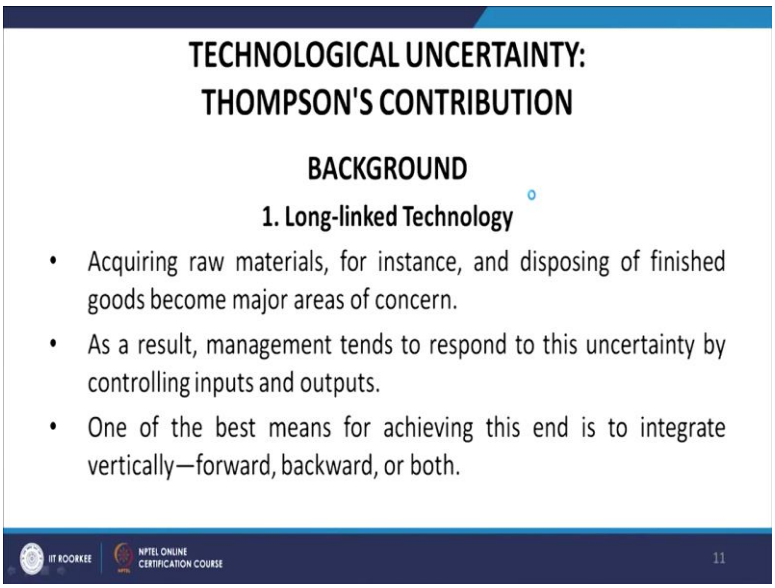

Acquiring raw material, for instance and disposing of finished goods becomes major areas of concern. As a result, management tends to respond to this uncertainty by

controlling inputs and outputs. One of the best examples for achieving this end is to integrate vertically-forward, backward and both.

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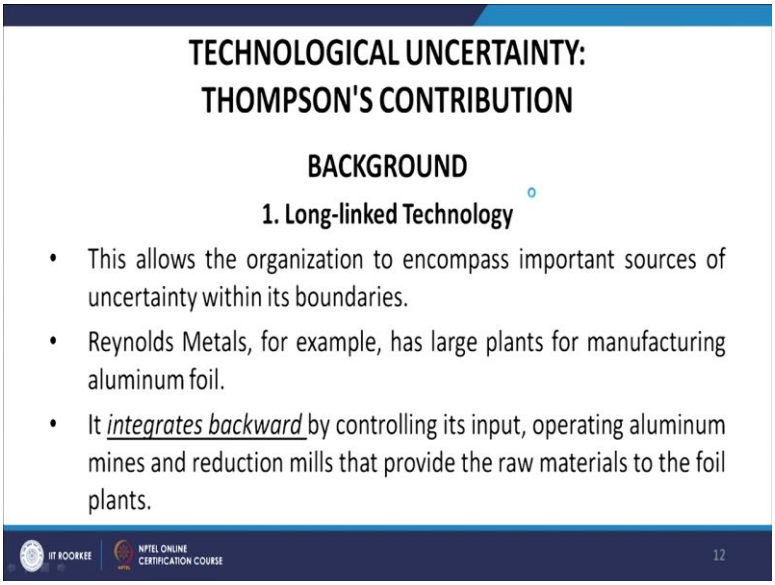

This allows the organization to encompass important sources of uncertainty within its boundaries. Reynold Metals, for example, has large plants for manufacturing aluminum foil. It integrates backwards by controlling its inputs, operating aluminum mines and reduction mills that provide the raw material to the foil plants.

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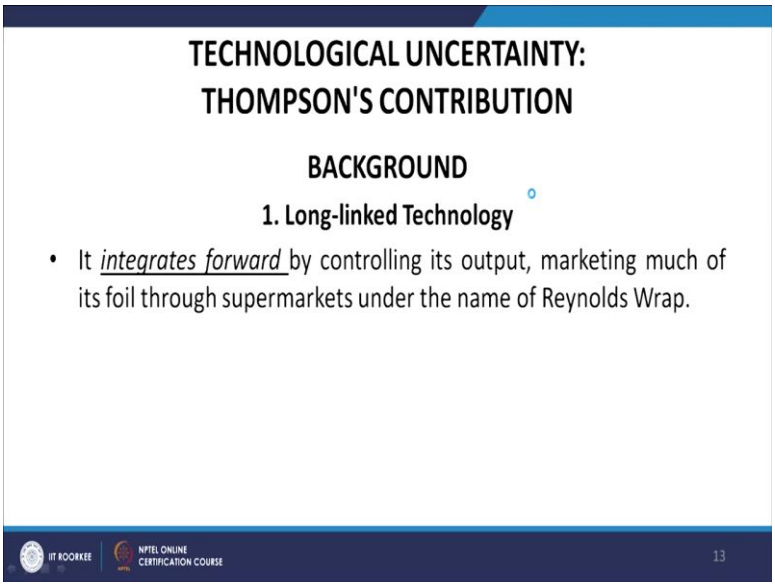

It integrates forward by controlling its output, marketing much of its foil through supermarkets under the name of Reynold wrap.

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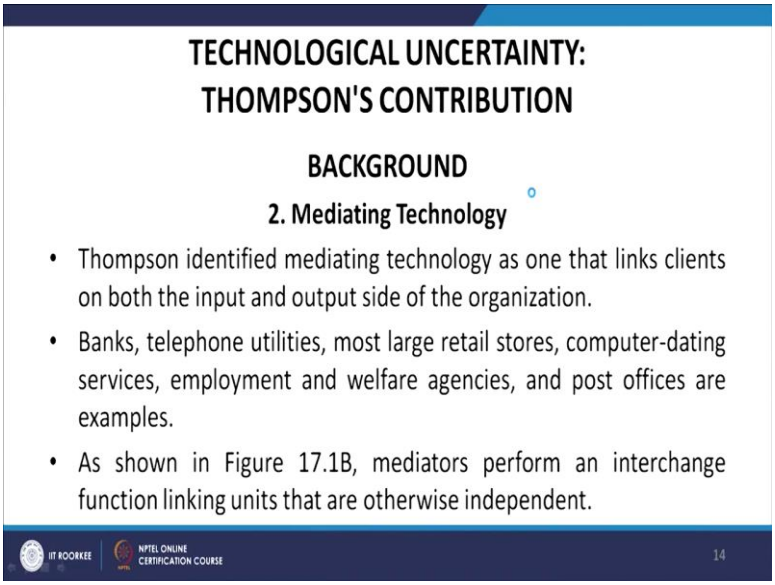

The second issue is the mediating technology. Thompson identified mediating technology as one that links clients on both the input and the output side of the organization. Banks, telephone utilities, most large retail stores, computer-dating services, employment and welfare agencies and post offices are examples. As is shown in figure 17.1B, mediators perform an interchange function linking units that are otherwise independent.

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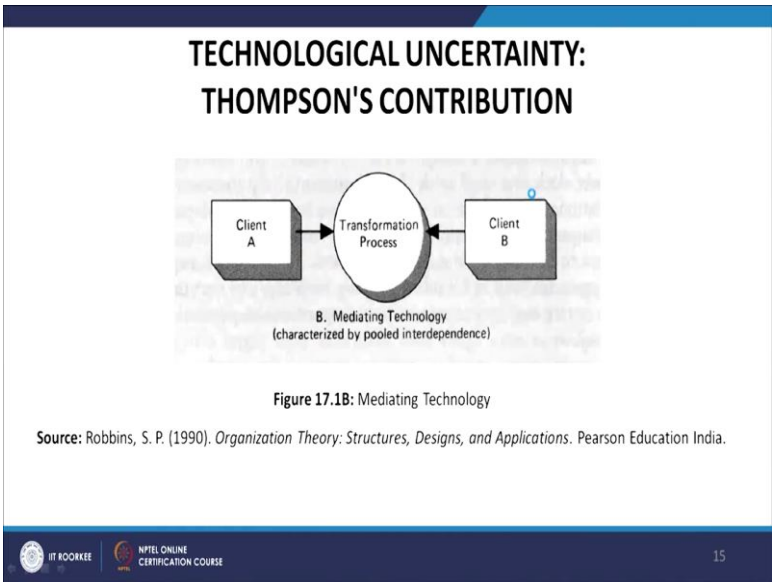

So, this is how a mediating technology looks like. There is a client A, then transformation process and then client B.

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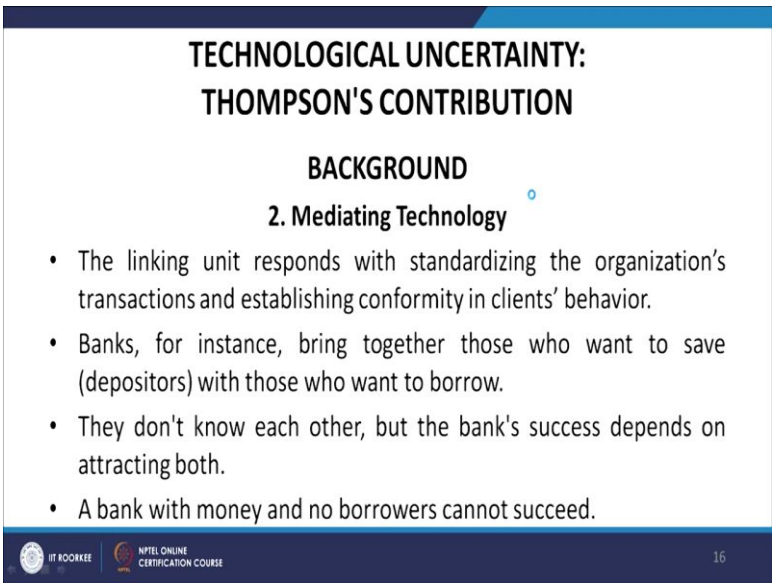

The linking unit responds with standardizing the organization's transactions and establishing conformity in client's behavior. Banks for instance; bring together those who want to save, that is, depositors, with those who want to borrow. They do not know each other, but the bank's success depends on attracting both of them. A bank with money and no borrowers cannot succeed.

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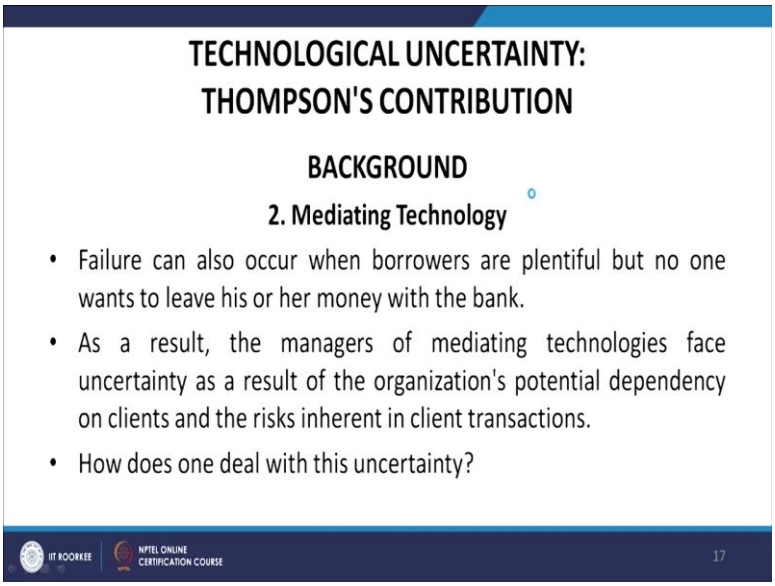

Failure can also occur when borrowers are plentiful, but no one wants to leave his or her money with the bank. As a result, the managers of mediating technologies face uncertainty as a result of the organization’s potential dependency on clients and the risks inherent in client transactions. How does one deal with this uncertainty?

