

SCIENCE, TECHNOLOGY & ADMINISTRATION*
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Historical Development

Science, Technology and Administration is a very wide topic and I believe it can be handled in many ways. I would like to look at it from the point of view of historical development of a number of difficulties that have arisen in organized effort all over the world. Alvin Toffler has illustrated this in "Future Shock" by some interesting statistics. If we were to consider the average life of a human being as 62 years and if one looks back about 50,000 years then there have been about 800 lifetimes or generations and of these 800,650 have been spent in caves. It is only in the last 6 lifetimes that we have come across the printed word which has established efficient communication from one generation to another. The electric motor was developed in the last 2 generations and most of the material developments that we observe in the world today have taken place within our lifetime. Another interesting way of looking at this increasing complexity is: they say in 54 BC it took 75 US cents to kill a person. In Napoleon's time the figure had increased to \$3000. In the World War I it was \$30,000 and in World War II it was \$200,000. Looking at this from yet another point of view we observe a kind of time compression. The motor conceived till such time as it was made use of productively. The aeroplane took 14 years after the first flight of the Wright Brothers at Kitty Hawk to be accepted as a means of locomotion. It took 10 years for the development of TV for commercial purposes from time that it was first invented. Use of nuclear power for peaceful purposes took 7 years after it was first conceived of for this purpose. The use of

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earth satellites for communication took 5 years. These are instances of the way in which increasing complexities have triggered a process of compressing time and annihilating distances in the world and the cost is going up all the time.

We live in an age of tremendous change today and let no one fool himself because with the increased speed of communications we are affected almost immediately by events taking place far away; communications have become central to our life today. We also know that we have been resting on Gutenbergs' laurels for a few centuries : the European inventor of the printing press although in the Far East they say it was invented much earlier. There are new approaches to communications in all disciplines. Even a child who goes to school is at the receiving end of a communication process, and finds that there are new approaches to arithmetic. If one picks up a book on modern arithmetic anyone used to the old method of approach will find it totally different from what it used to be. Trachtenburg's system is a case in point. Changes are also taking place in physics and in chemistry and in so many other disciplines. In addition, we have several new disciplines which are being created all the time. And of them some are moving very fast: like electronics that by the time a university student has gone through the course he finds that he is already out of date! In chemical engineering the system of instruction has changed twice since the forties. This process is something that will continue to accelerate.

We must therefore accept that there is to be quicker and quicker change and in fact I would say the secret of good administration is successful adaptation to change; not waiting for change to push us but to try to be one step ahead. This of course calls for a planning process. This process, in my opinion, is more important than the plan itself because we are aware that when we make a plan, by the time it is ready it may well be

out of date, on account of material changes taking place outside and within the environment : the plan becomes obsolescent. All this amounts to increasing complications, which will place more and more emphasis of the utilization of our powers of reasoning and logic rather than making use of tradition or precedent which at its best is a poor substitute.

We are aware that procedures do not really have useful lives of more than 5 years; in fact some do not have a useful life of more than 5 weeks. Yet we find ourselves in the administrative process going back and attempting to make use of outmoded ante-diluvian rules and procedures which bear no relevance to the problems at hand. In the language of the science of control or cybernetics we say that the rules or procedures do not possess "requisite variety". In other words, a rule or a procedure in the past was able to take care of almost all the situations that arose, this was a satisfactory situation. Today we may have five hundred different situations which a rule is expected to deal with and then try to stretch it to encompass all of them. This goes far beyond the elastic limits of the rules. Man has made the rules and procedures and it is for man to alter or change them when they are no longer relevant. We have to pay increasing attention to the process of adaptation so as to sense change, to absorb it and then to pro-act beneficially rather than re-acting in a negative fashion to what is being impressed upon us. What is technology anyway? It is know-how to enable problem-solving whether technical, commercial, industrial or administrative.

Three Tools

There are three major tools in the recent past which man has developed which are also part of the total picture. The first is that of automation. This is not to be looked at as

being merely a mechanical operation extending our muscle power, but as a logic of overall system operations. If we look at it from the point of view of amplifying muscle power we will find many things go wrong. After all automation is only one part of something much bigger and the objective in any productive effort cannot just be to improve the physical operations, we must ask ourselves to what end, what are the objectives? It becomes very difficult to define objectives where things are changing so very very quickly. If one does attempt to improve operations at a particular job, cost centre, desk or work centre we may merely be moving the bottleneck from point 'A' to point 'B' within the system which many times creates more trouble than it sets out to remove.

