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Introduction

Synopsis: *Increase in the productivity in all occupations is the topic of the day. This is achieved by Work Study which concentrates on organizing the work performed and developing or engineering the methods of operations. Work Study hence has a direct relationship with productivity and is referred to as the basic tool to increase productivity.*

Keywords: *Work organization, methods engineering IS 6363, BS 3138, method study, work measurement, productivity, production objectives, work study specialists, penetrating tool of investigation, International Labor organization, human abilities and psychological aspects.*

1.1 Work Organization and Methods Engineering

Work Organization and Methods Engineering is a subspecialty of industrial engineering. While Work Organization is concerned with human integration in industrial production processes by skills distribution and coordination of work tasks, Methods Engineering is the analysis and development of the method being employed in performing these tasks to achieve the objective of lowering the production costs and increasing reliability and productivity. Work study is that branch of industrial engineering, that aims at achieving both these objectives. For this reason, we use the term work study in this chapter as well as the other chapters of this book, to represent both Work Organization and Methods Engineering.

1.2 What is Work Study?

Before we attempt to answer this question, let us review some of the explanatory definitions available on work study, which may possibly outline what it incorporates. It basically is a system of assessing methods of working so as to achieve the maximum output and efficiency. Work study helps to increase productivity of men, machines and materials.

IS 6363:1972 *(Glossary of terms used in work study)* of the Bureau of Indian Standards, defines work study as

> *Work study is a modern discipline, which analyses and evaluates all aspects of the work system in order to enhance the effectiveness and functional efficiency.*

BS 3138:1979 (*Glossary of terms used in work study*) of the British Standards Institution gives a more typical and comprehensive definition, which is more an explanatory definition as

> *Work-study is a generic term for those techniques, particularly of method study and work measurement, which are used in the examination of human effort in all its contexts and which leads systematically to the investigation of all factors that affect the efficiency and economy of the situation being reviewed in order to affect the improvement.*

R.H. Hammond in his chapter *History and Development of Industrial Engineering* in the Production Hand Book edited by Gordon Carson, refers to t*he Report on the Training for Work Study Practices* of the Joint Industrial Training Board, which states as follows

> *Work study attains its benefits through, firstly by investigation of the current situation, examining especially any apparent weaknesses, for example, the performance of an operating team or a machine group. This diagnosis is followed by the determination and the introduction of appropriate improvements in operating methods. Then investigating and review will cover operating methods, selection and usage of equipment, plant layout supply and usage of materials, availability of ancillary services like material handling, work organization, effectiveness of total operating procedures, progress control and the potential effect of the investigations on overall costs and efficiency.*

The Free dictionary defines work study as *the analysis of industrial or work procedures to determine the most efficient methods of operation.*

We may cite a hoard of such explanatory definitions, which have one thing common with them - no single sentence definition can fairly and adequately explain the subject as much as the above definitions, or rather explanatory definitions do. They reveal how boundless work study can be in the day to day works in all walks of life, whatever it is a manufacturing industry or an automobile workshop, or a chemical industry or even an educational institution.

1.3 Work Study is a Tool for Increasing Productivity

From the above definitions, we can see that work study has a direct relationship to productivity and is the most frequently used technique for increasing the amount produced (output) from a given resource (input), with little or no increase in the capital investment. Productivity, of

course can be increased in the long run by innovations and development of new processes, modernizing of plant and equipment or by acquisition of advanced technology. But these need heavy capital outlay and cause a drain of our meager foreign exchange and other resources. No one would like to increase the capital outlay just like that. This aspect is discussed more in detail in chapter 11 on kaizen.

We shall hence look at the productivity problem from a different angle. Let us determine the causes of low productivity by systematic analysis of the existing processes, designs and work methods, thereby devising means and methods to increase output by eliminating or modifying wasteful elements of operations, designs etc., with no or minimal increase in the capital. But after all, history has time and again shown that, what is supposedly impossible in the yesteryears has become a possibility today, whether it is a steam engine or man landing on the moon or the desk-top and lap-top computers, or more so, in smart machines or IoT.