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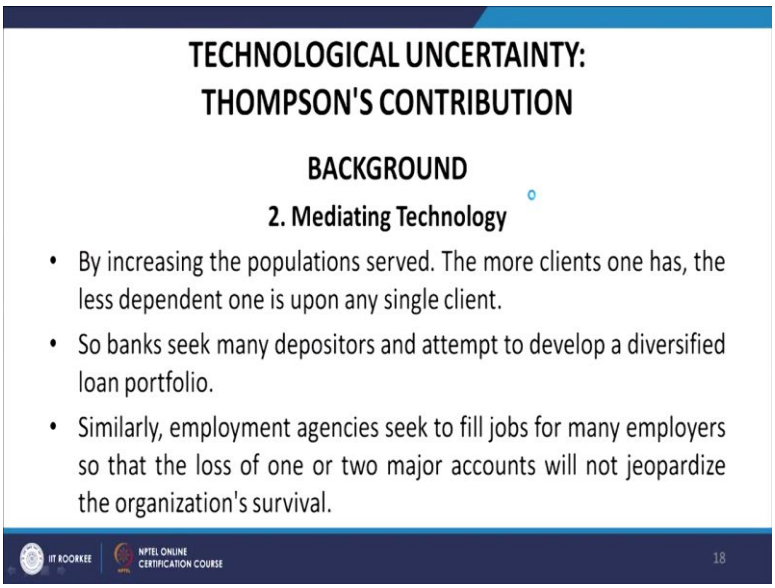

By increasing the population served. The more client one has, the less dependent one is upon any single client. So, bank seeks many depositors and attempt to develop a diversified loan portfolio. Similarly, employment agencies seek to fill jobs for many

employers so that the loss of one or two major accounts will not jeopardize the organization's survival.

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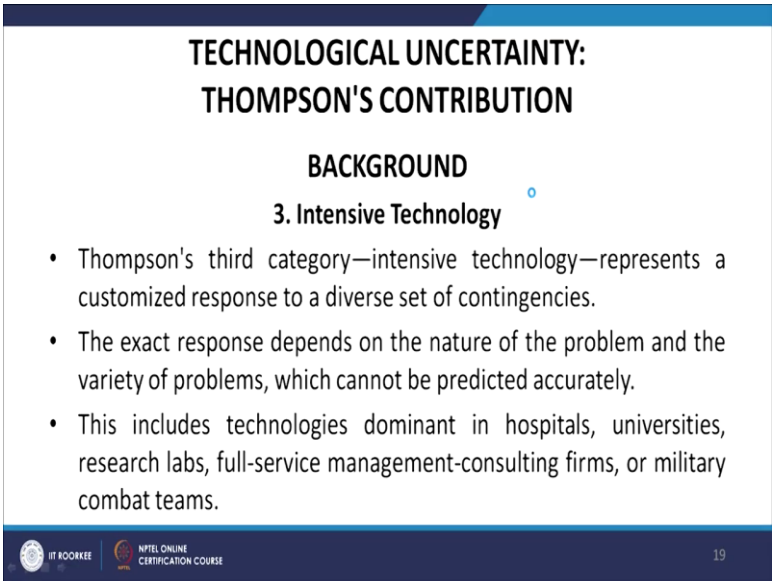

The third is intensive technology. So, Thompson's third category that is intensive technology represents a customized response to a diverse set of contingencies. The exact response depends on the nature of the problem and the variety of problems which cannot be predicted accurately. This includes technologies dominant in hospitals, universities, research labs, full-service management-consultancy firms, or military combat teams.

The intensive technology is most dramatically illustrated by the general hospital. At any moment an emergency admission may require some combination of dietary, X-ray laboratory and housekeeping or hotel services, together with the various medical specialties, pharmaceutical services, occupational therapies, social work services and a spiritual or religious services.

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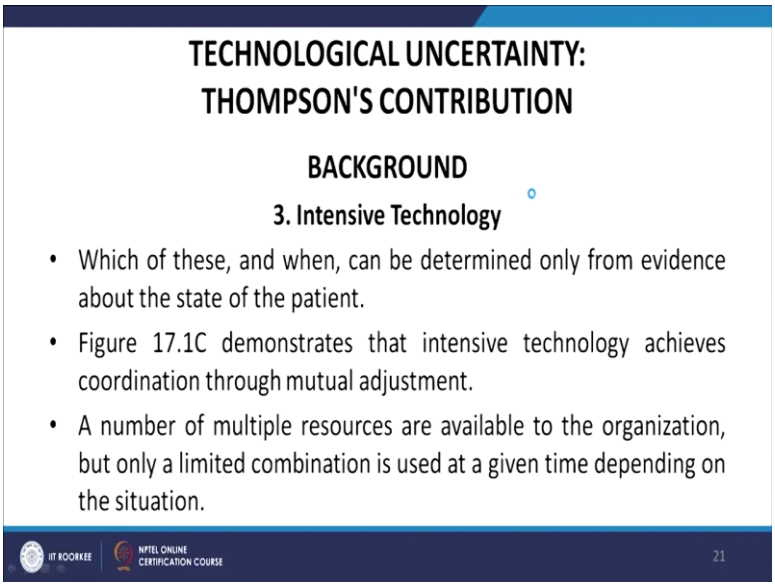

Which of these, and when, can be determined only from evidence about the state of the patient. So, figure 17.1C will demonstrate that intensive technology achieves coordination through mutual adjustments. A number of multiple resources are available to the organization, but only a limited combination is used at a given point depending on the situation.

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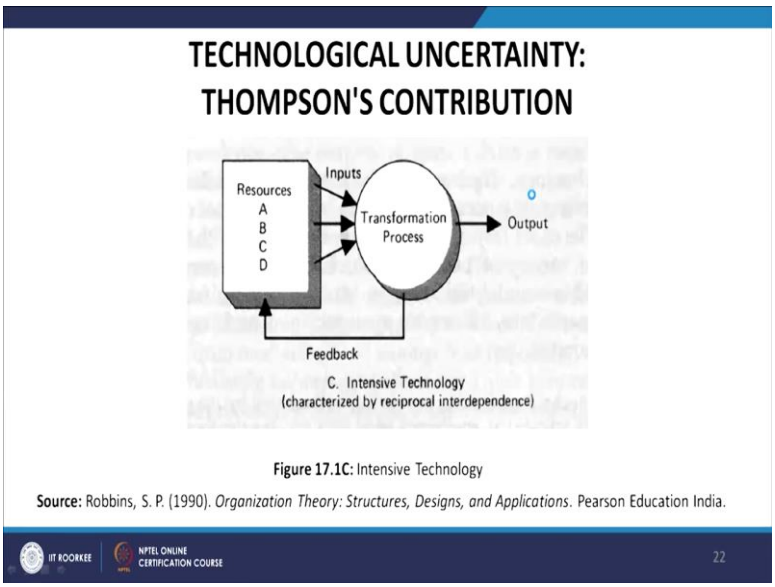

So, this is how this intensive technology looks like. On the left-hand side, we have lots of resources A, B, C, D, then these inputs they go into the transformation process and then,

this output comes and the feedback is going from transformation process to the resources.

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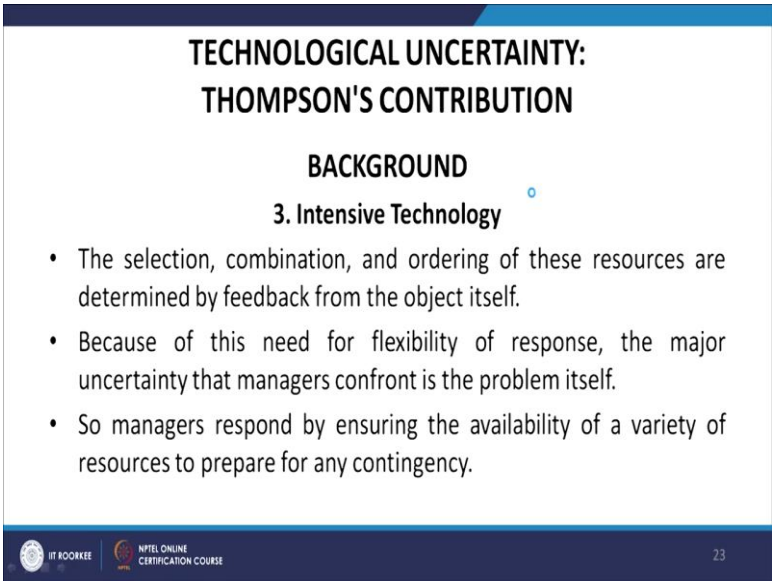

The selection, combination and ordering of these resources are determined by feedback from the object itself. Because of this need for flexibility of response, the major uncertainty that managers conferred is the problem itself. So, managers respond by ensuring the availability of a variety of resources to prepare for any contingency.

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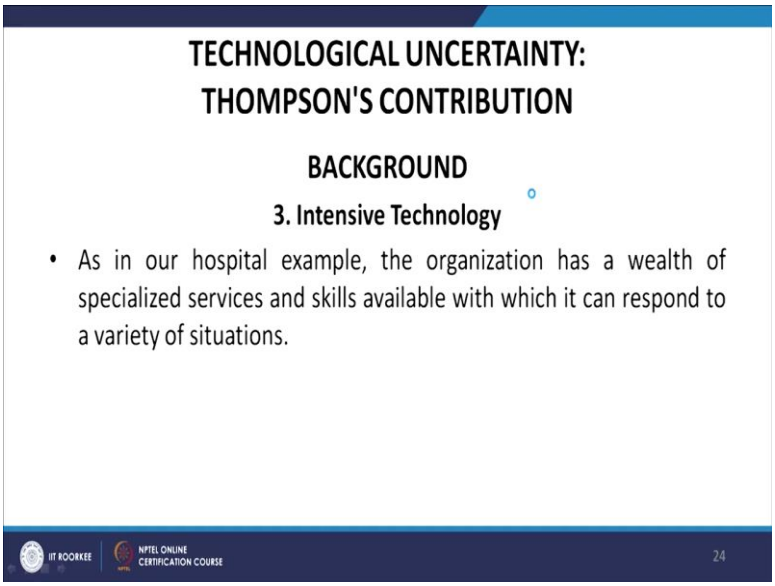

As in our hospital example, the organization has a wealth of the specialized services and skills available with which it can respond to a variety of situations.