The second major development is release of nuclear power whereby unlimited quantities of energy can be obtained. This is also creating severe problems of one kind or another. It is also interesting to know of this development of atomic power from the point of view of science. The physicist was adaptable to radically revise his concept of the atom on more than one occasion. Now this is a very important thing. There had to be a complete revision of the physicist's idea as to what the atom was structurally. In other words if we are to examine our problems, while we must of course make use of the lessons of the past, but at the same time we must be flexible enough to accept new ideas.

The third major development that has taken place is the use of the computer. Its invention is an interesting development because the computer was developed by Charles Babbage in the early years of Queen Victoria's reign. But it only really came to be meaningful when the radio tube was invented. It is a good example of an invention standing on the shoulders of another before it became really successful. But what does the computer do?

It amplifies brain power, *provided* we are prepared to make a more detailed examination of our administrative systems than is apparently obvious---if it is the administrative system we wish to improve. This is difficult because its true significance is usually lost in tinsel, window dressing and a lot of jargon. No management aid can solve any problem unless the manager or administrator is competent or capable of solving his own problems conceptually in the first instance. If the administrator cannot conceptually solve his problems the alternative is that he is forced to have complete faith in someone else's judgement and this is not usually a very satisfactory situation. It also means one has to do one's home work oneself. One cannot have one's home work done by proxy and expect to know all about it.

Science

If we look at the development of science we observe that all science started with extremely mysterious beginnings e.g. Chemistry we will find that it started with the Alchemist. His use of retorts and beakers was secretive and what was he attempting to do? He was trying to transmute base metals into gold. These "secrets" were closely guarded and passed on from father to son in very very restricted fashion. But it is out of such experiments over a period of time where hundreds or thousands of observations are made that it is possible for those coming later to systematize the same. Out of such systematization we are able to recognize patterns and from patterns we develop hypotheses. From hypotheses we move on to theories and from theories over to laws. Where the laws cannot explain natural phenomena hypotheses are reframed and so we work through the same process again. It is now hoped the revamped law will take care of the new situations satisfactorily. We all know that Newton's Laws of Motion existed

even before Newton came into this world. But quantitative or systematic recognition only came after he had enunciated them. Later when Einstein found that there were certain phenomena which could not be explained by Newton's Laws---that of light bending when getting close to huge body. . . .On examination it was found that Newton's Laws were all right but only as a special case of Einstein's discovery. So a superior law was enunciated and there is no reason why we cannot keep on developing in this fashion.

If we look at the administrative process it can be said that we have not had enough time to develop an administrative science because we have not had sufficient time to make innumerable observations of the type that the Chemists, Physicists and Biologists and the other scientists have made in the past. Such systematization has come over the centuries involving a lot of hard work and observation. This is the basis of the inductive method ie the empirical approach or the scientific method as opposed to the Greeks who were masters of the deductive method which depends on making assumptions. The quality of the conclusions is based fairly and squarely on the quality of the original assumptions. However, what this means is that if we have not as yet developed the necessary laws concerning administrative effort then should we not put in more effort to do so? Medicine and surgery also had very mysterious beginnings starting with the shamans or witch doctors with their incantations and mumbo jumbo. The barbar surgeons or chirurgion's methods of treating human beings was also primitive. About a 100 years ago, which is not a very long time, surgical practice compared to present day practice was laughable. Systematization of experience was the basis of how surgery progressed. All the more reason why we must make these observations on administrative endeavour so that if not

today, at least 20, 30 or 50 years later we will have developed a systematic body of knowledge which will be of use in improving administrative or managerial efficiencies.