It may be true that some improvements like the discovery of steam power by James Watt had come by pure chance. Nevertheless, many of the successes achieved in the recent past have been results of systematic applications of the work study principles. In these days of scientific and technical advancement, it would indeed be an unforgivable crime to rely on pure chance and here lies the need to have some reliable predetermined knowledge of the implications and consequences of a change.

After all, investigations and improvements of operations or increase in productivity are not new in the history of industrial development. Many geniuses starting from Frederick Taylor have made notable advances towards an increase in productivity. Unfortunately, we are yet to come across a factory that would produce such geniuses in a mass production line to cater for the highly complex industrial situations of today. Thus, it is of prime importance that the process of improvements be made so systematic, foolproof and at the same time, simple that any normal manager, by carrying out this systematic procedure can achieve results as good as, or better than what a less systematic genius was able to achieve in the past.

1.4 Work Study is a Tool to Achieve Production Objective

The basic objective of production management is to produce the right quantity of goods in right quality at a predetermined time at a predetermined cost. Work study is the tool with which the management strives to achieve this objective by providing standard methods of operation to the manufacturing activities.

The prime value of work-study lies in the fact that if a systematic procedure is applied both in the investigation into the problem and the development of solutions, one is sure that no criteria or limitation or alternative is left unconsidered and can confidently say that he had left no stone unturned. This is a prerequisite for effective results and this aspect undoubtedly distinguishes a systematic application of work study from chance improvements.

1.5 Work Study is a Penetrating Tool of Investigation

As we have defined earlier, work study is concerned with the analyses for the optimization of complex processes, systems or organizations, leading to the elimination of waste of time, money, materials, man-hours, machine time, energy and other resources that do not generate value. This is why it is also referred to as CREW (Cost reduction by elimination of waste). It hence involves investigations by direct observations of all the factors affecting the efficiency of an operation and is bound to show up any shortcomings in all the activities of an organization. A common example is the low productivity due to the forced idleness caused factors, frequent machine breakdown or non-availability of the raw material at the right time in the right place in the right quantities. In ILO's expression, work study acts like a surgeon's knife laying bare the activities and functioning of all the different departments of an origination, good or bad, for all those to see. These point inaction by respective officials in activities like maintenance and material control. That means it shows up people, and obviously no one likes to be shown up.

In other words, what we may start as a simple methods improvement may reflect on the effectiveness of one or more senior executives, and may well cause considerable resentment and in some cases, active opposition by the aggrieved, which might boomerang in situations where the work study engineer lacks adequate managerial support. Basically, such an opposition or resistance is caused due to the fact that many executives view such an exposition as an isolated case of loss of their prestige rather than by viewing it from the general overall benefit point of view. For this reason, work study must be handled like a surgeon's knife, with all the skill and care that are needed.

Therefore, it is vital that all concerned and involved in the implementation of the change must be taken into confidence while conducting the study. Secrecy or the appearance of secrecy must be avoided at all costs. The ideal situation is one where work study forms an integral part of all activities and not a separate entity. Chapter 20 may be referred to, wherein various aspects resistances change which is inherent to human nature and discusses how the work study engineer should strive to overcome the same.

1.6 Work Study and Productivity

As seen in the previous paragraphs, productivity implies the development of an attitude of mind and a constant urge to find better, cheaper, easier, quicker and safer means of doing a job, manufacturing a product or providing a service.

The whole principle of various industrial engineering techniques including that of work study is reflected in the above statement.

In other words, work study emphasizes in identifying, analyzing, and critically examining various factors that add to the ineffective time involved in the production of a product. By systematic procedure, detailed in subsequent chapters, alternative methods or processes are developed whereby productivity is effectively improved. This aspect is dealt more in detail in chapter 3.

