AN EMPIRICAL INVESTIGATION OF THE
INTERACTION "MANAGER-TASK" USING A HUMAN
INFORMATION PROCESSING APPROACH

TWO VOLUMES

VOLUME: 1

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SUMMARY

This study set out to investigate empirically the interaction "manager-task". Specifically it focused on trying to understand how managers handle the complexity implied by the tasks of their concern. In short its focus was in trying to isolate the various information management strategies used by managers when operating in their organisations.

A model was created to bring together many ideas from a number of authors, and which relied to a considerable extent on the work of a notable management cybernetician, Stafford Beer, and his conceptualisation of management i.e. management is the profession of regulation. The model highlighted the need to examine the manager's strategy to collect and validate information and the manager's approach in responding to this information. As a method to examine the manager himself a number of tools were used and/or developed. Carl Jung's theory of psychological types formed the basis of the method to examine the manager's cognitive style. Two anxiety/strain instruments were used as a way of gaining from the manager's point of view his "fit" within the organisation. Beer's Viable System Model formed the basis of the framework to analyse the organisation structure the manager was operating in.

It was found that Beer's conceptualisation of management and his Viable System Model provide a powerful conceptual framework to understand what managers do in the organisational context. There is evidence that managers' cognitive styles are an important variable in defining the strategies used by managers to handle complexity. It also appears that tasks are not independent of the manager but rather it is the manager himself who defines, shapes and develops the tasks.

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To

My Late Father

If only you know how much I miss you.

.

and

Widad, Asma and Iman

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1   Background To The Study

How managers think and operate has become an increasingly researched area in the last three decades. This is partly due to the increasing influence that managerial decisions have on our day-to-day lives and our need to understand how these decisions are made, in the hope that we can somehow influence and shape those decisions. But probably the greatest motivation behind a great deal of the work carried out by management scholars stems from three main sources, these being:

1)   A need to improve the knowledge base in particular areas of management.

2)   The inadequacy of some existing management theories in explaining the nature of managerial work and in giving an accurate reflection of how managers operate, and should be operating, in organisations.

3)   Recent advances in other disciplines have given new, relevant and important insights that have forced management researchers to rethink and reexamine both the classical and established theories of management.

The author's drive to understand how managers operate and interact, how they develop and shape their tasks, is borne from a combination of the three above-mentioned sources. That is, the inadequacy of existing management theories has led the author to look to new advances in other areas to help explain how managers operate (with the aim of improving the corpus of management

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theory in an area where we have a poor understanding of the mechanisms underlying the interactions of the manager with the tasks of his concern).

1.2   The Research Problem

Using a human information processing approach and drawing on the disciplines and theories of organisational cybernetics and cognitive psychology the author attempts to:

1)   Develop a different methodological approach to those currently used in the study of how managers operate, in the hope of overcoming some of the major weaknesses outlined by major reviewers of managerial work and research.

2)   Empirically examine how managers operate, perceive, develop and shape their tasks in an attempt to highlight the strategies used by managers in handling their complexity.

When the author uses the term human information processing approach, the term has two connotations with respect to this study. First it means using recent advances in how the human brain processes information, and secondly, it means using the work of Stafford Beer on the general laws and principles which govern the control processes and organisation of the central nervous system.

The need to draw on the disciplines of cybernetics and cognitive psychology will become evident to the reader as the author begins to examine and review the literature in the area of how managers operate in organisations. However, cybernetics is unique in that 'it offers a method for the scientific treatment of the system in which complexity is outstanding and too important to be ignored' (Ashby, 1964). Cybernetics, defined by the American mathematician and founder of the science of cybernetics as the "science of control and communication in the

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animal and in the machine" (Wiener, 1961), is about finding invariances, or laying down invariances, that give a dimensionability to the system under study. Cybernetics isolates relevant dimensions that are common across a variety of systems. In this case the system under study is the manager-task interactions, as defined by the structure of how the individual manager operates, and the strategies that he uses to handle the complexities of his job. In terms of this study it sets the author the objective of seeking the kind of abstract variables that would give a dimensionability to the ways managers operate and permit the classification of individual managerial strategies in handling complexity, based on the assumptions that these dimensions recur.

Recently published papers in management and psychology journals stress the need for scholars and researchers in management to examine cognitive differences in managerial information processing. These differences stem from the way our cerebral hemispheres process information. It is widely believed by experts in the area of neuro-physiology and neuro-cybernetics, and to some extent clinically shown, that we as human beings become dominant in the way our cerebral hemispheres process environmental information. As the brain matures specific hemispheres become specialised in particular types of information processing and individuals become dominant with respect to the type of information processing they use to process and handle environmental information. If this is so, it could partially explain widely perceived differences in managerial behaviour and differences in managerial operating modes, for managerial tasks imply both a certain degree of complexity and of content which, to be adequately managed, require a cognitive ability on the part of the manager that can handle or absorb the complexity of the task.

The author in this study seeks to empirically examine and test the following hypothesis:

"Managers, consciously or unconsciously, use certain strategies to handle the complexity of their tasks. Two major variables underlying the explanation of these strategies are the manager's cognitive style and the structure of the system the manager operates in."