When I spoke of science I would like to distinguish between the inductive and the deductive methods. Let us look at it from the point of view of administration. If we back to 1700 we will find that the philosopher was then the repository of all scientific knowledge. But around 1700 the sum total of scientific knowledge had increased to such an extent that the philosopher could not cope with the mass of science. The natural philosopher as his successor was custodian-in-interest of all scientific knowledge till about 1850 when history repeated itself. The sum total of scientific knowledge had grown to such an extent that the natural philosopher perforce threw in the towel and the natural scientist was born. Roundabout 1850 the universities split up into the arts and the sciences and with this split in academic knowledge seeking the superiority of the scientific method was proved to the hilt. But it was also tacit admission of the human being's incapacity to attack nature or knowledge as a whole. So ingenious as we are, we split knowledge into small bits and pieces and were able to bring a sharper focus to bear on a smaller area and progress took place very rapidly in each small compartment, labeled as physics, chemistry or biology. . . . These developments in academic knowledge seeking lead increase in discipline proliferation which continues to this very day. Roundabout 1900 the social sciences of anthropology, psychology and sociology came to the fore. Twenty or twenty five years ago we had no nuclear engineers; about 14 years ago we had never heard of ground water engineers. These developments in knowledge acquisition gained by focusing more and more on less and less will continue and the frontiers of knowledge in each small compartment will be pushed ahead at increasingly

quicker rates. The principal problem which we have to face, talking of the academic side, is how we can integrate all the brilliant advances taking place in hundreds of different disciplines? You will find that new multi-disciplines are cropping up such as biophysical ecology where three disciplines go into a study of the influence of industrial wastes on human environment or biopetrochemical engineering where four disciplines go into determining how proteins can be synthesized from petroleum or orthomolecular psychiatry where three disciplines go into study of the effect of trace chemicals on human behaviour. So there is a deliberate attempt to bring together or integrate what is happening in a number of the isolated compartments. This we will recollect has grown out of our incapacity to attach nature or knowledge as a whole.

If this is what was happening on the academic side what was happening on the applied?

We find that the results of developments in each of the small compartments when applied to technical, industrial, commercial or administrative problems was able to bring about a lot of improvements. Organizations that were run by one person became larger. They became larger either through diversification ie introducing new activities or through intensification of their existing activities working towards mass production. Whether organizations expanded horizontally or vertically, the net result was that one person could no longer effectively control the system by himself. He had to take on other people and when we have several people working in an organization we have to delegate authority. When authority is delegated we have to find out how the authority has been used. Has it been used in accordance with the original plan or standard which had been laid down in the first instance? This requirement leads to the setting up of a system of feedback. Feedback will depend on the flow of information which is usually recorded on paper, as a

permanent record of what had been said or what had been done. This, of course, is where our problems begin. Just as there was this split in academic knowledge seeking we will find an analogy of this on the applied side in technical, commercial, industrial or the administrative side---in the garb of functional specialization eg in accounting we have financial accounting, cost accounting and management accounting. On the engineering side we have several activities such as production planning and control, maintenance, design, after sales technical trouble-shooting etc. Examples can be multiplied from almost all the disciplines. Would it not, therefore, be reasonable to assume that some of an integration has to take place on the applied side similar to the academic side? We have, therefore, through analogy to accept that there has to be a multi-disciplinary effort towards administrative, towards technical, towards industrial and commercial problems. Now this may not be simple. However, techniques have been developed since the World War II to do precisely this and there are at least 4 management services which assist in this direction, the first is that of Work Study. It is true that the origins of Work Study go way back before World War II but significant developments in it have taken place since then. The second is that of Systems & Procedures, the third is that of Operations Research, and the fourth is that of Electronic Data Processing or use of the computer. No computer in itself can solve any organizational problem. We have to put our organizations right ourselves to be able to make use of the computer productively. This depends on the administrator being able to conceptually solve his problems before it is possible to transfer the solution to this black box. No computer has ever been known to put an organizational system right. Operations Research is the father in modern terms of the Systems Approach.

But going back to science or to development we observe the cyclical nature of progress starting with development of scientific knowledge from the philosopher to the natural philosopher, to the natural scientist and then the question of multi-disciplines. In other words the philosopher or natural philosopher was really one person who knew all there was to know about science in his time. We are now trying to find multi-disciplines which can bring all science and if not all science at least a major field of science together. This is completing the circle at a higher level of sophistication and this cycle has many parallels.

Science rests on values, most values rest of knowledge rests on science itself. We have the circular process going round and round which we hope is in the form of a spiral, each new circle being generated at a higher level of sophistication than the previous. Many times one asks what is the use of a scientific discovery. I can only quote Benjamin Franklin who posed another question in reply “what is the use of a baby”? Well, it is a question of development over a period of time and if look at science we find that 17th century science was merely an inquiry into causes more than anything else because making observations was important eg to predict an eclipse one did not have to know its purpose but its causes, hence the development of European 17th century science became exclusively an inquiry into causes more than anything else.