1.7 Work Study is an Unquestioned Valuable Tool for the Management

We can summarize the reasons for considering work study as a valuable tool of management as

1. It is a direct means of raising productivity and production efficiency of an organization or an operating unit, involving little or no capital expenditure on plant and equipment.
2. It is based on systematic, consistent and simple principles and procedures where analysis is based on fact and data and not on individual opinions.
3. It ensures that no factor or data affecting the efficiency are overlooked.
4. The various recording techniques adapted help in presenting all the facts as well as the analysis in simple but clear cut and specific charts, symbols and reports, so that not only the bosses, but personnel at all levels who are involved in the implementation of the change, can understand and appreciate the procedure adopted.
5. It is a reliable and accurate means of setting up targets of performance, which help effective planning and control of not only the production but also other activities like maintenance.
6. An effectively conducted work study results in immediate savings to the company and would continue as long as the change continues.
7. Work study has universal applications. It can be used wherever the manual work is involved, whether it is machining operation or transport, workshop, clerical work, hospital, supermarket or even educational institution.
8. As explained in paragraph 1.4, work study is a penetrating tool of investigation, and shows up all the ineffective practices by the staff at different levels, as well as the invisible ineffective elements, similar to the bottom of the iceberg hidden in the ocean, as illustrated in Fig. 4.1.

1.8 Work Study is an Interdepartmental Function

Like any other functional activity that performs an advisory role or as a staff function, work study cannot work in isolation, but forms a central function round which all other departments stand to benefit, as illustrated in Fig. 1.1. It is hence imperative that a regular flow of information to other related departments is indicated in Fig. 1.1 is maintained.

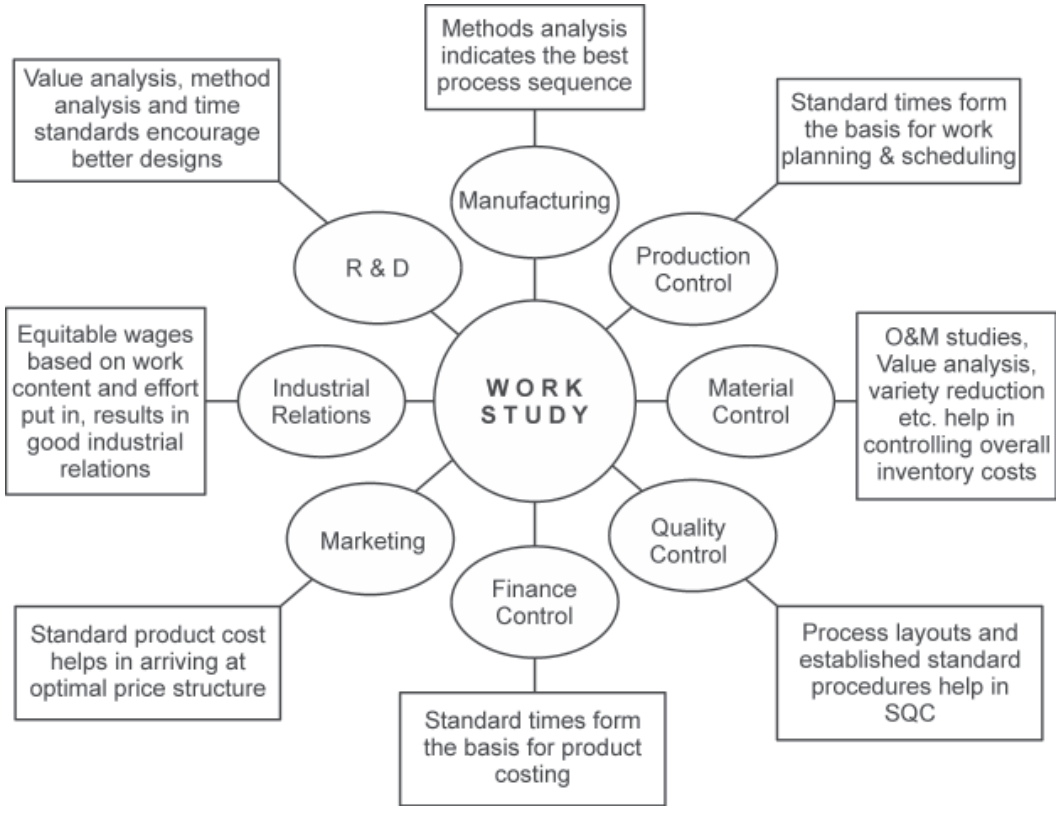


Figure 1.1 Relationship between work study and other departments.