By cognitive style is meant:

"Stable individual preferences in mode of perceptual organisation and conceptual organisation of the external environment." (Kagan et al, 1963: 2)

1.3 The Methodological Approach To Be Used In The Study

The methodological approach to be used in this study differs considerably from most methodological approaches used in the studies of how managers operate. It involves a rigorous understanding and formulation of a model to be used in the study of how managers operate prior to carrying out any empirical work. Most of the findings in management studies are based on empirical generalizations. That is, researchers rely to a considerable extent on their findings to model the situations of their concern. The approach taken here differs from the main stream of methodological approaches in that it attempts to formulate an understanding of how managers operate, sets up a model a priori, and attempts to empirically validate it. This approach was guided by the early work of Stafford Beer into the nature of a scientific model (Beer, 1966). While the author's approach does not follow Beer's well defined and necessary steps to the letter, it does, however, use his work as an important and valuable guide. Stafford Beer's ideas into the nature of scientific models and his contributions to cybernetic theory, in particular organisational cybernetics, have given management scholars a far more meaningful perspective into understanding the complexity of both the organisational system and the managerial process.

The methodological approach to be used in this study is very much multi-disciplinary, which requires a number of rigorous and well defined steps to be followed sequentially in order to test the general hypothesis. This approach is

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shown in diagrammatical form in Fig. 1.1. The first step required by the method is for the researcher to carry out a literature review of major studies in the area of how managers operate. This is to establish the existing knowledge base at the time of the study. It specifically requires the researcher to highlight major findings by management researchers in the area under study. This in turn highlights major weaknesses and information gaps that the researcher must be conscious of when carrying out his study, and which he must endeavour to overcome if at all possible. This in turn leads to step two which requires the researcher to examine other disciplines for possible methods in order to overcome some of the shortcomings and weaknesses which he has recognised by carrying out the first part of the literature review. With respect to this study it entails a literature review in the area of cybernetics and in particular organisational cybernetics. Once the researcher has gained a richer understanding of the managerial process and the working mechanisms underlying organisations he creates a model, step three, by putting down his thoughts and perceptions of how he perceives managers as operating in their organisations. It must be understood that models are more than analogies: they are meant to disclose the key structure of the system under study (Beer, 1975). This model is to some extent a loose understanding that can only be improved on, modified, validated or invalidated by carrying out studies on managers presently working in organisations. This loose understanding triggers a need to validate the model empirically. However this can only be done by a rigorous formulation of the ideas and perceptions, step four, and by creation of sub-models and specific tools that break down the model to enable its testing. The author uses many of the ideas of Raul Espejo in the area of developing tools to capture and analyse the complexity of organisations, especially with respect to the application of Stafford Beer's Viable System Model. These tools are then used in a field study, step five, and are applied to a number of managers in differing organisations to either validate or invalidate the model.

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│    MAJOR STUDIES PREVIOUSLY     │        │                                  │
│   CARRIED OUT THAT SEEK TO      │        │                                  │
│  EXPLAIN HOW MANAGERS OPERATE   │        │                                  │
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│  MAJOR WEAKNESSES AND           │        │          STEP FOUR               │
│  INFORMATION GAPS THAT NEED     │        ├──────────────────────────────────┤
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│  EXAMINATION OF RELEVANT        │        │ SCIENTIFIC TOOLS TO BE USED BY   │
│  ADVANCES IN OTHER DISCIPLINES. │        │ THE AUTHOR TO CAPTURE            │
│  CYBERNETIC INSIGHTS            │        │ MANAGERIAL DATA AND NECESSARY    │
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│  IMPORTANT INSIGHTS INTO        │        ┌──────────────────────────────────┐
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or invalidates or modifies

Fig. 1.1

The researcher can then use this information to modify his model or, having recognised weaknesses in some of the scientific tools used, attempt to modify them or highlight their weaknesses to future researchers.

1.4 Plan Of The Study

The plan of this study is based on the methodological approach described previously. In chapter two the author reviews major studies on how managers operate drawing on papers using either of two major approaches, viz. the managerial behavioral approach and the human information processing approach. Major weaknesses and information gaps are highlighted. This leads to the second part of the chapter where the literature in cybernetics and systems science is examined to gain important insights that may shed light on ways to study how managers operate. In chapter three the author presents his understanding and ideas in a form of a model that attempts to disclose the key structure of how managers operate and the strategies they use. This model poses a number of specific hypotheses that need to be empirically tested. In chapter four the various methods used to test empirically the specific hypothesis are outlined and specific tools in the form of questionnaires and sub-models are developed to test the model. In chapter five an explanation of how the author carried out the field study, outlining the sample and method of data collection is explained. In chapter six empirical results are discussed with reference to the model. In chapter seven major conclusions of the study are outlined leading to chapter eight where specific recommendations are made to future scholars wishing to undertake similar research.

CHAPTER TWO

LITERATURE REVIEW

2.1   Introduction

It is the purpose of this chapter to review major studies carried out by researchers in trying to explain how managers operate in their working environments. While it is recognised that there exists a number of methodological approaches and theories, used by researchers, it is not the purpose of this study to review all of them but rather to concentrate on a number of them to highlight the nature of the findings attained by such approaches. The author first reviews a number of major empirical studies that have already been carried out on managers and then follows this by a review of some of the findings attained by the human information processing approach. Once this is done, the author then reflects on the findings and highlights major weaknesses that appear to emerge from such studies. In an attempt to overcome some of these weaknesses, the author then reviews the literature in the area of systems science and cybernetics. The purpose of this is to see if recent advances in these disciplines can somehow seek to explain how managers operate, or provide the author with a framework by which managerial operating modes and strategies can be examined in a consistent and effective manner.

Major Empirical Studies On How Managers Operate

In a recent paper Rosemary Stewart summarises how recent empirical findings have changed the traditional perception we have of the way managers behave:

"From viewing managerial behaviour as primarily:

Orderly	to disjointed, characterised by 'Brevity, variety and fragmentation'
Planned	to reactive and instinctive
Working with subordinates and boss	to recognising importance of lateral relationships
Using formal information	to also using informal, speculative information"

(Stewart, 1983: 96)

This conclusion is probably based on her understanding of the major findings reached by her own empirical studies and those of Mintzberg (1973) and Kotter (1982).