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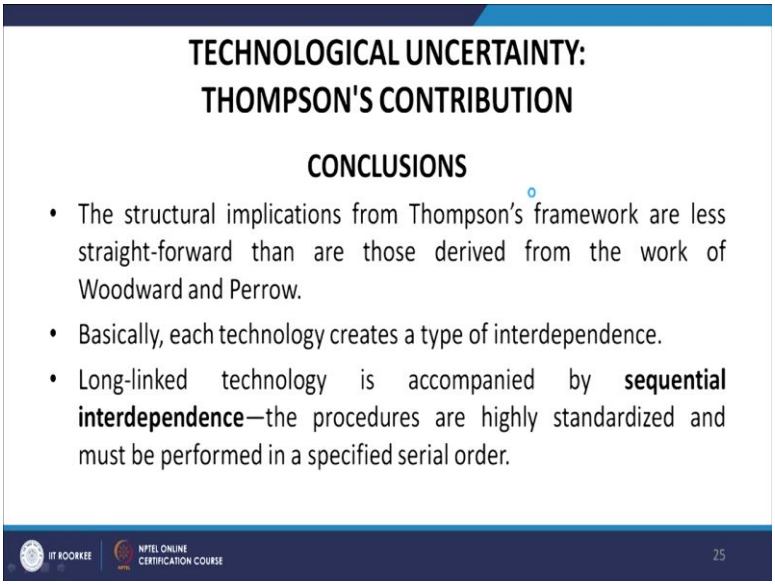

So, in order to conclude the Thompson's contribution, the structural implications from Thompson's framework are less straightforward than are those derived from the work of Woodward and Perrow. Basically, each technology creates a type of interdependence. Long linked technology is accompanied by a sequential interdependence - the procedures are highly standardized and must be performed in a specified serial order.

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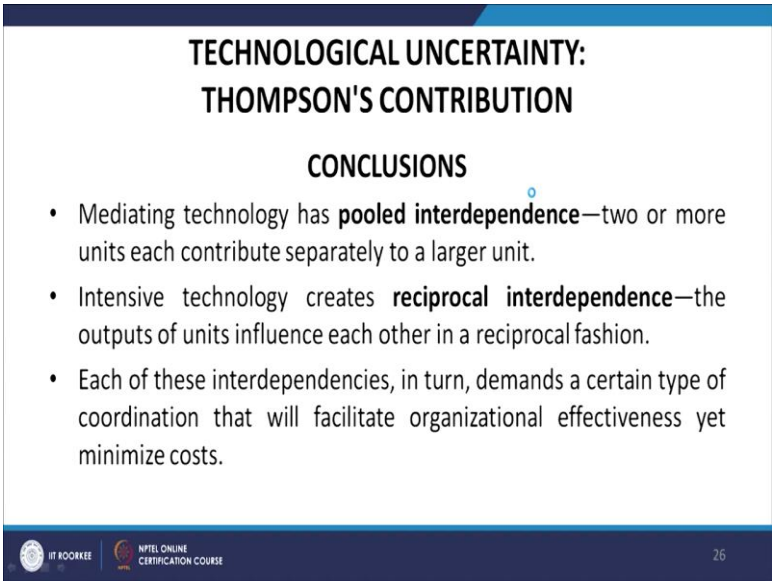

Mediating technology has pooled interdependencies two or more units each contribute separately to a larger unit. Intensive technology creates reciprocal interdependence-the output of units influence each other in a reciprocal fashion. Each of these interdependencies, in turn, demands a certain type of coordination that will facilitate organizational effectiveness yet minimize cost at the same time.

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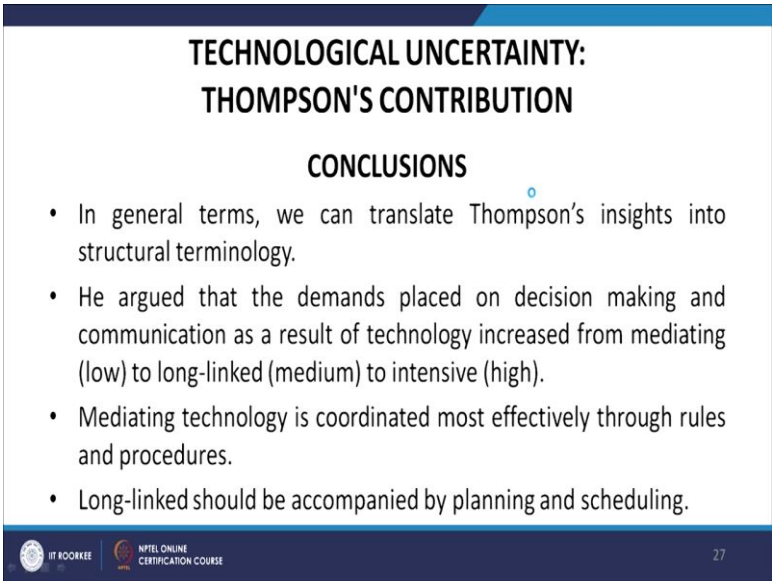

In general terms, we can translate Thompson's insight into structural terminology. He argued that the demands placed on decision making and communication as a result of technology increased from mediating low to long linked medium and to intensive high. Mediating technology is coordinated most effectively through rules and procedures. Long linked technology can be accomplished by planning and scheduling.

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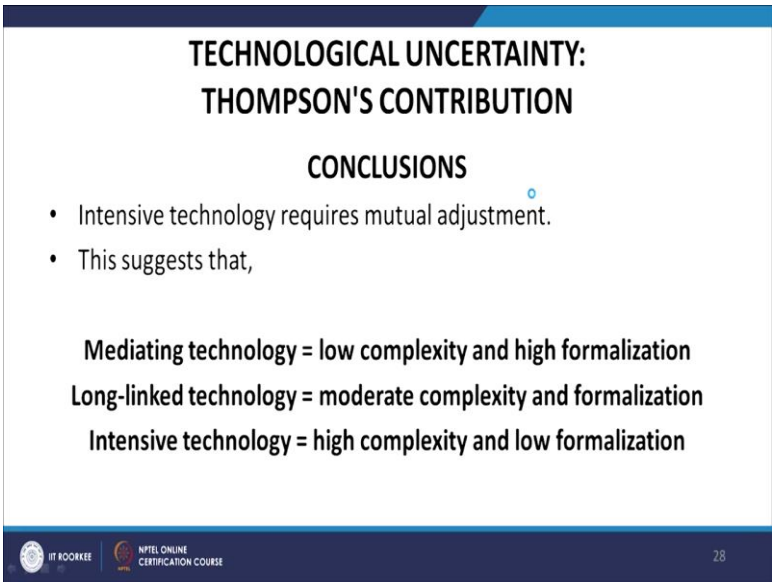

Intensive technology requires mutual adjustments. Now, this suggests that, mediating technology is equal to low complexity and high formalization. Long linked technology is equal to moderate complexity and formalization. While intensive technology is equal to high complexity and low formalization.

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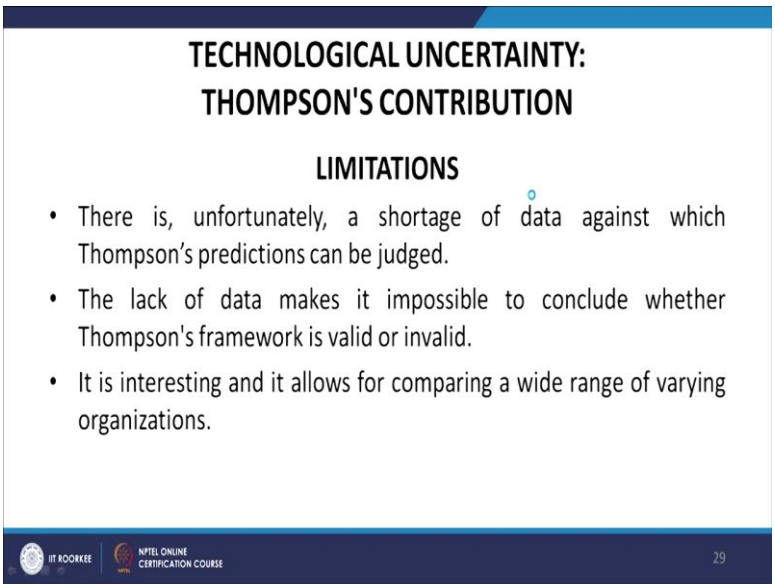

Now, it is time to look at the limitations of Thompson's contributions. So, there is unfortunately a shortage of data against which Thompson's predictions can be judged. The lack of data makes it impossible to conclude whether Thompson's framework is

valid or invalid. It is interesting to and it allows for comparing a wide range of varying organizations.

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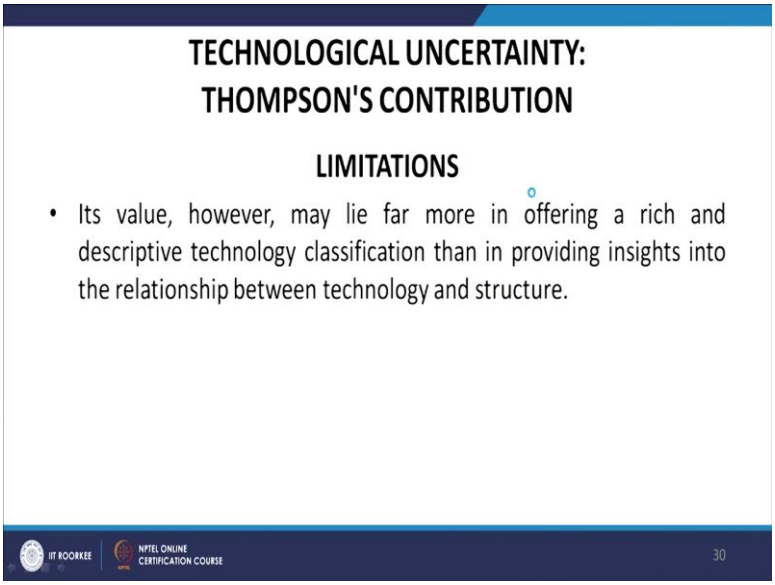

Its value, however, may lie far more in offering a rich and descriptive technology classification than in providing insights into the relationship between technology and structure.

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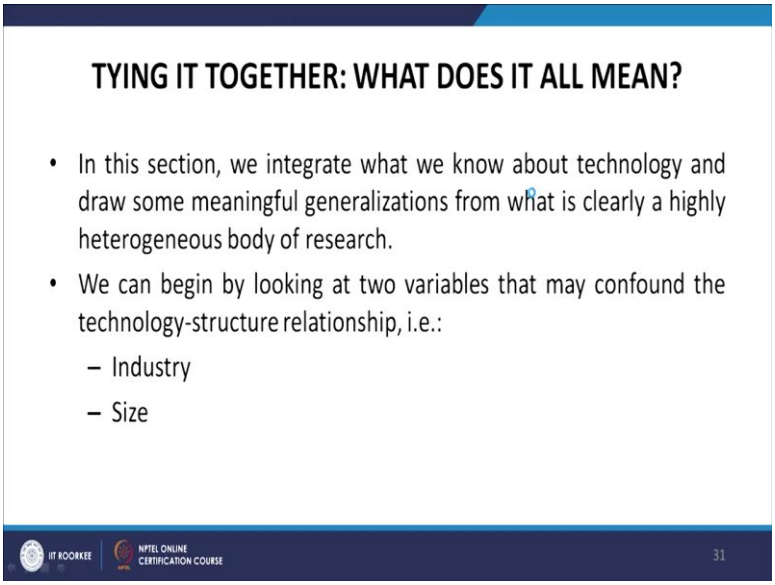

Now, let us tie it together, what does all of it means? In this section, we integrate what we know about technology and draw some meaningful generalization from what is

clearly a highly heterogeneous body of research. We can begin by looking at two variables that may confound the technology structure relationship. One variable is industry and another variable is size.