1.9 Inter-Departmental Information Flow

Inter-departmental Communication is one of the organizational functions that help smooth and streamlined flow of information necessary for the uninterrupted production flow; this helps a company to stay efficient and productive. It is the communication between departments that keep the organizations alive and efficient and when it breaks down, crises would develop affecting the smooth production flow. The following illustrations can be cited to highlight the importance of prompt communications between several departments and sections.

1. When inter-departmental communication is poor, customer service too can suffer. For example, if the accounts receivable department is not communicating properly with accounts payable, a client continues to receive a bill for an invoice that was already paid and this will result in losing the customers and the repeat business.
2. If the production department is not appraised about an increase in product demand, then the company suffers a loss of revenue. This would also result in subsequent priority allocation on war footing, resulting in poor efficiency.

We can cite hordes of similar illustrations that we experience in our day to day manufacturing life.

Fig. 1.2 illustrates (See next page) how the policy and the feedback communication flow between several productions and related departments. For further information on Inter-departmental Communication, reference may be made to the book *'Production Planning and Control, A Comprehensive Approach'* by this author.

1.10 Management Information Systems

Despite conducting an excellent method study project, the work study engineer's efforts would be appreciated only if he makes a good report of the work. For this he must understand the principles of management information system, as explained in the next paragraphs.

Feedback system is the communication or an effective flow of information as well as the policy at the right time to the management. In general, for effective communication, the policy information flows from the management to the planning and control staff, while the feedback information flows from the control staff to the management. This is represented in Fig. 1.3.

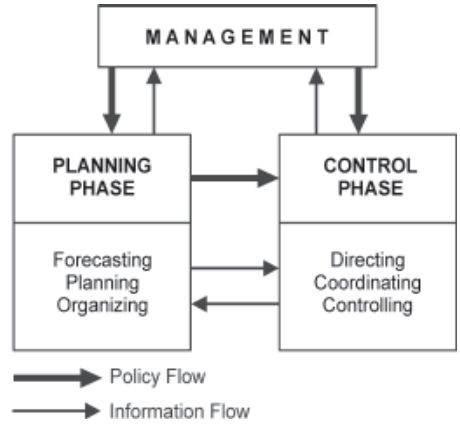


Figure 1.3 Management information system.

1.10.1 Why MIS is Essential for the Managers?

When a manager is in the dark about what is happening in the factory, he is in a state of uncertainty and cannot decide his next step. An effective information system can help him understand and analyze the situation. In other words, an effective MIS provides facts based on which the manager can take a decision. Fig 1.4 illustrates how the MIS assists the manager as above. Chapter 21 on the role of consultants, explains MIS further and discusses its significance in making the job of work study engineers and consultants more effective.