Rosemary Stewart's original study of managers and their jobs (Stewart, 1967) concentrated on finding similarities and differences in the way managers spend their time. In this study 160 managers kept diaries of their activities for four weeks. She found that managers in her samples spent 41% of their contact time with employees, 12% with their own bosses and 47% with people outside the organisational chain of command.

Mintzberg's study on the nature of managerial work (Mintzberg, 1973) was based on an observational study of five chief executives, each for a period of one week. From the results of the observational study he points to three major set of roles that managers carry out:

1st set of roles: three interpersonal roles:

 a) figurehead   b) leader   c) liaison

2nd set of roles: three informational roles:

 d) monitor   e) disseminator   f) spokesman

3rd set of roles: four decisional roles:

 g) entrepreneur   h) disturbance handler

 i) resource allocator   j) negotiator

In a later paper he reflects on these results and states:

> "Do all managers play all the ten roles? We think we have shown that
> they do, that these ten roles describe the work of managers from
> foremen to presidents, from managers in corporations to those in
> school systems and governments. But saying that all managers play all
> ten roles is not to say that every manager gives equal attention to each
> role" (Mintzberg, 1978: 263).

In a more recent empirical study, Kotter studied 15 general managers from
a diverse set of corporate settings using interviews, observation and
questionnaires. He isolates two invariances in the way general managers approach
their work and what they do each day i.e. agenda setting and network building. He
also recognises two relevant elements with respect to the manager's job demands,
these being:

> "1) Keeping on top of a very large and diverse set of activities.
>   Being able to identify problems ("fires") that are out of control
>   and solve them quickly.
> 2) Getting corporate staff, other relevant departments or divisions,
>   and important external groups to cooperate despite the lack of
>   any formal authority over them" (Kotter, 1982: 14-17).

What clearly emerges from these three studies are three major points. The
first is that there appears to be a lack of consistency between the purposes of the
studies and the actual variables chosen to carry out the study. The objective of
the studies implied that they were going to draw invariances in the nature of
managerial jobs and the way managers operate - invariances that would allow
anyone to recognise what managers do and how they operate irrespective of the
nature of the industry or the organisational setting. Their results do not appear to
achieve this. The level of abstraction they chose to operate at ignored important
dimensions of the system they were studying. The purpose of the study
necessitated that they be systemic in their approach, incorporating all relevant
dimensions that affect the managerial system. Such an approach would have
clearly recognised the importance of the organisational variable in such studies.
This point can best be highlighted in the approach taken by Mintzberg, who states:

"If you ask a manager what he does, he will most likely tell you that he plans, organises, coordinates, and controls. Then watch what he does. Don't be surprised if you can't relate what you see to these four words (Mintzberg, 1975: 49).

Such a case assumes that managerial behaviour is observable and gives no appreciation to the organisational context in which such behaviour occurs.

The second point is that, the models used by these studies are not dependent on a clearly stated conceptualisation of management. These studies are dependent on their findings to help them formulate a conceptualisation of management. The problem that emerges from this is that any change in the organisational setting necessitates a change in the initial model, leaving the model in a continuous state of instability.

The third point that emerges from these studies is the perception that the manager's task is independent of the manager himself. It is not only these three researchers that give this impression but many others also. Managerial tasks have been differentiated by their level of hierarchy in the organisation, e.g. top level task, middle level task etc and so on. Recently some authors have began to look at tasks based on their analysability (Daft et al, 1981), their variability (Perrow, 1967: Hickson et al, 1969; Woodward, 1965; Litwak, 1961; Hage et al, 1969; Delbecq et al, 1969 and Grimes et al, 1970). Others have looked at tasks in terms of difficulty (Perrow, 1967; March et al, 1958; Hage et al, 1967 and Van de Ven, 1973). Such treatment ignores research findings in the field of psychology that stress that individuals cognitively organise the world around them and that each individual perceives the environment around him in his own particular way.

2.3   Human Information Processing

Literature in the area of human information processing is quite extensive, especially in the fields of psychology and neuropsychology. However management

researchers have only recently focused on this area. There seem to be three basic approaches that management researchers have used in studying human information processing (HIP):

> "One approach attempts to model the heuristics that individuals use in making choices.... The ultimate aims of this approach are two. The first is simply to build a descriptive model of how people process information, particularly in complex situations. Second, the applied purposes is to provide decision makers with "good" or "efficient" models so that their decisions can improve.
>
> A second approach to HIP deals with cognitive complexity, the relative complexity within an individual's conceptual system. An optimal level of environmental complexity is identified, suggesting that too little or too much environmental complexity results in reduced ability to process information....
>
> A third approach, that has found more recent acceptance within management, emphasizes the dual nature of HIP. It expressly identifies HIP styles that are qualitatively different (based on the cerebral hemispheres in the brain)" (Taggart et al, 1981: 187-188).

While the approaches are different, each accepts the fact that there exists a fundamental information procesing model. One that has gained some form of recognition in the literature is the Atkinson-Shiffrin Information Processing Model outlined below:

Aston University

Illustration removed for copyright restrictions

(Atkinson et al, 1971: 82)

However even this model is widely criticized for:

"1. Its emphasis on role rehearsal as the major process for registering information in LTS.