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Now, let us look at influence of industry and size. Technology and structure are both multi-dimensional concepts. As a result, it is possible that technology may be related to structure although not in any simple, straightforward manner. There are in fact, some logical arguments to support the idea that the industry within which the organization operates and the organization size confound a clear causal relationship between technology and structure.

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So, when we are talking about the influence of industry and size, now let us talk about industry. In earlier modules, we discuss industry as a determinant of structure by way of its impact on strategy. Here we again discuss industry, but in terms of its relationship with technology.

Organizations within any given industry may have to adapt the conventional core technology to be competitive. Just as industry often influences the efficient operating size of an organization, its degree of competition or extent of government regulation, it can also limit the viable set of technology options.

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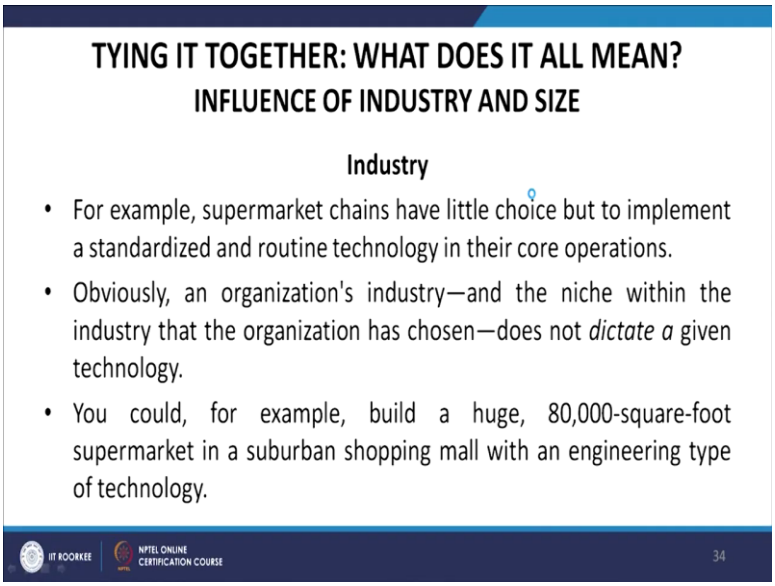

For example, supermarket chains have little choice, but to implement a standardized and routine technology in their core operations. Obviously, an organizations industry and the niche within the industry that the organization has chosen does not dictate a given technology. You could for example, build a huge, 8000 square foot supermarket in a suburban shopping mall with an engineering type of technology.

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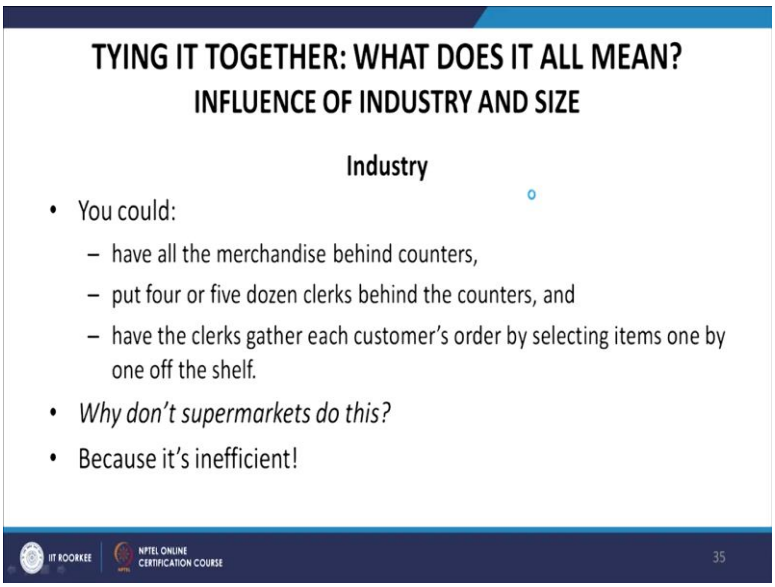

You could have all the merchandise behind counters, put 4 or 5 dozen clerks behind the counters and have the clerks gather each customer's order by selecting items one by one off the shelf. Why don't supermarkets do this? Because it is inefficient.

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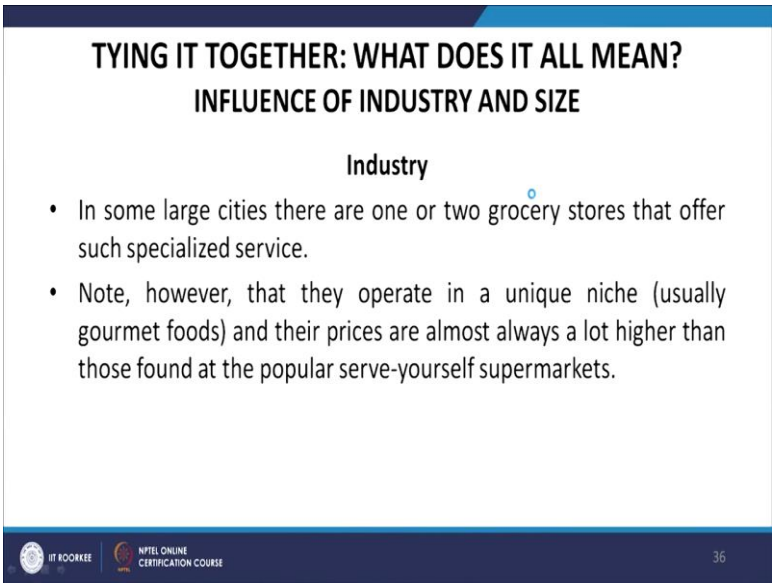

In some large cities there are one or two grocery stores that offer such a specialized services. Note, however that they operate in a unique niche usually gourmet foods and their prices are almost always a lot higher than those found at the popular serve-yourself supermarkets.

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Now, let us look at the influence of sizes. The strongest attacks against the technological imperative has come from those who argue that organizational size is the critical determinant of structure. For instance, several Aston Group of studies failed to find an association between technology and organizational structure. Rather, size was found to have a more dominant influence on structure.

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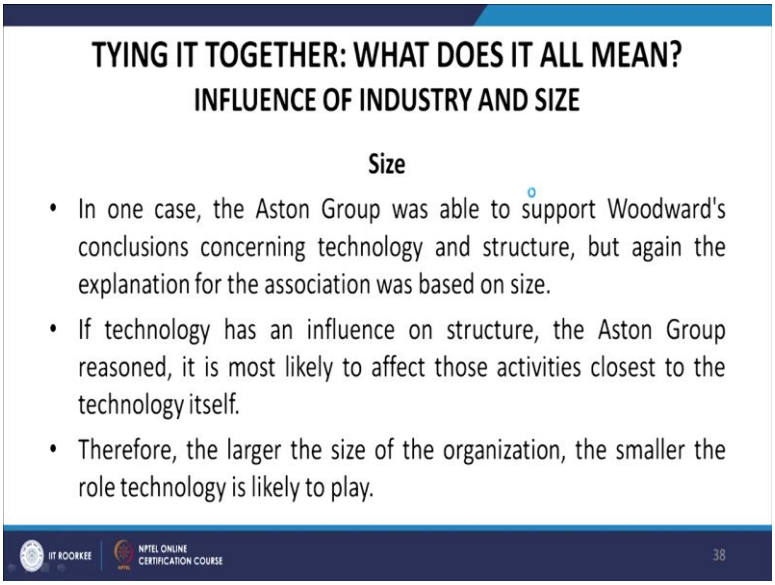

In one case, the Aston Group was able to support Woodward's conclusions concerning technology and structure, but again the explanation for the association was based on size. If technology has an influence on structure, the Aston Group reasoned, it is most likely to affect those activities closest to the technology itself. Therefore, the larger the size of the organization, the smaller the role technology is likely to play.

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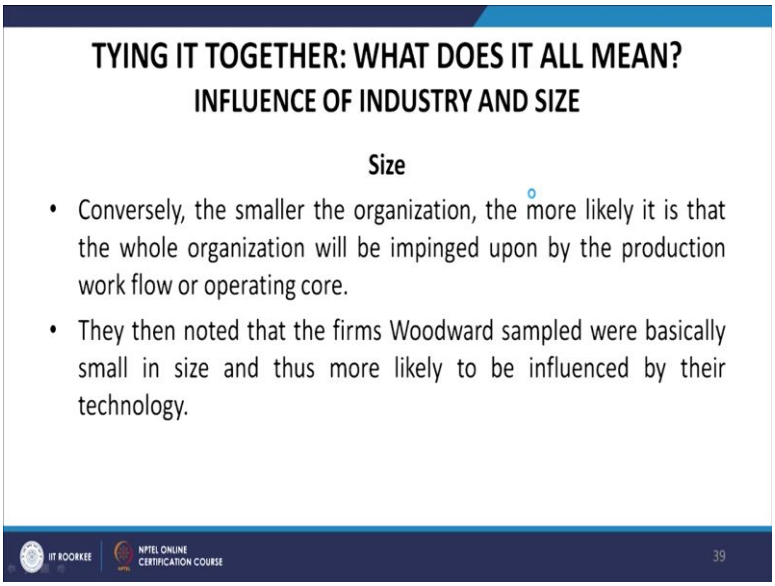

Conversely, the smaller the organization, the more likely it is that the whole organization will be impinged upon by the production workflow or operating core. They then noted that the firms Woodward sampled were basically small in size and thus more likely to be influenced by their technology.

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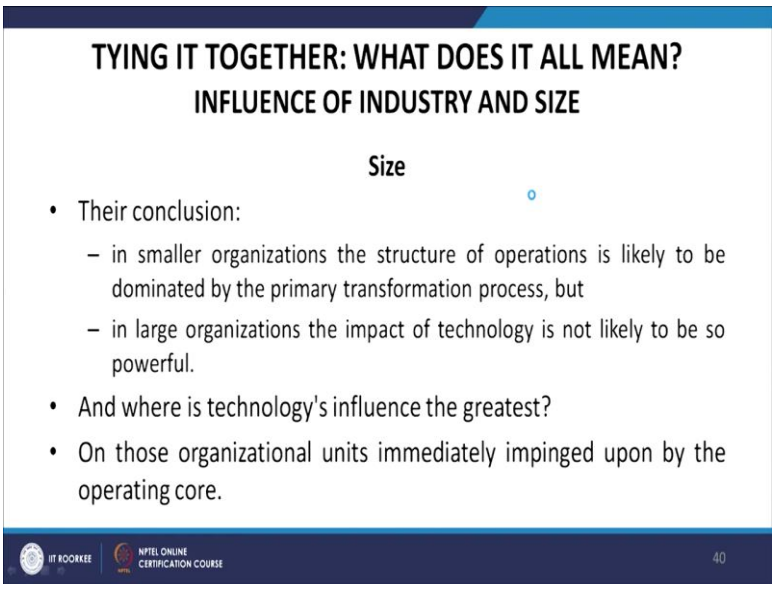

Their conclusion, first in smaller organizations, the structure of operations is likely to be dominated by the primary transformation process, but in large organizations, the impact of technology is not likely to be so powerful. And where is technology's influence the

greatest? So, that is the question. On those organizations units immediately impinged upon by the operating core.