Difficulties

Now all this coupled with an understanding of time compression, annihilation of distances and the increasing size of organizations added on to difficulties we are imposing on ourselves like having a financial year, a calendar year, an income tax year, a Five-Year Plan, an Annual Development Plan and in the past a Six Monthly Import

Policy all generating pipeline problems when one moves over from one period to another. We also know that on the financial side in the government we have to face severe problems because basically we are wedded to what M/s Foster and Whiffin recommended in 1863, ie about 111 years ago! Basically single entry cash accounting system. Now nothing is wrong with single entry cash accounting system so long as we are dealing with highly predictable cash outflows timewise within a particular financial or fiscal year such as salaries, rents, rates, TA, DA etc. The moment we have problems of carry over from one year to another this system just cannot work. It cannot work on a commitment basis or what is called on accruals basis and this is causing severe problems. Well if the rules were created by M/s Foster and Whiffin 111 years ago and we insist on using those rules to look after ourselves. Should we not think about it logically and clearly and use our faculties of logic and reasoning to be able to make observations generate hypotheses, theories and then laws so that we are in a better position to apply something which matters which will help deliver the goods or produce the results? We are all familiar with problems with finance and one of the basic reasons for our difficulties with finance is that we insist on using rules and procedures which have ossified over the years. Originally they were very good for looking after payment of salaries, pensions and rents and traveling allowances and daily allowances because they are highly predictable and there is little or no carry over from one kind of year to another. But when we go in for purchasing commodities or capital equipment and machinery or to purchase technical services these activities all extend well over one year. In fact putting up any project today may take 3, 4 or 5 years before it sees the light of day. But we insist on using rules and procedures which were not designed to cater for these carry-over problems.

Islam's Gift

We should, in my opinion, try to understand the reasons why these difficulties have arisen before we are in a position to take any action and that calls for a goodly dose of the inductive method. This to me is Islam's greatest gift to the world. It was Islam that propagated the inductive method, of making observations through using our faculties of logic and reasoning to the extent that we are admonished again and again to weigh or measure both the material and immaterial and then logic and reasoning so as to arrive at a decision. There is also a Hadith which says that if you use your powers of logic and reasoning in arriving at a judgement and if you commit an error you earn "one good" but if you make the right decision you earn "two goods". The emphasis to be noted is on objective investigations and it is this that forms the basis for being able to create hypotheses and that is why after the first few decades of Islam i.e. the period of absorbing knowledge from other cultures, there was a sudden expansion. This explosion took place not only in the arts but the sciences also. Whether it was zoology, whether it was ophthalmology, whether it was algebra, whether it was cubic equations, whether it was insurance, whether it was spreading risks or whether it was using things such as letters of credit.... All these developments took place in a very short period. Even such matters as the influence of the mind over illness in a body were exposed through observations i.e. through objective observations which is the inductive method. Unless we are prepared to use the empirical or the productive or the scientific method we are certainly not going to be able to arrive at proper assessments of situations as they exist. And making any decision from a base of ignorance is a dangerous thing. One may say that certain decisions require intuition which cannot be quantified. My reply to that is very simple

and that is: investigations provide a higher knowledge threshold and this helps to improve the level of intuition. This is not as easy as it looks but I believe that it helps develop the proper attitude towards knowledge acquisition. If we are prepared to accept the physical inconvenience we are in a position to “condition” fate. I think it is very clear that we have to make these observations and make these quantitative assessments by actually weighing as I had said not only the material but the immaterial and nothing is achieved without hard work. In other words what I had mentioned earlier you cannot have your home work done by proxy and expect to know all about it. *Va anlaisa lil insaani illa ma sa-aa* (53:39) and that man hath only that for which he make efforts. You get as much out as you put into it.