2. Its suggestions that items in STS are automatically accompanied by their meaning.

3. Its claim that STS is essential for input and retrieval from LTS.

4. Its implication that STS is a unitary system" (Baddeley, 1976: 155)

Simon, in describing man as an information processor, examined the development of such a processor. In so doing he emphasized that we should give greater emphasis in our research to the limitations of capacity in short-term memory, the mechanisms of attention, the long-term memory capacity, the hemispheric specialization in long-term memory, and the control of behaviour (Simon, 1972). Miller had previously examined the limitations of channel capacity and concluded that:

"If input in bits per second is plotted on the abscissa against output in the same units on the ordinate, output will rise as a linear function of input up to a certain point, levelling out at channel capacity which cannot be exceeded, remaining at that level for a period. It will probably then decrease swiftly, the amount of information being put out actually decreasing in a "confusional state" as the input rate continues to increase. This represents a final collapse of this function of the system" (Miller, 1960: 697).

Others have examined this "overload" from the viewpoint of decision-making:

"It appears that increasing environmental complexity and load has the effect of first increasing the degree of flexibility of integration involved in decision making to an optimal peak, then causing it to diminish as "overload" occurs" (Schroeder et al, 1967: 61).

Miller made great headway in this area by examining what happens to the human processor once "overload" does occur, and the mechanisms of adjustment that the processor incorporates. These mechanisms are identified as:

"(a) Omission-temporary nonprocessing of information.
(b) Error-processing incorrect information.
(c) Queueing-delaying the response during a period of high overlap of input information.
(d) Filtering-neglecting to process certain categories of information while processing others.
(e) Cutting categories of discrimination.

(f)   Employing multiple channels-processing information through two or more parallel channels at the same time.

(g)   Escape from the task" (Miller, 1960: 697).

The basic information-processing model and the basic concepts that go with the model form the basis of information-processing theory, and have had a considerable amount of influence in what we often term as "individual decision-making". However there is considerable emphasis in the current literature that emphasizes that these applications have omitted a crucial aspect of the process. This aspect is the cognitive style used by the individual in the processing of the information (Ungson et al, 1981). The cognitive "style" of an individual is defined as:

> "Stable individual preferences in mode of perceptual organization and conceptual organization of the external environment" (Kagan et al, 1963: 2).

Hunt goes as far as to suggest that there exists "biological cognitive motivations in human information processing" (Hunt, 1963). "The motivation to seek a certain optimal amount of complexity in one's environment is suggested as one such cognitive motivation" (Driver et al, 1969). Huysman showed that cognitive style is an effective constraint for the enactment of operational research study proposals (Huysman, 1970), and Doktor et al (1973) went further in suggesting that cognitive style might act as an obstacle for the acceptance of management science recommendations. "Statistical evidence favourably supports the existence of individual differences in information perception and information selection" (San Miguel, 1976). Although not all researchers believe this to be so. For example:

> "The study of cognitive style as a basis for deriving operational guidelines for MIS and DSS designs has not been fruitful and such study is likely not to prove fruitful" (Huber, 1983: 570).

Redding examined cognitive style from a cultural perspective and noted that:

> "Western cognition: Logical, sequential connections. Use of abstract notions of reality which represent universals. Emphasis on cause.
>
> Chinese cognition: Intuitive perception and more reliance on sense data. Non-abstract. Non-logical. Emphasis on the particular rather than the universal. High sensitivity to context and relationships" (Redding, 1980: 132).

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Dermer studying the perceived importance of information in accounting studies found:

> "The results of this study indicate that accounting studies examining the effects that alternative types of information provisions have on decision-making behaviour can be influenced by the cognitive characteristics of the participants.... One of the strongest relationships found in this study was the negative correlation between ambiguity, tolerance and the amount of information perceived to be important" (Dermer, 1973: 516 and 518).

Probably the greatest in-depth studies of cognitive style have come from the field of psychology. Adorno et al's study of authoritarianism "revealed that authoritarian subjects to be more intolerant of ambiguity and more rigid than nonauthoritarian subjects". Rokeach's study of dogmatism perceives that "a person can be best understood by studying his beliefs and disbeliefs" and that an individual's cognitive processes are probably organized or structured on the basis of belief and disbelief systems. Kelly's study of personal constructs and cognitive complexity is based on the premise that an "individual's present constructs are subject to revisions or replacement". He argued that man is actively engaged in cognitively organising the world that is around him, with the essence of man's activity being his forecasting of events (Goldstein et al, 1978). Witkin et al's study of field dependence found that "the more differentiated the individual, the more field independent he is. Differentiation may be understood as the capacity to distinguish graduations of a stimulus dimension" (Goldstein et al, 1978).

Management researchers in the last decade have focused on the cognitive style aspect of HIP and have come up with some interesting results. At times the term "decision style" has been used to describe the cognitive style used in the decision-making process of managers. In an attempt to focus on the characteristics of managerial cognitive processes, management researchers have used a "typology" strategy. These strategies are numerous and differ from author to author. For example, Sieber et al based their studies on the difference between individuals who prefer to think in abstract or concrete terms:

"(a)   Information search and time spent in processing information are curvilinearly related to uncertainty and to external demand.

(b)   Abstract persons search for more information and spend more time in processing information than do concrete persons.

(c)   Information search and information processing by abstract persons increases more with increasing uncertainty than does processing by concrete persons.

(d)   The asymptote of searching and processing time occurs at a lower level of uncertainty and external demand for concrete persons.

(e)   Searching and information-processing time of abstract and concrete persons are most dissimilar in the middle ranges of uncertainty and external demand.

(f)   Abstract persons give more information in their decisions than do concrete persons.

(g)   Abstract persons are more likely than concrete persons to qualify their decisions with remarks indicating remaining doubt, uncertainty, and tentativeness" (Sieber et al, 1964: 114).