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The preceding discussion suggest that an organization's size moderates the impact of technology on structure. In small organizations, divisions of large operations or technological or organizational activities most closely related to the operating core, technology should explain more of the resultant structure.

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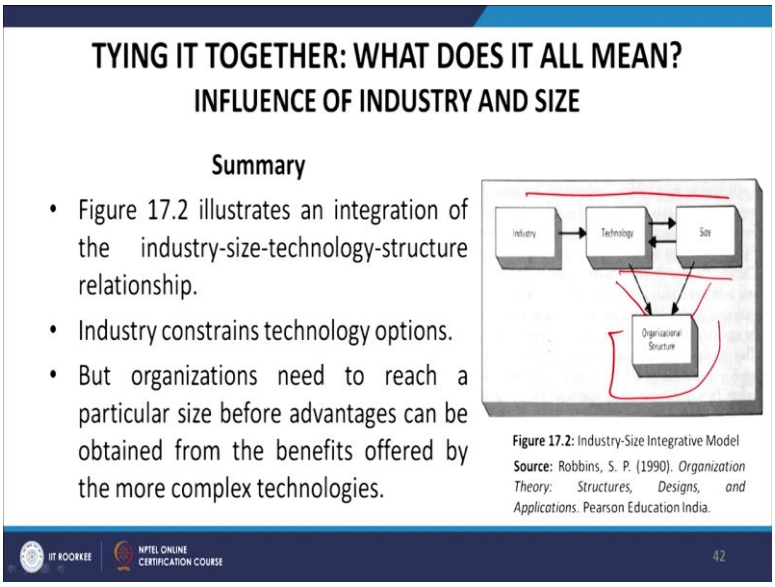

So, to summarize, let us look at this figure 17.2. So, now we started with industry, moved on to technology and size, then size again affects technology and technology and size, both of them they affect organization structure. So, figure 17.2 illustrates an integration of the industry, size, technology-structure relationship. Industry contains technology options. But organizations need to reach a particular size before advantages can be obtained from the benefits offered by the more complex technologies.

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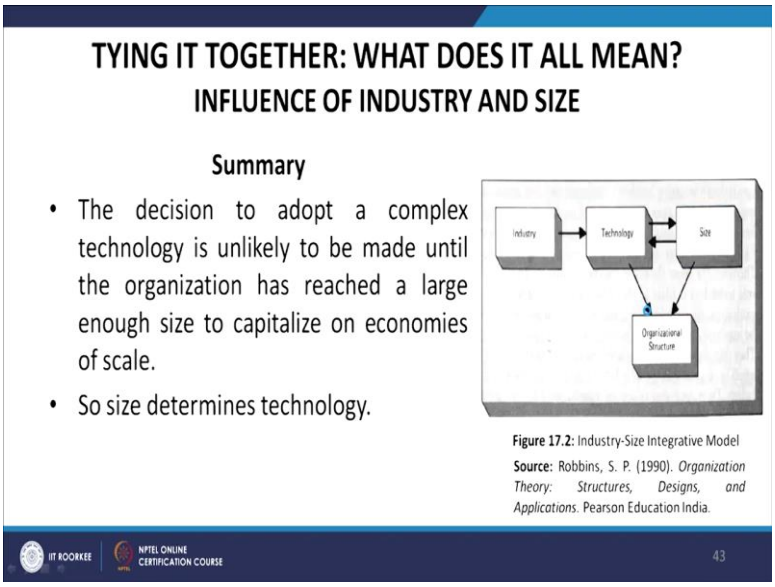

The decision to adopt a complex technology is unlikely to be made until the organization has reached a large enough size to capitalize on economies of scales. So, size determines technology.

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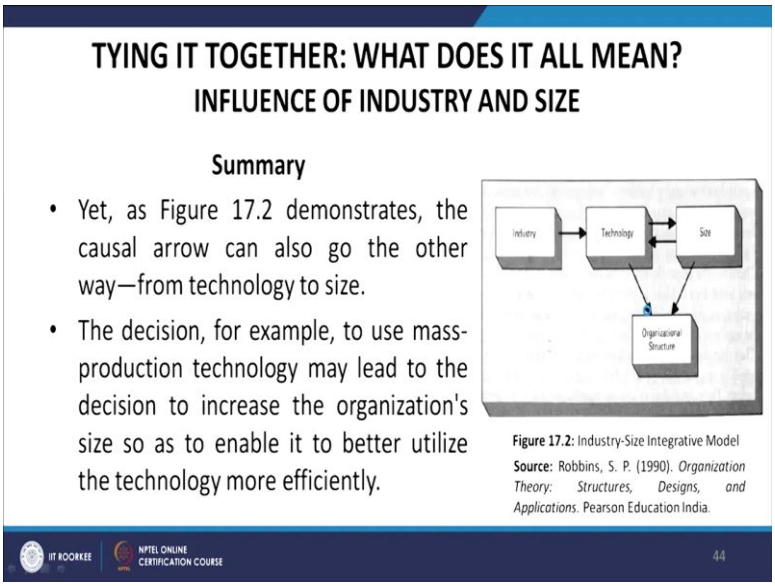

Yet, as figure 17.2 demonstrates, the causal arrow can also go to the other way from technology to size. The decision, for example, to use mass production technology may lead to the decision to increase the organization size so as to enable it to better utilize the technology more efficiently.

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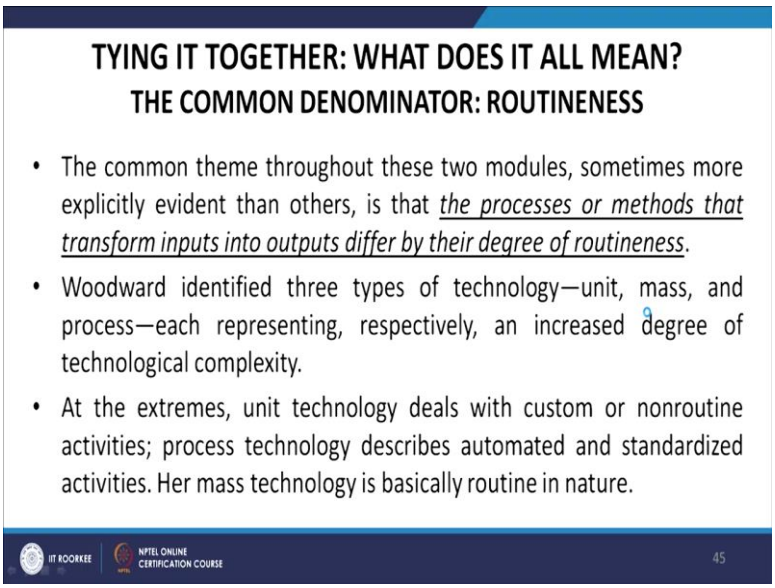

So, now, what is the common denominator: routineness? The common theme throughout these two modules, sometimes more explicitly evident than others is that the processes or methods that transform inputs into output differ by their degree of routineness.

Woodward identified three types of technology: unit, mass, and process each representing respectively, an increased degree of technological complexity. At the extreme, unit technology deals with customs or non-routine activity; process technology describe automated or standardized activity. Her mass technology is basically routine in nature.

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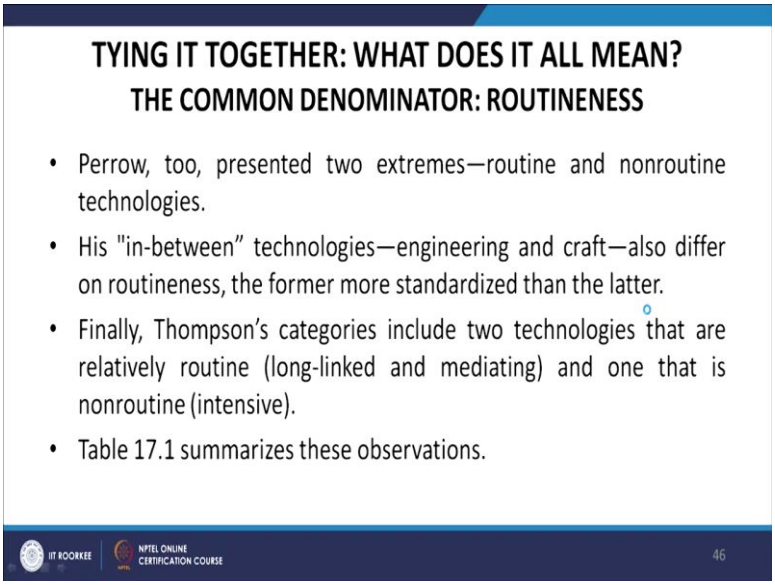

Perrow too represented two extremes: routine and non-routine technologies. In his “in between” technologies-engineering and craft, also differ on routineness, the former more standardized than the latter. Finally, Thompson’s categories include two technologies that are relatively routine; long linked and mediating and one that is non-routine that is intensive. So, table 17.1 summarizes these observations.

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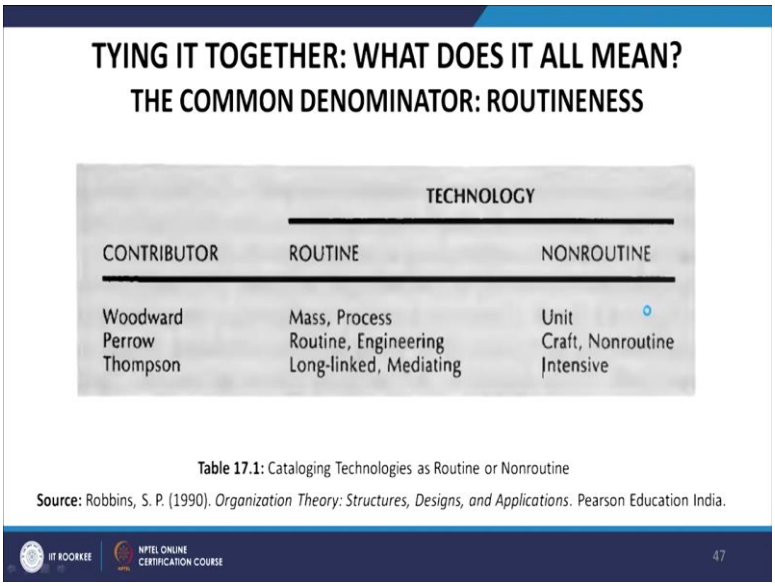

So, this is table 17.1. So, on the left-hand side, we have the contributors; Woodward, Perrow and Thompson, then technology is routine or non-routine. So, Woodward said that routine technology is in mass production and in process industries, while in non-routine, it is unit production. For Thompson, the routine is long linked, mediating and non-routine is intensive.