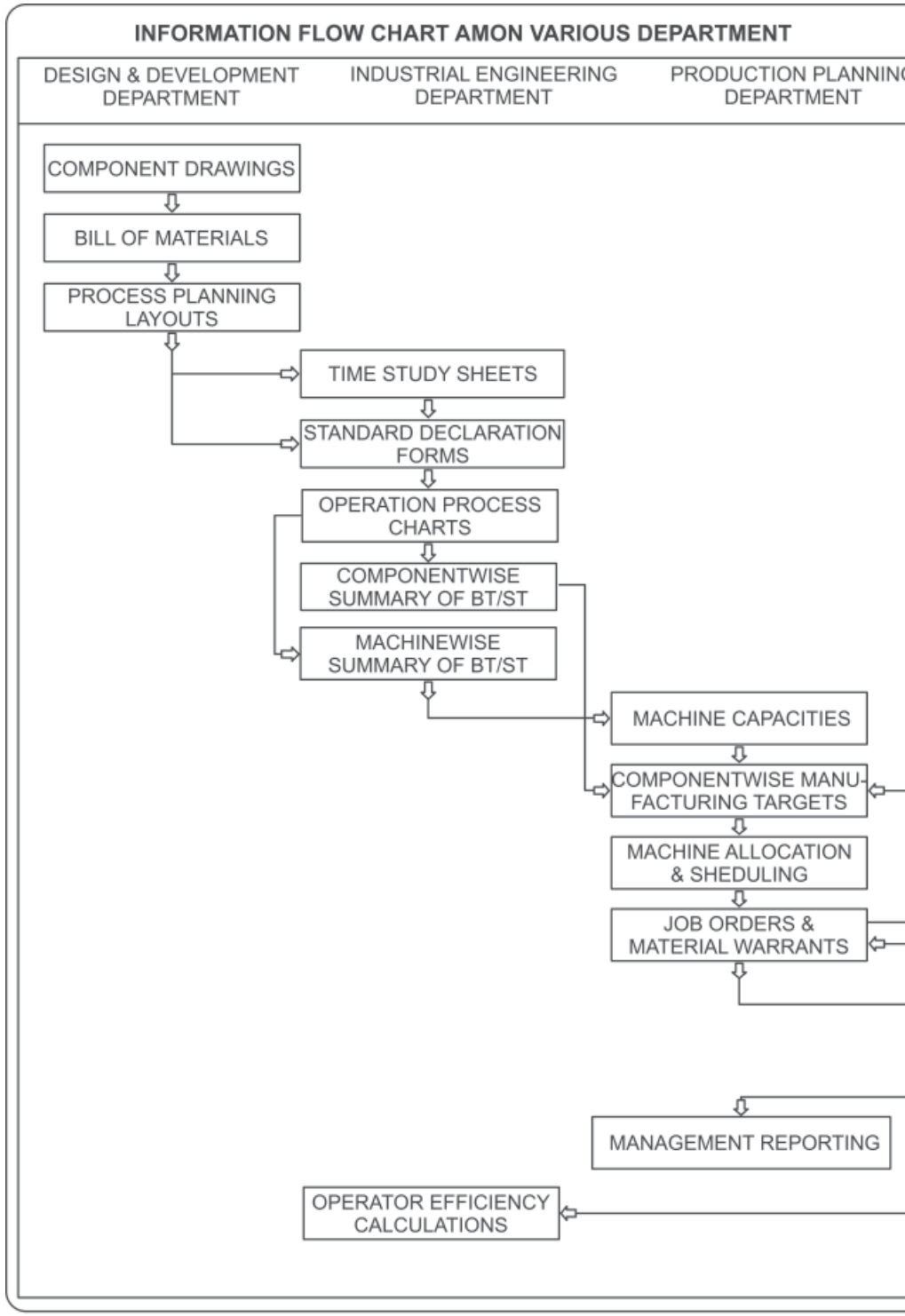
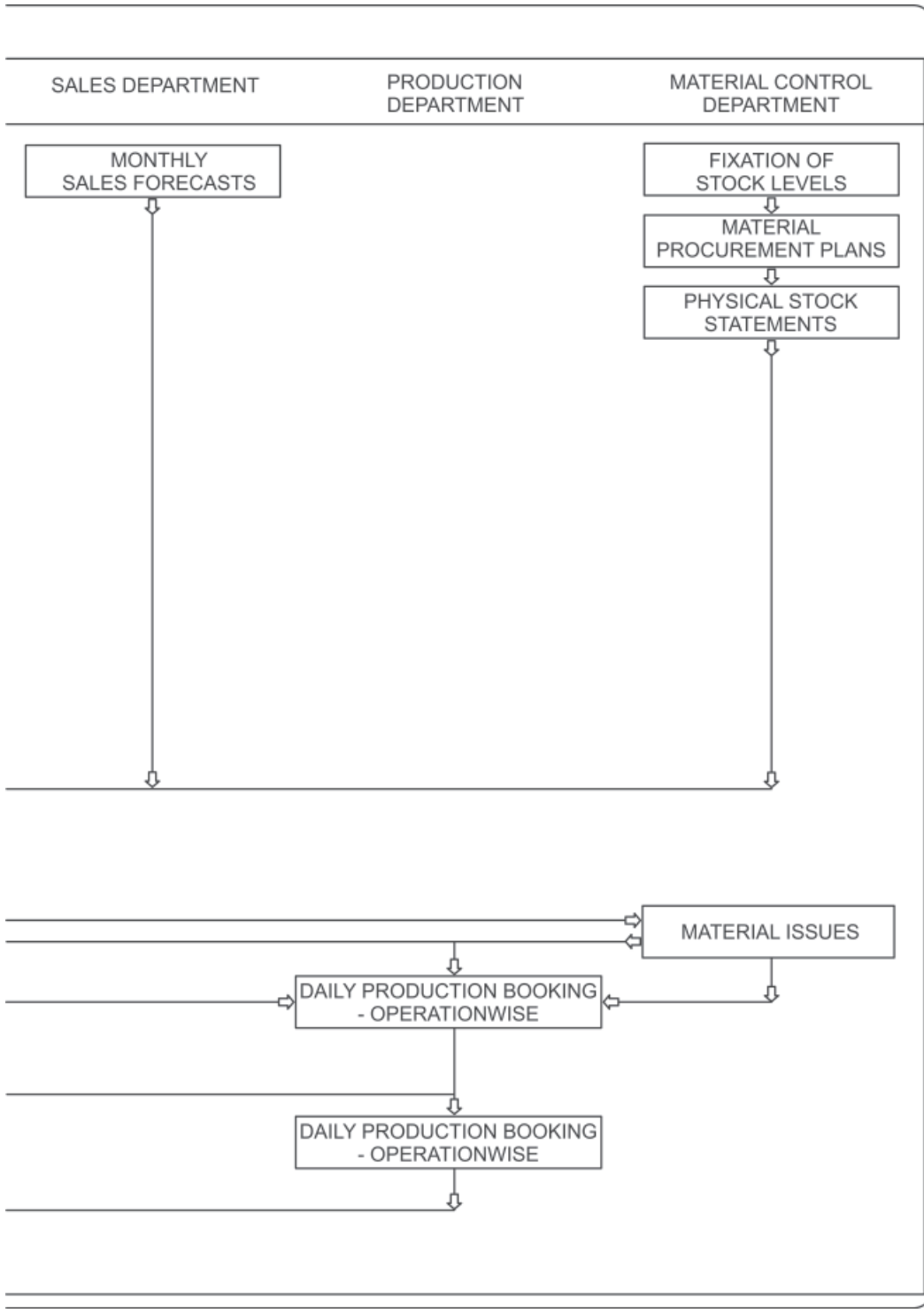