A common typology found in management research is the use of Carl Jung's psychological types. Carl Jung had stated that what appears to be random variation in human behaviour is actually quite orderly and consistent, being mainly due to dispositions towards one psychological orientation over another. What Carl Jung (1923) had observed is that what emerges for each individual is a dominance of orientation for each of four major dimensions, which he refers to as extroversion-introversion, sensation-intuition, thinking-feeling and judgement-perception. What has been of considerable debate in the literature is which combination of these orientations or dimensions characterise the individual's style of information processing. Mason et al treat each orientation on two dimensions (sensation-intuition and thinking-feeling) as being a unique style of information processing, here briefly summarised:

> Sensation Type: Objective hard facts and attention to detail. Data bound. Afraid to risk generalization. Information entirely empirical devoid of almost any theoretical context. Day-to-day operations management.

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Intuitive Type:	Objects as possibilities and in totality, as a Gestalt. Data free. Strength of strategy making. Information will be in the form of imaginative stories, "sketches of future possibilities.
Thinking Type:	Relies primarily on cognitive processes. Evaluations along abstract True/False judgements, and are based on formal systems of reasoning. Rule making, especially formal rule-making. Instinct to formulate models. Information will be entirely symbolic (model, string of symbols).
Feeling Type:	Relies primarily on affective processes. His evaluations tend to run along personalistic lines of good/bad, like/dislike. Takes moral stands. Information takes the form of "art", "poetry", "human drama" and especially "stories that emphasize or have a strong moral content".

<div align="right">(Mason et al, 1973: 476-479).</div>

However not all authors agree. Taggart et al stress that characterization of style is dependent on the <u>combined</u> orientations of two dimensions (thinking-feeling and sensation-intuition). They came up with two major cognitive styles using a Jungian typology and at the same time related them to the cerebral assymetry in the human brain: (Taggart et al, 1981)

"Sensation-Thinking Type	Left hemisphere processing. Logical, sequential, objective, causal, deductive, and analytic.
Intuitive-Feeling Type	Right hemisphere processing. Non-logical, simultaneous, subjective, acausal, inductive, and synthetic."

<div align="right">(Taggart et al, 1981: 191-192).</div>

Using the same typology Henderson et al compared the types with the ability to handle risk:

"Cognitive style was found to be an important factor in the decision to adopt and the assessment of risk. ST (Sensation-Thinking) styles saw the highest risk and were reluctant to adopt the projects, while SF (Sensation-Feeling) styles were risk tolerant and more likely to adopt the same projects" (Henderson et al, 1980: 371).

Davis also concluded that "sensing-feeling and sensing-thinking types are better decision makers than intuitive-thinking types at the operational level" (Davis, 1982). Blaylock and Winkofsky found that cognitive style is directly related to innovation in R & D processes (Blaylock et al, 1983). Some authors have come up with cognitive style positioning theories to reduce conflict and increase the effectiveness of the organisation by matching the cognitive style of the individual to the organisational task (Hertz et al, 1981; Nugent, 1981; White et al, 1983).

New developments in cognitive style or decision-style literature have attempted to establish a link between the cognitive style of the individual and the cerebral hemispheres of the brain. The reasoning behind this is related to the fact that while cognitive style theory has been useful in identifying the various modes of processing, it still does not explain the reason why this grouping occurs. Since the 1950s, and as a partial result of the split-brain studies of Sperry and his colleagues, neuropsychologists and neurophysiologists have increasingly studied patients before and after a commisurotomy operation (bisecting the corpus collosum that links the two hemispheres and thus isolating each half of the brain) and found evidence of two major modes of processing existing in the brain. It is generally believed that the left-hemisphere of the brain uses sequential processing and the right simultaneous processing. Literature in this area is quite extensive from a neuropsychological perspective, however several articles are of particular interest. Of particular importance is the recognition of the complexity of the human brain:

> "A typical neuron in the cortex of brain may make over ten thousand connections with other cells, and the total number of synopses in the brain is probably in the order of ten trillion at least - 10,000,000,000,000. The mind boggles at its own complexity.
>
> There is little hope that we can analyze all the interconnections in a single brain. Research workers at Cambridge University have spent three years analyzing the nervous system of a very simple worm. This creature has only twenty-three neurons yet it took a team of scientists and a computing system three years just to analyze the interconnections of these few neurons" (Russel, 1979: 33-34).

However, given the limitations imposed by the complexity of the human brain some interesting results have emerged:

> "Taken together, our studies seem to demonstrate conclusively that in a split-brain situation we are dealing with two brains, each separately capable of mental functions of a high order. This implies that the two brains should have twice as large a span of attention - that is, should be able to handle twice as much information, as a normal whole brain"
> (Gazzaniga, 1973: 98).

> "Several studies were conducted which provided evidence that the left hemisphere is superior for the processing of sequential stimuli and for the organization and performance of sequential motor-responses. In addition, two components of a sequential task were defined, timing and ordering, and shown to be important in determining the left hemisphere superiority. Where the tasks could be performed better by a gestalt form of processing a right hemisphere superiority was obtained"
> (Layton, 1978: i - summary).

Some of the studies have led Mintzberg to hypothesize that:

> "the important policy processes of managing an organization rely to a considerable extent on the faculties identified with the brain's right hemisphere. Effective managers seem to revel in ambiguity; in complex, mysterious systems with relatively little order" (Mintzberg, 1976: 53).

Doktor et al, using EEG (a recording of faint electrical signals on the scalp which result from the electrical activity of the brain), examined this by testing executives and operations researchers, and their results confirmed their hypothesis although their sample was statistically small:

> "For the operations researchers, language and analytical tasks were expected to engage primarily the left hemisphere, spatial and intuitive task were expected primarily in the right hemisphere, consistent with earlier findings with normal subjects (the presidents were expected to engage primarily the right hemisphere independent of cognitive task)" (Doktor et al, 1977: 385).