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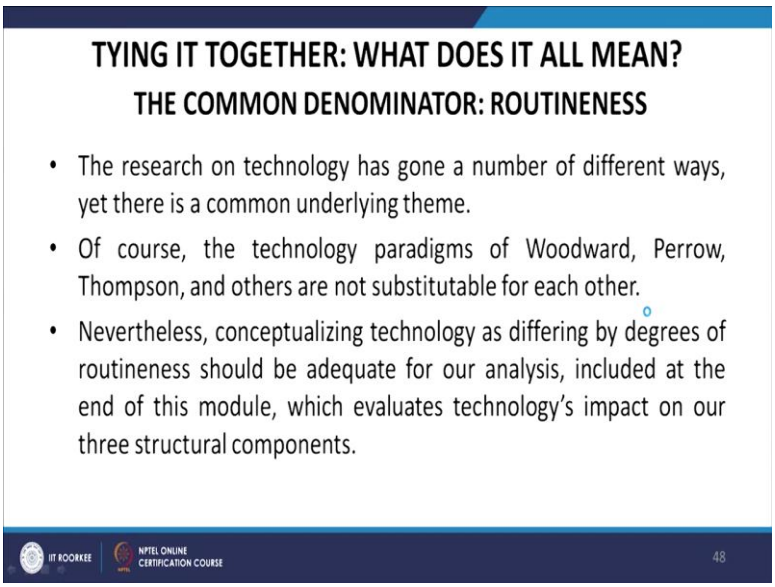

The research on technology has gone a number of different ways, yet there is a common underlying theme. Of course, the technology paradigms of Woodward's, Perrow's,

Thompson's and others' are not substitutable for each other. Nevertheless, conceptualizing technology as different by degree of routineness should be adequate for our analysis, included at the end of this module, which evaluates technology's impact on our three structural components.

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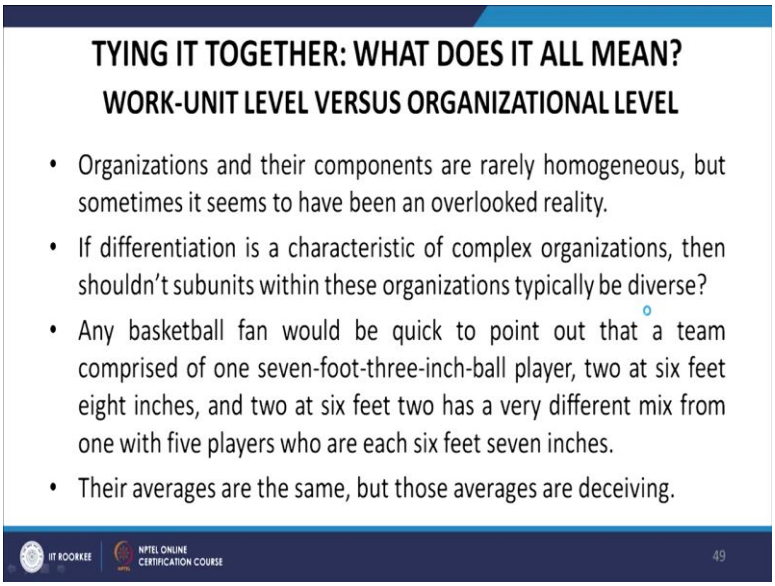

Now, let us look at the work unit level versus organization level. Organizations and their components are rarely homogeneous, but sometimes it seems to have been an overlooked reality. If differentiation is a characteristic of complex organizations, then should not subunits within these organization typically be diverse?

Any basketball fan would be quick to point out that a team comprised of one seven-feet-three-inch ball player, two at six feet eight inches, and two at six feet two inches have a very different mix from one with five players who are each six feet seven inches. Their averages are the same, but those averages are deceiving.

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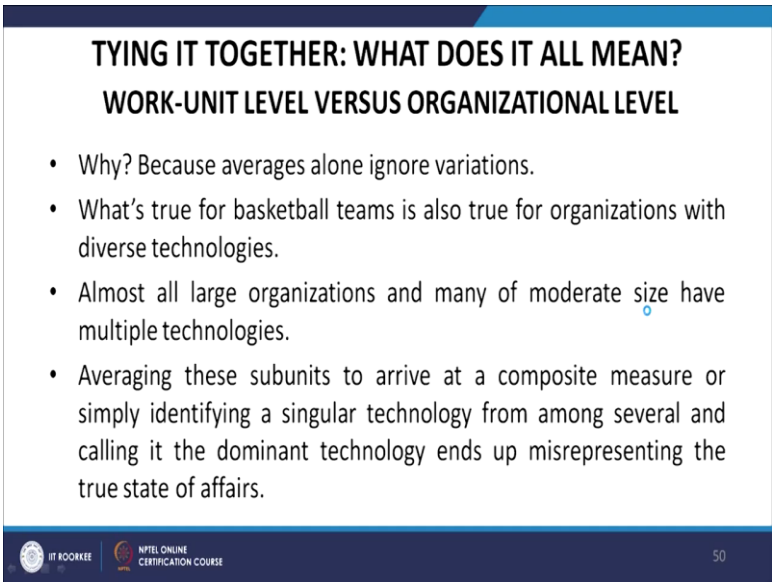

Why? Because averages alone ignore variations. What is true for basketball teams is also true for organizations with diverse technologies. Almost all large organizations and many of moderate size have multiple technologies. Averaging these subunits to arrive at a composite measure or simply identifying a singular technology from among several and calling it the dominant technology ends up by misrepresenting the true state of affairs.

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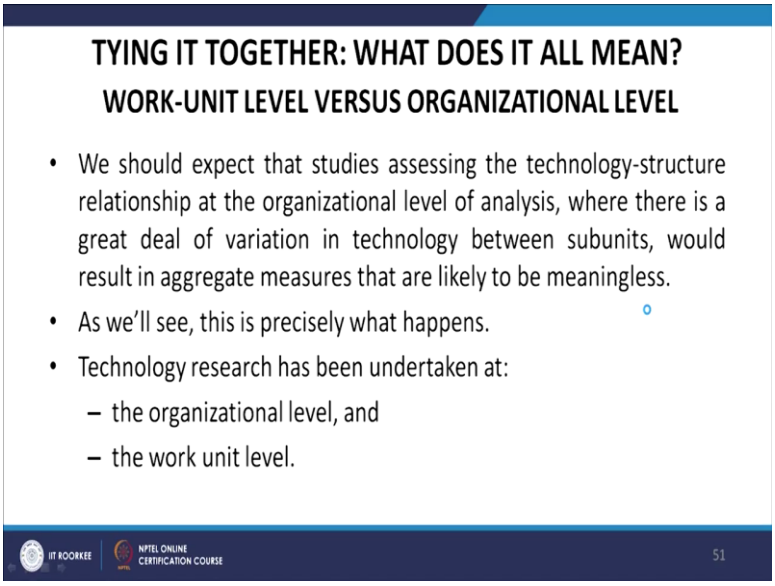

We should expect that studies assessing the technology-structure relationship at the organizational level of analysis, where there is a great deal of variation in technology between subunits would result in aggregate measures that are likely to be meaningless. As we will see, this is precisely what happens. Technology research has been undertaken at one the organizational level and the work unit level.

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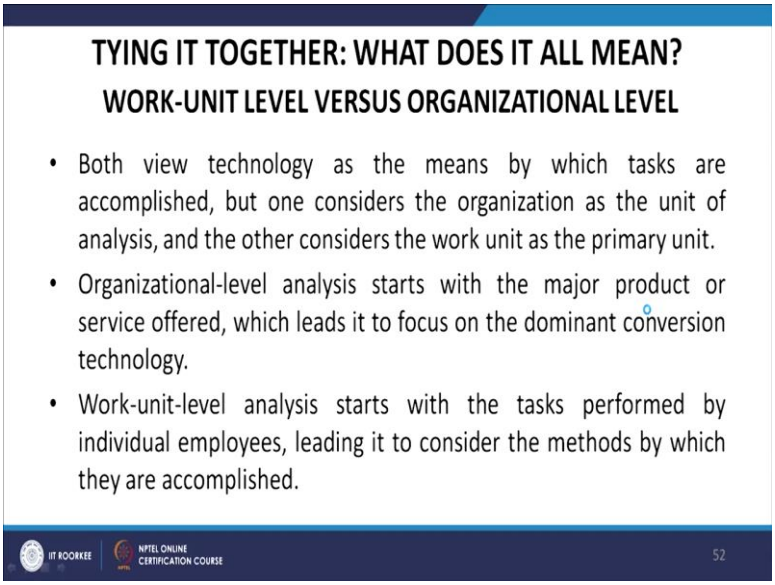

Both view technology as the means by which tasks are accomplished, but one considers the organization at the unit of analysis and the other considers the work units as the primary units. Organizational-level analysis starts with the major product or service offered which leads to focus on the dominant conversion technology. Work-unit-level analysis starts with the tasks performed by individual employees, leading it to consider that technology by which they are accomplished.

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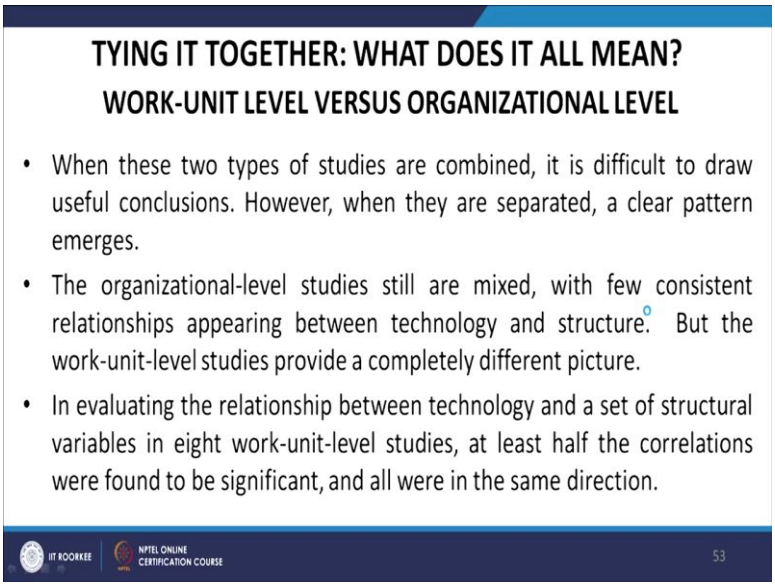

When these two types of studies are combined, it is difficult to draw useful conclusions. However, when they are separated, a clear pattern emerges. The organizational-level studies still are mixed with few consistent relationships appearing between technology and structure. But the work-unit-level studies provides a completely different picture. In evaluating the relationship between technology and a set of structure variables in eight work-unit-level studies, at least half the correlations were found to be significant and all were in the same direction.