We must also remember with communications becoming easier and quicker, we are moving from the spoken word to the audio-visual in one fell swoop. In the West they have moved from the spoken to the written and then from the written word to the audio-visual. Because of the high percentage of illiteracy in the country we are skipping over the written word for the majority of the people in the country. Is this not going to create severe problems? I am sure it is already creating them. Somebody sneezes 10,000 miles away and we are affected immediately! In other words we are not insulated, we are not an isolated system. It is up to us to be able to make the observations and to understand the inter-links and out of the inter-links to be able to try recognize patterns and so on.... It was said some time ago that “the modern age has a false sense of security because of the great mass of data at its disposal but the valid criterion of distinction is rather the extent to which man knows to form and master the material at its command” this comes through proper systematic observation and was said by Goethe in 1810.

It is not out of place to mention that in June 1967 a far thinking Dutchman---Klaus von Waveren stated at the Chemical Week---A.D. Little Seminar at Frankfort "that the widely discussed 'technology gap' between the US and Europe is a symptom rather a cause of disparity in utilization of technology. The underlying cause is a difference in managerial environment". A little later the famous book *The American Challenge* by Servan-Schrieber said much the same thing. The technology gap is a myth, we suffer from a 'management gap' which is synonymous with resistance to change. Having a few star performers proves we cannot rely on them for too long---there simply aren't enough of them to go around. As Servan-Schrieber says "The wealth we seek does not lie in the earth or in numbers of men or in machines, but in the human spirit. And particularly in the ability of men to think and create. The training, development and exploitation of human intelligence---these are the real resources, and there are no others" a truism that we prefer to gloss over, do we not?

Technology I believe brings about an awareness of human capital if we are prepared to give it any thought. We know in World War II that the physical capability or capacity of knowledge acquisition of both Germany and Japan were halved not to talk of the physical destruction of their means of productive employment: most of it went, but even with the reduced brain power left they were able to develop everything all over again. It is *knowledge* which is the principal resource of any country, not money. It is knowledge, and the more we can develop this aspect the more powerful in true terms any country in the world is. If we think of America as being gadget minded certainly it is. But on the closer investigation we find its basic strength lies in the application and development of knowledge in a big way. Because in America over the years they have found an

imbalance in that they were deficient in the pure side of knowledge development ie they did not have enough scientists that there has been an inflow of brains from Europe to America. This has helped the USA to keep the pure & applied side of endeavour in an even balance which helps to optimize resource utilization. A strong economy means a strong country and in order to achieve this balance there has to be meaningful communication from application to the pure side and from the pure to the applied side in the form o a cyclical feedback or feed forward. Any country which fails to create this beneficent circle cannot really progress. This means you cannot have your citizens of learning working in isolation from the citizens of productive employment who cannot work in isolation from the government machinery or its organizations. It is only through a vibrant technology that feedback is meaningful and can sustain a living science---the interaction between practice and theory which alone brings about progress, otherwise reliance on borrowed technology ultimately means economic domination as well. However, the emphasis required here and for some years to come is on the applied side not the pure. We have to determine the inter-links, which will only come through proper objective analysis, this is worth repeating *ad nauseam*. It is not foreign to what we are admonished to do.

Population

One of the big problems that we face is that we are told that there is an exploding population. Attempts must always be made to attempt to distinguish between cause and effect or between the symptoms and the disease. Many times we attempt to treat the symptoms which can create more problems than it sets out to solve in the first instance. One may have a splitting headache and have a large dose of aspirin, it may result in the

symptoms disappearing but an X-ray may reveal that there is a tumour in the head for which the cure is to open it up and remove it surgically. Therefore, symptoms are our allies, provided we recognize them as such. It helps to direct our attention to what the disease may be.

The demographic development of any country ultimately follows three stages. The first is that of very high mortality and high fertility in which case the population is not really increasing quickly and this has been in the past the condition of any of the present-day undeveloped countries and about 200 years ago of what is what we call the developed West. But what with emphasis on prevention through chlorination of water, vaccination against smallpox, typhoid and a few other diseases, the high mortality has become low mortality but the overall fertility has increased, in other words there is quick increase in population growth. In the developed West they have moved into a state of demographic development where there is not only low mortality but also low fertility, but how has this come about? It has come about over a period of 150 years on account of economic forces which have been impressed on the families. It came about on account of the increasing number of professions which arose out of the development of the scientific method and its application. It arose out of the increasing costs and time it took to educate children. These were pressures or constraints which were experienced and the result was that over a period of time without forcing people the birth rate went down. Today in some countries it has gone down to such an extent that the state wishes to increase it. What we are attempting to do in Pakistan is within a generation we want to compress stages two & three of demographic development. In physical systems when we experience very quick compressions---adiabatically---it generates enough heat for an explosion, the diesel cycle

works thus. Well let us look for the safety valves. I do not think sufficient investigations have been made with an open mind to arrive at conclusions sympathetic to our socio-economic structure. But this I believe, that the use of science and technology in the administrative process comes in and there is a common link between all developments that lead to spontaneous control over 100 years in the West. We have to generate indigenous solutions through indigenous knowledge in its indigenous application. Again we cannot have home work done by proxy and expect to know all about it! The extent and magnitude of the problem is very clear.