Different methods of processing information and different groupings of individuals could well explain Grayson's observations that:

> "Managers and management scientists are operating at two separate cultures, each with its own goals, languages, and methods. Effective cooperation - and even communication - between the two is just about minimal" (Grayson, 1973: 41).

A fact that could also be answered by Triandis. "The greater the attribute similarity between A and B the greater the communication effectiveness between

them" (Triandis, 1960). Cognitive style is not the only major variable believed to affect the information-processing process of managers. Moskowitz et al recently examined the attributes of the incoming message to the system and believe the following message attributes to have an effect on the information processing behaviour of the processor.

1   informativeness
2   order effects
3   sequential versus simultaneous presentation
4   favorability
5   objective versus subjective sources
6   source complexity
7   format of presentation   (Moskowitz et al, 1976: 131-133).

Another variable that seems to explain a significant portion of the information processing behaviour of the manager is the task environment in which he operates, as shown by McGhee et al:

> "The results of this experiment provided little support for the notion that personality variables explain a significant portion of the variance in human information processing behaviour.... On closer examination, both personality theorists and cognitive psychologists argue that to explain a significant portion of the variance in behaviour, a model should account for the processor, the task and the task processor interaction. And of these two main variables, the person variable may be the least important" (McGhee et al, 1978: 692-693).

But are manager's perceptions of their task environment stable? Griffin's (1981) results show that "employee's perceptions of their tasks are fairly stable, at least over short time periods". Tushman et al (1978) also found that "the tasks of organizational subunits vary in their degree of uncertainty". Uncertainty being here defined as the difference between the information being processed and the information required to complete the task.

> "P2:   As work related uncertainty increases, so does the need for increased amounts of information, and thus the need for increased information processing capacity.... In short, the greater the uncertainty faced by the subunit, the greater are its information processing requirements....
>
> P3:   different organization structures have different capacities for effective information processing....

P4: organizations will be more effective when there is a match between information processing requirements facing the organization and the information processing capacity of the organization's structure....

P5: if organizations (or subunits) face different conditions over time, more effective units will adapt their structures to meet the changed information processing requirements" (Tushman et al, 1978: 616-621).

Cravens compared decision-maker, task, and interaction variables (independent set) with information-processing variables (search, evaluation, and integration phases) and found a high correlation. Of the independent variables he found that information processing efficiency (the efficiency of an individual in assimilating information), task result (degree to which positive statements can be made regarding a task solution), image state (accumulated, organised knowledge of the individual concerning a particular task) and risk-taking (tendency toward risk-taking in problem solving situations) to be the key contributors to the independent set. He states:

> "These results suggest the following description of an individual's task-oriented information processing behaviour: those individual's who process information relatively inefficiently, have relatively low states of knowledge concerning a task at its outset, tend to be risk takers - on tasks where the results are rated relatively high, tend to seek information from many sources, place high ratings on the competency and reliability of rejected information elements, spend more time in evaluating information, and place low relevance ratings on the information elements which they accept" (Cravens, 1970: B664).

2.4   Major Weaknesses And Information Gaps

The review of the management literature on how managers operate and/or process information have highlighted some of the methods and approaches management researchers working in this area have used, while at the same time showing some of the results that have been attained. While these studies on the information processing behaviour of managers have to some extent shed light on some aspects of the manager-task interaction, again there appears to be a lack of

consistency between the purposes of these studies and the actual variables chosen to carry out the study. At the surface level this is attributed to the use of models that neglect to incorporate key and relevant dimensions of the system under study. However the author feels the heart of the problem lies in the choice of the abstract level the researcher chooses to work at.

While it is clearly understood that a researcher has to concentrate on a limited number of variables, it is important however to recognise that whatever the set of variables that are chosen they should be ones that matter and that seek to represent the major dimensions of the system under study, at a particular level. The problem for the researcher is in determining which variables matter and where to set the boundaries of the system (note: the boundary of the system is in itself a property of the system). Everyone has different beliefs as to how a particular system operates, and thus the detection of any system is very much subjective. The final outcome in the choice of the variables and in the formulation of the model represents how the particular researcher perceives the system.

Now, there is no wrong model, but rather some models are better able than others in predicting the behaviour of the system being modelled. Whether the model is an implicit or explicit one, the researcher has little chance of predicting the behaviour of particular aspects of the system if that particular area of the system is not represented in his initial model. Thus important dimensions of a system can go unrecognised for a long period of time, until the researcher modifies his model or another researcher points to relevant relationships which others have not recognised or failed to incorporate in their models. The focus of the individual researcher has thus to be on trying to isolate the key dimensions of the system. His ability to achieve this depends on many factors.

The relevance of the dimensions only becomes apparent when they are used to describe or predict the behaviour of the system in question. Relevant

dimensions will give a rich understanding of the system. In reflecting on previous research on managers it does not seem evident that the results give us such a rich understanding. Now these researchers might say 'you are making a value judgement'. Maybe so, but the value judgement is built on insights that stem from a science that has put forward a number of powerful models and techniques that aid the researcher to isolate relevant dimensions.