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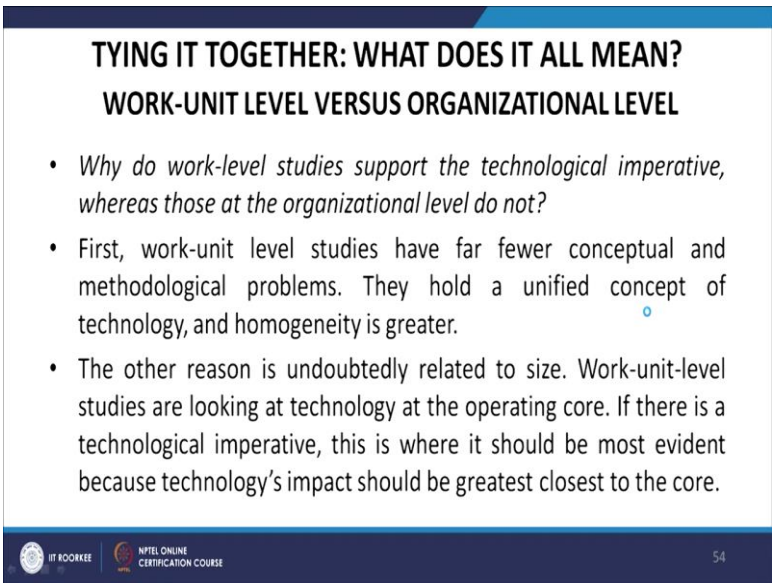

Why do work-level studies support the technological imperative whereas, those at the organization level do not? First, work-unit level studies have far lesser conceptual and methodological problems.

They hold a unified concept of technology and homogeneity is greater. The other reason is undoubtedly related to size. Work-unit-level studies are looking at technology at the operating core. If there is a technological imperative, this is where it should be most evident because technology's impact should be greatest closest to the core.

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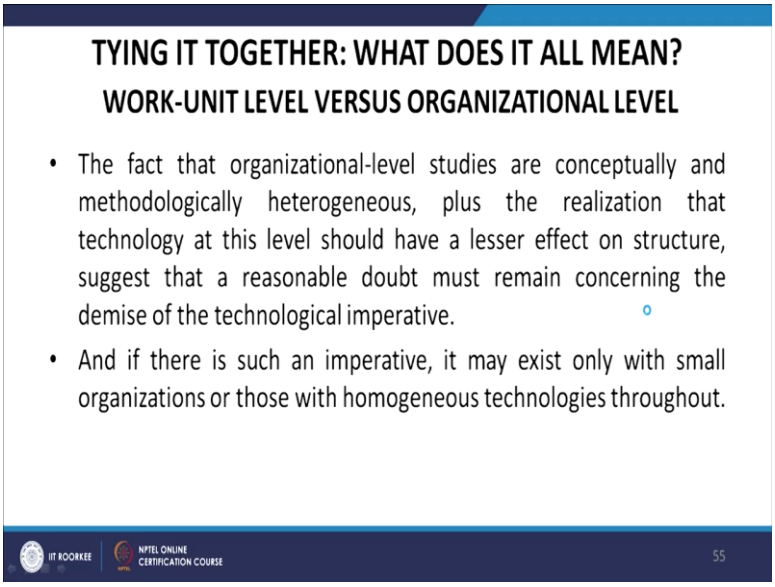

The fact that organizational-level studies are conceptually and methodologically heterogeneous, plus the realization that technology at this level should have a lesser effect on structure, suggests that a reasonable doubt must remain concerning the demise of the technological imperative. And if there is such an imperative, it may exist only with small organizations or those with homogeneous technologies throughout.

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Now, let us look at manufacturing versus service technologies. Summaries of studies assessing the relationship between technology and structure indicate that nearly 80 percent of those that looked at only manufacturing organizations or service organizations supported the relationship.

But when data from manufacturing and service settings were combined, only about 14 percent achieved supportive results. This suggests that there may be real differences between the dominant technology in the two types of organizations.

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Moreover, when the researchers combine the two types of organizations, they may wash out underlying relationships. So, researcher studies that combine manufacturing and service organizations are less likely to find a significant relationship between technology and structure.

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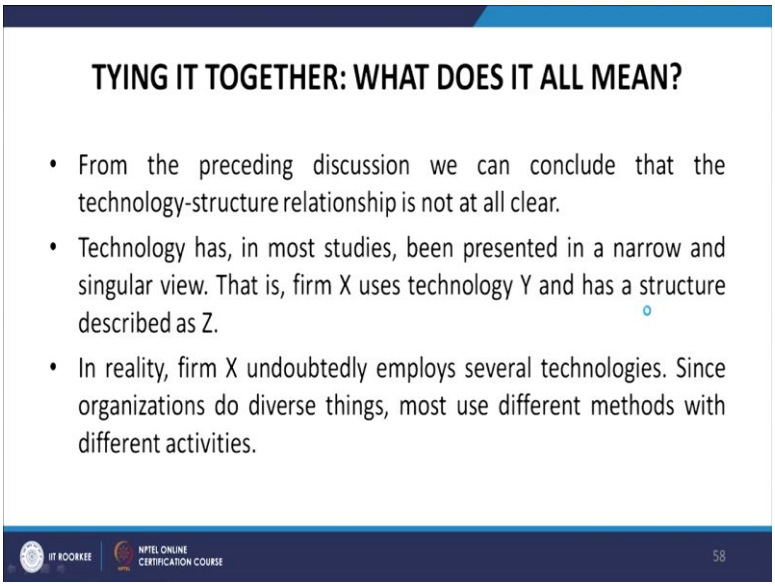

So, from the preceding discussion, we can conclude that the technology-structure relationship is not all that clear. Technology has in most studies been presented in a narrow and singular view. That is, firm X uses technology Y and has a structure described as Z. In reality, firm X undoubtedly employs several technologies. Since organization do diverse things, most use different methods with different activities.

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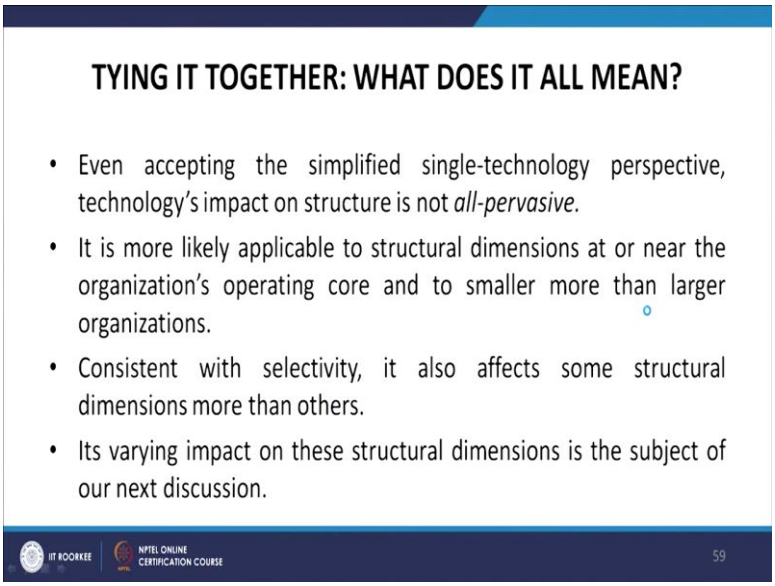

Even attempting the simplified single technology perspective, technology's impact on structure is not all-pervasive. It is more likely applicable to structural dimensions at or near the organization's operating core and to a smaller more than larger organizations. Consistent with selectivity, it also affects some structural dimensions more than the others. Its varying impact on these structural dimensions is the subject of our next discussion.

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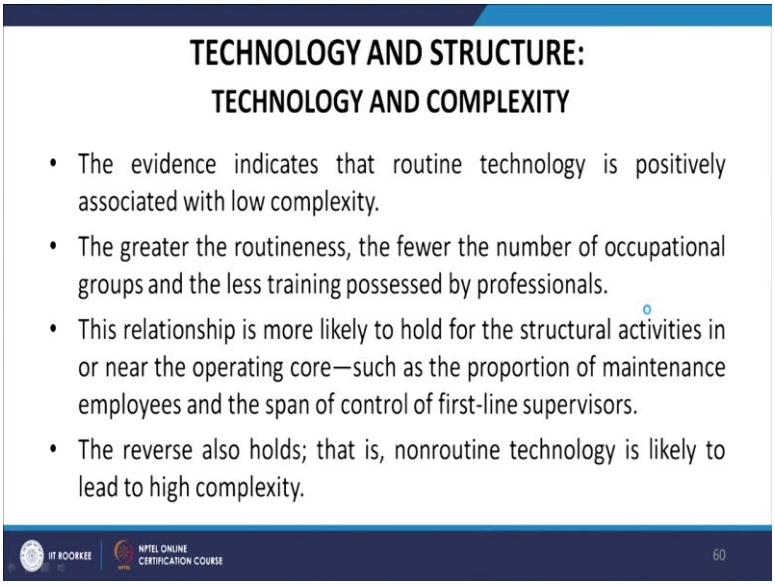

So, now, we are talking about technology and complexity. This evidence indicates that routine technology is positively associated with low complexity. The greater the routineness, the fewer the number of occupational groups and the lesser training possessed by professionals.

This relationship is more likely to hold for the structural activities in or near the operating core such as the proportion of maintenance employees and the span of control of first line supervisors. The reverse also holds that is non-routine technology is likely to lead to higher complexity.

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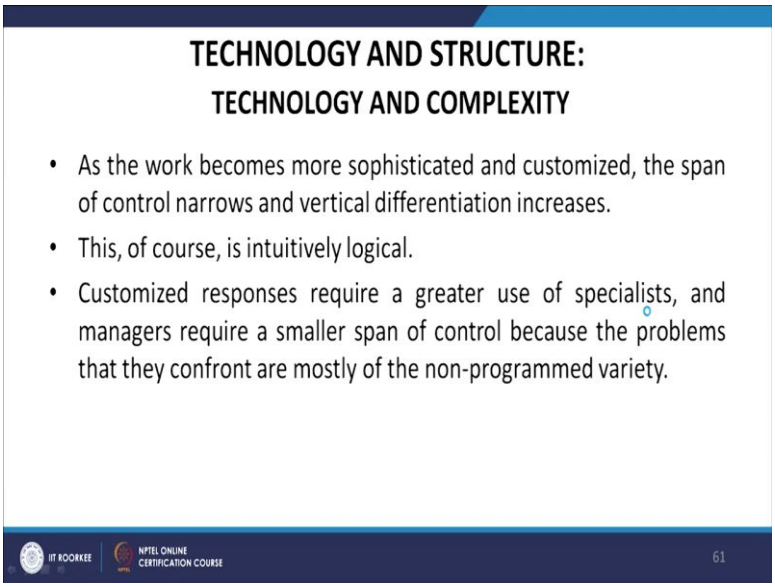

As the work becomes more sophisticated and customized, the span of control narrows, and the vertical differentiation increases. This of course, is intuitively logical. Customized responses require a greater use of specialists and managers require a smaller span of control because the problems that they confront are mostly of the non-programmed variety.

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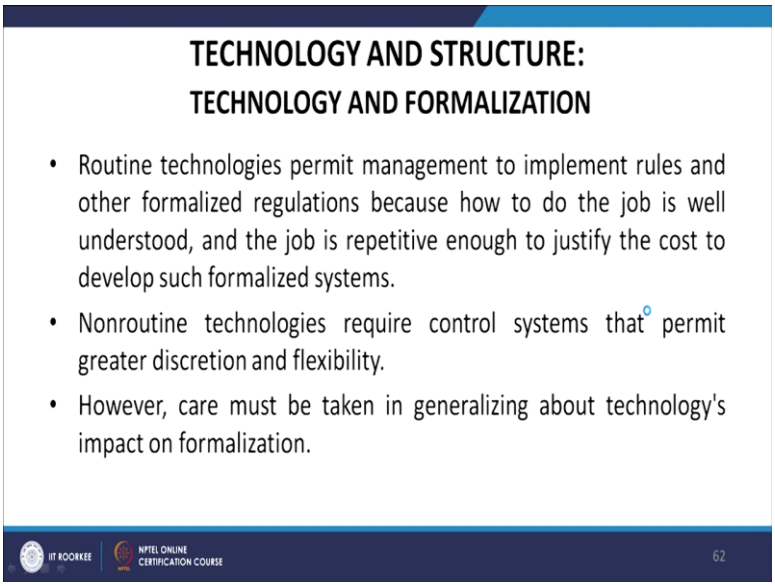

Routine technologies permit managers to implement rules and other formalized regulations because how do they do the job is well understood and the job is repetitive enough to justify the cost to develop such formalized systems. Non-routine technologies require control systems that permit greater discretion and flexibility. However, care must be taken in generalizing about technology's impact on formalization.