In 1972 our population was 65 million I would estimate by 1990 and that is not very far away, it will be well over 115 million. Just imagine what pressures will be generated in the urban areas. Concentration of anything creates a gradient or problems. Whether it is a concentration of population or a concentration of information or a concentration of wealth. If the population of Lahore or Karachi or Rawalpindi doubles, let us say in a few years what happens to the logistics of those areas including the movement of human beings, the movement of food, the facilities for education and so on. The problems are so huge that unless we have multidisciplinary teams looking into these problems now we are never going to know what inter-links exist between the different aspects of the totality of the situation.

Multi-disciplinary Approach

There is a story, apocryphal or not we can derive certain lesson from it! It is said that there was an office in the United States on the 70th floor. After work gave over the white collar workers came into the lobby to get into the lift to be taken down to terra firma so that they be homeward bound. There was a tremendous number of complaints regarding

the long waiting time in the lobby. The problem was obviously one for the engineers and so it was handed over to them. They made work measurement studies and they agreed that the complaints were justified. They, therefore, suggested in an effort to reduce the waiting time, that the lifts be banked between pairs of floors. This did increase the waiting time somewhat but the complaints yet remained. The engineers then had faster lifts installed at considerable expense. The waiting time was reduced a bit more but the complaints continued. The harassed manager of this organization in despair spoke to the first person who came into the office one day. She happened to be a psychologist. She said that why you did not tell me about this earlier, the solution is very simple. All you should do is to install full length mirrors in the lobby and everything will be all right. Full length mirrors were installed in the lobby and the complaints did indeed evaporate! What morals can we draw from this story? I think the first is that what originally had been assumed to be an engineering problem ended up with psychological answer. The second is the difficulty in defining objectives. Was the objective to reduce the waiting time or to remove the complaints? Apparently both were not related to each other as far as the engineers were concerned. If one could generalize: when faced with a complex problem it is not usually possible to predict in advance what particular approach will give the best solution. Hence the necessity for using multi-disciplinary teams. What happened in this case was that the men were busy looking at the women without the women being aware of it and the women were, of course, very busy looking at themselves! The attention of the "lobbyists" was drawn away to something interesting!

The necessity of having different points of view focused on a particular problem is vitally important because of the split in academic knowledge seeking which had arisen out of the

incapacity of man to attack nature or knowledge as a whole on the pure side. The analogue on the applied side is that of functional specialization. Out of the present day proliferation of various functions the principle function of management or administration is to find ways and means to integrate the activities going on in each compartment. What can be a better integrating medium than *information*? Money is not the most common denominator of organized activity. It is information for there is no organized activity which is not generating information, though there are several activities to which you cannot attach a rupee tag. Information is common to all organized activity. Information handling is not without its problems. How do you know what your subordinate or subordinates subordinate has filtered out in the upward movement of information? By definition you do not know, for do we not have wastepaper baskets at each level in the hierarchy. If we do not know what is being filtered out how can we proceed? After all we are involved in two activities only ie of handling information and of making decisions. And if we agree that lack of information or ignorance can lead to disastrous decisions obviously we must do something about it. We must consciously and deliberately design and install the information handling or filtration system. Whilst organization's budget for their future requirements, we hope, of manpower and facilities and cash, no organization budgets or plans (the budget is merely a financial reflection of the plan, one has to plan first and then create the financial reflection) for its future increasing requirements of information. Therefore a lot of decision making is based on a foundation of ignorance. Man has created these problems for himself by himself.