This science is that of cybernetics, which does not rely on the findings emerging from an investigation to create and shape the implicit model (such models are not stable, because they are dependent on a particular environment i.e. the setting of the study, and any change in the environment necessitates a change in the initial model), that is systemic in its perception, and which requires the researcher to set out the key structure a priori to the investigation. The cybernetic approach is also a practicable one because it begins by formulating a model that uses invariances to reduce the variety of the system in question to a manageable one (Beer, 1966). At the same time it forces the researcher to work at a particular abstract level that enables him to isolate invariances, and thus it is less prone to ignore particular areas of the manager's system as do some approaches i.e. those models that treat managers as islands to themselves, while ignoring that managers are individuals working and operating in an organisational system that affects the very operations and information that they are handling (such models thus assume, whether consciously or unconsciously, that the environmental variables are stable). What cybernetics does require of the researcher is rigorous modelling that force him to represent the pattern of events in advance. How effective the model is depends on its ability to predict and represent the behaviour of the system in question.

The strategy used by the researchers of the three major empirical studies (Stewart, Mitzberg and Kotter) and those that used the human information

processing approach, seems to be a reductionist one. Too narrow a focus has led important dimensions of the system to be neglected. Many of the researchers using the human information processing approach sought to explain the information processing behaviour of managers without taking into account the organisational system, of which the manager was an integral part, and the way the manager perceives his task. The focus was rather on the individual, giving us results that tell us little of the human information processing behaviour of managers in organisations. The reason why such results were not achieved could best be understood in Beer's words when he reflected on the reductionist approach:

> "Take a railway engine apart: there is no _speed_ in there. Chop up the human brain, and you will not find a component called _compassion_ (Beer, 1986: 2-3).

It is the author's perception that a way of overcoming the weaknesses (and inevitably the large information gaps that emerge from them) is to recognise three major elements when carrying out any research on the managerial process. The first is to establish a conceptualisation of management that actually reflects the purpose of having managers in an organisation. The second is to establish a framework that is systemic by nature, that seeks to disclose the key structure of the system under study, and one that is built on a strong theoretical paradigm. The third is to establish the abstract level that one will operate at and that is congruent with the initial purpose of the study. It is from this basis that the author examines the field of cybernetics, a science whose findings in the last thirty-eight years have been insightful and which could well be explaining many of the mechanisms that management researchers have been struggling to understand.

2.5   Cybernetic Insights And Systems Theory

The systems concept deals with those parts or elements that interact in a manner that an observer could possibly define them as a whole, with the

'wholeness' being perceived to emerge from the interaction and relationships between the parts. It thus has a central role in the study when we deal with human, organisational and environmental systems. Cybernetics, the science and control and communication in the animal and in the machine (Wiener, 1961), offers the researcher a method to understand not only systems behaviour but also viable systems. By viable it is meant the ability to maintain a separate identity, an aim that complex systems such as human beings, animals, organisations, social groups and so on, strive for in their environment. What is common to all these systems, is that they are all interacting with an environment that is far more complex than themselves. However, no matter what the degree of environmental complexity, every viable system's objective is to maintain its unity. Systems will continue to survive, according to the Law of Negative Entropy, as long as they continue to:

> "import from the environment more energy than they expend in the process of transformation and exportation" (Katz et al, 1966: 28-29).

The mechanism that the system uses to insure its continuous survival has been called "Autopoiesis" which has been defined as:

> "a network of processes of production, transformation and destruction of components that produces the components which: i) through their interactions and transformations regenerate and realise the network of processes (relations) that produce them; and ii) constitute it as a concrete unity in the space in which they exist by specifying the topological domain of its realisation as such a network" (Maturana et al, 1975: 4).

This implies that what is kept within physiological limits of the homeostat is the organisation of the system. The organisation itself is defined as:

> "the relations that define a system as a unity, and determine the dynamics of interaction and transformations which it may undergo as such a unit constitute the organisation of the system" (Maturana et al, 1975: 105).

What has emerged from cybernetic studies is that (1) the control and communication elements of the organisation that the system adopts, is independent of both the nature and content of its parts, and (2) that there are basic principles of control that apply to all large systems. These are based on

fundamental laws that have been traced in various systems and that have universal applicability. For example, one of the principles of control is that the controller is part of the system under control, that this function is spread throughout the whole architecture of the system, and it is control that facilitates both the existence and the operation of systems (Beer, 1981). What has also been recognised is that systems are held together by the communication between the parts.

2.5.1 The Relationship Between The Organisational System And Its Environment

The viability of the organisational system is largely dependent on its capacity to respond to challenges arising from the environment, and the complexity of the response should match the environmental complexity. For according to the Law of Requisite Variety "only variety can destroy variety" (Ashby, 1964); variety being defined as the number of possible states of a system. However given the idea that all systems are operating in environments that are far more complex than they are, and therefore these environments generate a great deal more variety, it thus leads the organisation to three possible states by which it can attempt to match the situational variety:

   (1)   Attempt to amplify its own variety, or

   (2)   Attempt to attenuate the situational variety   or

   (3)   Use any appropriate combination of amplifiers and attenuators.

Since organisational systems are only perceived and defined by our own mental constructs, it thus falls to the responsibility of management to determine "information processing strategies" needed to cope with the environmental complexity.

2.5.2 Management And The Environment

One strategy that managers have used to cope with situational variety has been to structure the organisation in such a way as to both attenuate and amplify situation variety (Espejo, 1981). However not all of these amplifiers have been successful when we examine the number of business failures and the inability of many organisations to cope with the environmental complexity. This is why cyberneticians, most notably Stafford Beer, turned to the study of self-regulating systems, for they recognised that while management is accountable for everything that happens within the organisation "it cannot assume direct autocratic control of everything that happens" (Beer, 1975). What Beer came up with, following some thirty years research into the mechanisms of control in the central nervous system and other systems, was that if a system is aiming for viability it needs to develop five basic functions, Beer calls them system one, two, three, four and five, that actualise the control capacity internal to the system (Beer, 1979 & 1981). These five systems are shown in Fig 2.1.