Figure 1.2 Information flows between several departments.


SALES DEPARTMENT
PRODUCTION DEPARTMENT
MATERIAL CONTROL DEPARTMENT
MONTHLY SALES FORECASTS
FIXATION OF STOCK LEVELS
MATERIAL PROCUREMENT PLANS
PHYSICAL STOCK STATEMENTS
MATERIAL ISSUES
DAILY PRODUCTION BOOKING - OPERATIONWISE
DAILY PRODUCTION BOOKING - OPERATIONWISE

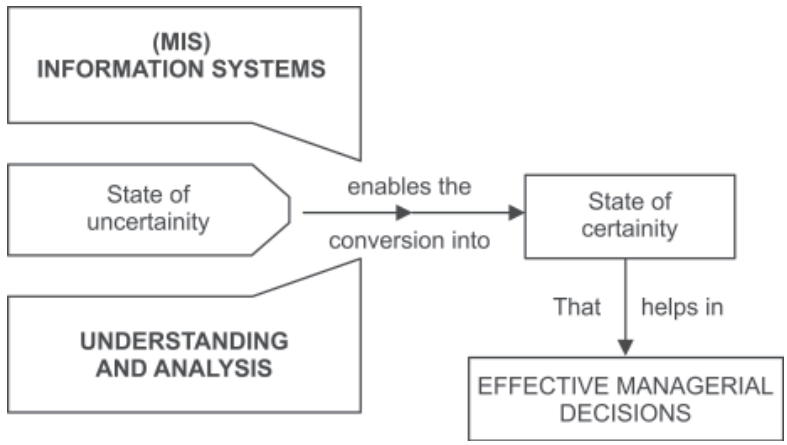


Figure 1.4 How Effective MIS help in Managerial Decisions.