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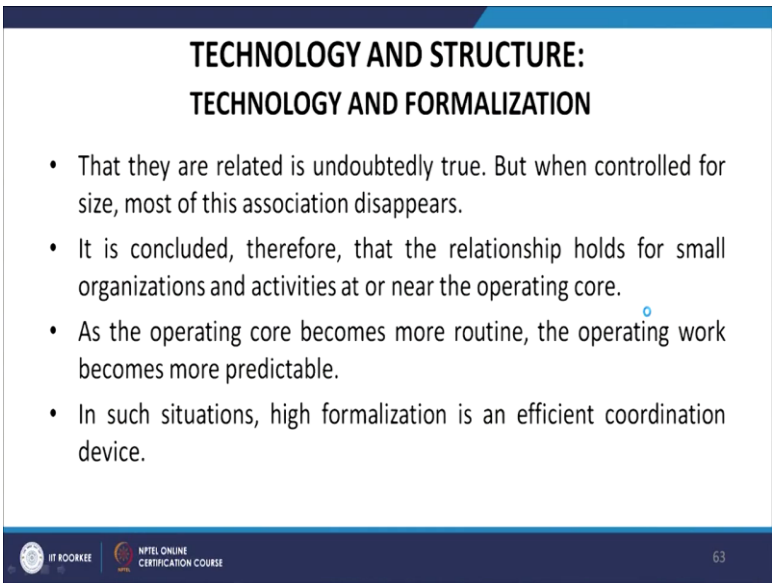

That they are related is undoubtedly true. But when controlled for size, most of this association disappear. It is concluded therefore, that the relationship holds for small

organizations and activities at or near the operating core. As the operating core becomes more routine, the operating work becomes less predictable. In such situations, high formalization is an efficient coordination device.

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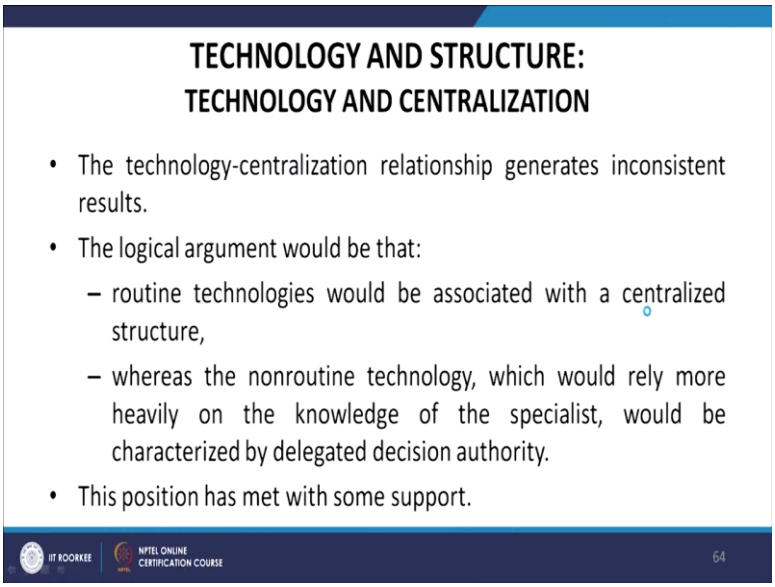

Now, let us look at technology and centralization. The technology-centralization relationship generates inconsistent results. The logical argument would be that: routine technologies would be associated with a centralized structure, whereas the non-routine technology which would rely more heavily on the knowledge of the specialist would be categorized by delegated decision authority. This position has met with some support.

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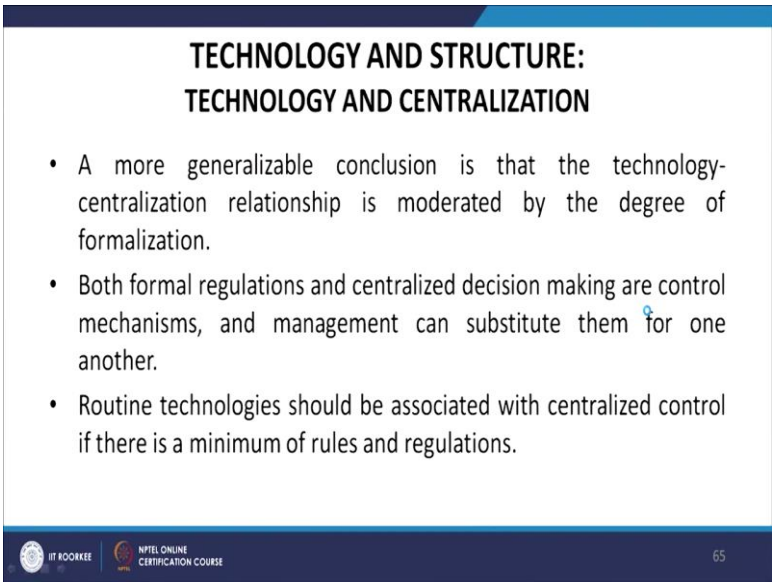

A more generalizable conclusion is that the technology-centralization relationship is moderated by the degree of formalization. Both formal regulations centralized decision making are control mechanism and management can substitute them for one another. Routine technologies should be associated with centralized control if there is a minimum of rules and regulations.

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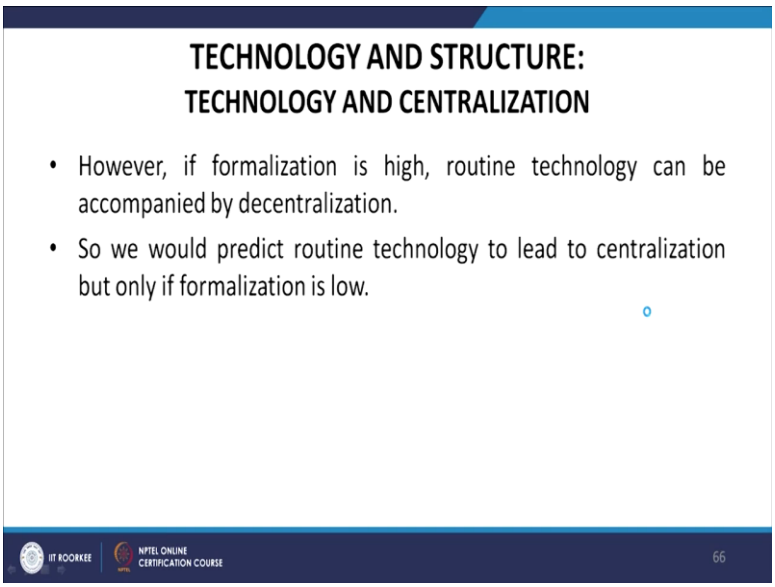

However, if formalization is high, routine technology can be accompanied by decentralization. So, we would predict routine technology to lead to centralization but only if formalization is low.

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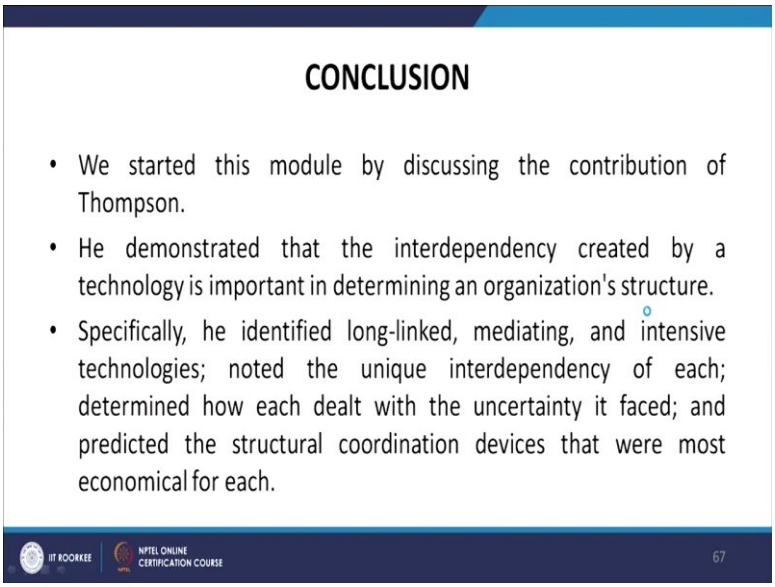

So, to conclude this module, we started this module by discussing the contribution of Thompson. He demonstrated that the interdependency created by technology is important in determining an organization’s structure. Specifically, he identified long-linked, mediating and intensive technologies; noted the unique interdependence of each; determined how each dealt with the uncertainty it faced and predicted the structural coordination devices that were most economical for each.

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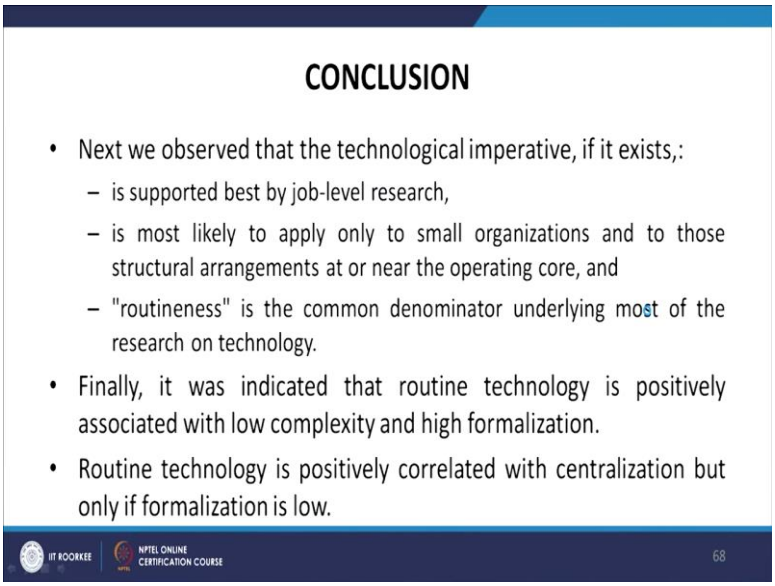

Next, we observed that the technology imperative if it exists, is supported best by job level research, is most likely to apply only to small organizations and to those structural arrangements at or near the operating core, and routineness is the common denominator underlying most of the research on technology.

Finally, it was indicated that routine technology is positively associated with low complexity and high formalization. Routine technology is positively correlated with centralization but only formalization is low and these are the four books from which the material for this module was taken.

Thank you.