It is, therefore, necessary for man to solve them himself. If it calls for fresh thinking, objective thinking and this is not foreign to our genius or culture or faith or to our

historical heritage. Why do not we move in the right direction, each one at its own level has to give a push. Our indifference to our heritage has caused us to transplant institutions from the West blindly rather than graft, to adopt rather than adapt. In developed countries practice inspires theory; in under-developed countries theory inspires practice! We know with what results. Good practice, it is said, produces excellent theory! If we observe the workings of various institutions developed elsewhere eg the Joint Stock Company System which arose out of the South Sea bubble---an effort to limit the liability of an investor. But like any other man-made device it calls for periodic updating. It means we accept the fruits of Western thinking but are not prepared to accept the continuing effort that goes to maintain the particular vehicle we use. We throw out what we do not like, we add what we like, but then we must blame ourselves, not others that the results are not what they should be. Look at our semi-autonomous institutions do they not leave much to be desired? Have we not misused a number of imported devices? Look at our banking system prior to nationalization and there are other examples. Unfortunately “the graver the problems the less resources available to combat it” was said by Machiavelli quite sometime ago.

Information

We should also do a bit of introspection regarding the type of information that we are dealing with and I believe in any administrative effort. The technology of information is something which is vitally important because as mentioned earlier we are only doing two and two things only. We are either handling information or making decisions. We observe that in the planning process it moves from the general to the particular. This implies the necessity of developing a methodology otherwise we will be like a rudderless ship, this

means we must have a fixed logic in our means to approach or attack our problems. This structure or operative logic will be fed by repeated observations so that in the final analysis a process is developed and used. We know a decision is only a moment in the process. After making a decision it may have to be altered. Modifications may be required frequently, hence what is more important is setting up the process that helps generate a decision. I maintain we have not paid enough attention towards creating this predictable process, where we can have a predictable filtration or information handling process and arrange these things properly. You will also observe that when we talk of control we move in the opposite direction, in other words we have particular information and the logic for obtaining this feedback information is variable. We can get it in many ways if you want to know what is going on somewhere. Unless we are prepared to recognize these differences we will not be in a position to conceptually solve our problems and unless we generate conceptual solutions to our problems I can assure you no management aid or machine is ever going to do that for us. It is totally out of the question. Let us examine how knowledge has developed, we find it has developed by through particular observations, observations that concerned individuals personally eg in agriculture the individual was concerned with seasons hence the calendar and so astronomy was developed to assist in problem-solving about when rivers were in flood, when it would rain etc. Out of ownership of land grew land geometry, out of barter grew the science of weights and measures and out of enumeration grew the study of numbers. Because we live in dwellings and require stores for grain and places of worship hence the science of mechanics developed. This process of systematisation from the particular to

the general, is reversed in the classroom. The teachers move from the general to the particular but this takes place at a higher level of sophistication ie there is a solid base.

If we look at resource utilization it is clear that the commitments involved with each decision are increasing along with the time frames involved. Therefore, all the more reason why we should try and keep ourselves better informed. I believe that it is only through an understanding of the inseparable relationship between science and technology that resource utilization can be optimized. One without the other is not of much use. Knowledge which is not applied is sterile, and application without knowledge is groping in the dark. Again, discipline without imagination is sterile but imagination without discipline is chaos. We always have to try and find the middle road and unless we have ways and means to get the proper information through an understanding of the scientific method I do not see how the administrative process can really progress in an enlightened manner. It will not have the built-in capability to adapt to the changing environment. As Stafford Beer concluded in his book on Management Science that the dinosaur did not adapt so we have none of them today!

You will find that all the factors which governed the traditional way of handling projects have altered today. The planning cycle is much longer. Resource commitments did not really materially alter or change in value within the life time of a project, today changes take place overnight altering the situation completely. We, therefore, have to try and understand what is it that makes up a given situation and substitute fact for fancy so as to replace ambiguity to ensure we are dealing with propositions that can be validated by meeting the tests of reasons and experience. Institutions like persons, develop habits to which values become attached, precedents are sanctified. It is up to us to make a break

with the past and if we do not I am quit sure we are going to find it increasingly difficult to achieve what we wish to achieve. And if that be the case then what the Brazilian Helio Jaguaribe said is certainly appropriate “underdeveloped countries of western or westernized tradition are not underdeveloped because their own elites want it that way. In order to maintain their privileges, tey are dependent on maintaining the status quo. What is important is to force social change by giving new qualifications to the new generation....to create a functional elite whose interests are compatible with and dependent on an increase in general welfare”.

/Science