1.11 Why we need Specialists in Work Study?

We have said that work study is systematic and at the same time is simple to understand. Then why do we need specialists for work study? Can the production personnel not conduct a work study themselves and achieve results?

Well, before we answer this, let us refer to paragraph 1.3 where we said that work study succeeds due to the fact that all the limitations, criteria and alternatives are considered by systematic investigations. These detailed investigations take time and a high amount of concentration of thoughts and specially acquired skills. The production manager or the supervisor might have acquired these skills and is efficient, but he is engrossed in his day-to-day and minute-to-minute technical and other production problems that he is never free for long interruptions from his work of achieving the production targets. It would be much more difficult for him to gather all data patiently and unless all the facts are fully known, it would be difficult to continue investigations.

This means that the function of a work study must always be the responsibility of someone, who is free from production problems like the stress of achieving production targets. He should be able to undertake his job as a staff function and not as a line function.

1.12 Psychological Aspects of Work Study

Management is both an art and science. There are a number of scientific techniques that can be applied to solve management problems with systematic, step-by-step approach from the known to the unknown on the basis of ascertaining facts.

While scientific techniques are applied to materials which are governed by known physical laws, the management techniques have to be applied to people by people. A full understanding

of the human behavior, especially of those affected by the decision is essential for the very success of these techniques. We can say that while the systematic analysis forms the science part of management, the human relations form the art part of the management. The chief aim of every management is to lead the enterprise towards specified goals. This can be achieved by organizing and controlling all activities, especially the human activities of the organization.

Despite industrial engineers having widened into most of the management techniques like operations research and analysis, robotics etc, work-study continues to be their chief activity. Industrial productivity aims at method improvement or systems improvement. But the very word 'improvement' is linked to an action of change and the resultant resistance is more psychological that the workers being against the change itself. A sincere attempt to understand the possible motive for such a resistance, as well as the past history responsible for the development of such a resistance, together with the complete analysis of the situation would possibly enable the management to plan a rational course of action for the successful implementation of the change. This aspect is dealt much more in detail in chapter no. 20 on Resistance to change.

1.13 Conclusion

As highlighted in paragraph 1.12, there is no doubt that, even though the industrial engineer's activities have widened into research issues, robotics, Internet of Things etc., their principal activity continues to be work study. Today, even large industries are resorting to stopwatch time study for setting work standards. For this reason, not only industrial engineers, but all those who work in operational controls, should acquire sufficient knowledge about work study, and this book strives towards that direction.

Further Reading

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2. Keith Landen - *Management's use of Industrial Engineering - Industrial Engineering Handbook,* edited by H.B. Maynard (McGraw Hill - 2nd ed.).
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8. B.S. 3138 - *Glossary of Terms used in Work Study*.
9. IS 6363 - *Glossary of Terms used in Work Study*.
10. Michael J. Papa, Daniels T.D. & Spiker, B.K. - *Organizational Communication*.

Criteria Questions

1. How do you relate the term Work Study with Work Organization and Methods Engineering? (1.1)
2. How do you justify 'Work study is a tool for increasing productivity'? (1.3)
3. How can work study be a penetrating tool of investigation? (1.5)
4. Represent in a sketch, how Work study is related to other functional activities. (1.8)
5. Why we need specialists in work study, free from production responsibilities? (1.10)
6. Distinguish between data and information. (1.11)
7. With reference to Fig. 1.5, match the following.

	Set A		Set B
1	Input	a	Retains instructions and partly calculated results for future use
2	Programming	b	Provides the defined steps in which the processor is instructed to understand and convert the input data
3	Processor	c	The main body of the computer which converts the input data and/or rearranges them in the desired form
4	Storage	d	The result of the computations and processing which rearranged and presented in the desired form
5	Output	e	The raw data as presented to the computer in a way it can understand and interpret it.