The author will not go into the details of each of the functions and the organisational laws which they are subject to, as these are well formulated and explained in Brain Of The Firm and Heart Of Enterprise (Beer, 1979 & 1981). However what we must recognise here is that Beer's Viable System Model offers a powerful tool by which we can assess the effectiveness of the organisation in dealing with its environmental complexity; and a much needed alternative approach to the way we design our business organisations.

A second strategy used by management to cope with the environmental complexity is by investment in information systems, and more recently computerised data processing systems have attempted to facilitate this process.

CHART ONE

Adapted From Stafford Beer (1985)

NAME OF THE VIABLE
SYSTEM IN FOCUS:

© S. Beer 1985

Fig 2.1

The basis on which management adopts such a strategy is linked to its belief that such a vertical information system will increase its capacity to process more information and also its use as a means to filter situational variety.

> "This strategy increases the capacity of existing channels of communication, creates new channels, and introduces new decision mechanisms. It also increases the capacity of the organisation to make use of information acquired during task execution .... there are fewer exceptions referred up the hierarchy" (Galbraith, 1973: 30).

While such a strategy has been used successfully in many organisations, it continues to fall short of providing the necessary information for management. Too often, in many organisations, information systems have evolved into nothing more than sophisticated accounting systems, providing little in terms of relevant information necessary for the management of tasks. This is because many designers of these information systems lack the cybernetic insights into the filtering process that occurs in the organisation system. Successful systems have been applied as in the case of the use of "Cyber-filters" (Beer, 1975) and others applying the new microcomputer technology show good potential (Espejo, 1979). However recent research provides evidence that many information systems fail in the application by not recognising the user's cognitive style.

2.5.3 Management In Cybernetic Terms

Given these cybernetic insights the next question that must be answered is what does this concept of variety engineering have to do with management and the role of a manager in an organisation? To answer this, let me quickly turn to the traditional conceptualisation of management. John Child (1977) distinguishes three different conceptualisations prevalent in existing management literature:

1) Management as an economic resource that performs a technical and an administrative function.

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2)   Management as the professional corps that is identified by its expertise and credentials.

3)   The political aspect of Management where management is seen as a system of power and authority.

Management in cybernetic terms is seen as "the task of making organisations effective" (Espejo, 1983), and cybernetics not only seeks to examine how managers operate, but also examines if the manager is using efficiently his capabilities for complexity management by reference to cybernetic laws. As Stafford Beer notes:

> "Management is the profession of regulation, and therefore of effective organisation, of which cybernetics is the science " (Beer, 1985: x).

This conceptualisation clearly sets a purpose to the manager in an organisation which the above mentioned conceptualisations lack. Secondly it gives researchers and scholars a powerful insight into examining how managers operate for it spells out clearly the function the manager has to play in an organisation, that is, to regulate the activities and operations of the organisation effectively. Thirdly it gives us an important and valuable measure of performance by which we can examine the effectiveness of managers. With this in mind, cyberneticians state a different purpose to the manager's job. Beer sets the manager's job the purpose of:

1)   setting down the criteria of stability

2)   recognising and detecting instability

3)   and changing the criteria if deemed necessary. (Beer, 1979: 286-287).

If management is the profession of regulation then it is accepted that the manager will use whatever tools or strategies necessary in order to regulate the situation. This means that it is pointless to attempt to specify in detail, as many management researchers attempt to discover, e.g. Stewart, the way a manager spends his time. The manager is embedded in a system, and he has the job to regulate particular operations of the system, and how he spends his time is very

much dependent on the situation that he has to control. It might require the manager to plan, organise, communicate, investigate or it might require him to motivate and train his subordinates. As Espejo notes:

"Therefore studying the management of complexity in any social situation is to undertake inquiries about the strategies used by one viewpoint in its interactions with relevant viewpoints."

He continues thus:

"The strategies used by a viewpoint to cope with the complexity of its black boxes not only imply a particular Weltanschauung (worldview) but also the very complexity of these black boxes" (Espejo, 1985: 12).

This is extremely important for it establishes for the researcher the objective of studying the manager's strategies in handling the complexity of the situation, and not what managers appear to be doing as exemplified by such studies as that of Stewart, Mintzberg and Kotter, for some managerial activities are not actually to do with managing the situation as noted by Clemson:

."The management of an organisational unit is able to regulate only those aspects of the unit that it has in some sense modelled. The model may be an implicit one, carried in someone's head, but the management has no way of even noticing (much less managing) those aspects that are not included in their models."

He goes on to say:

"Managers with defective models are in fact not managing their units. This situation may go unrecognized for long periods of time if the unit is not in a highly competitive environment. In such cases the activity of the management is irrelevant or damaging to the unit" (Clemson, 1984: 218).

These statements have serious Implications for the way we examine the managerial situation. They give us a new perception to what managers are attempting to carry out in an organisational setting. Beer's work has provided for the author a rich framework to use in the study of the manager-task interaction.

CHAPTER THREE

THE MODEL OF THE STUDY

3.1   Introduction

In the previous chapter major works carried out by researchers in the area of how managers both operate and process information have been reviewed, and major weaknesses and information gaps have been highlighted with respect to those studies. As a way to overcome those weaknesses the author reviewed the area of cybernetics, if only briefly, to highlight a different conceptualisation of management. What the author attempts to do in this chapter is to explain a model that provides a framework to guide the study. First the author presents his own perception of how managers operate and then presents a model based on those perceptions. The purpose of the model is not only to disclose the key structure of the system under study, but also to provide a framework for the author to examine the strategies that managers use to handle the complexity of their task.

3.2   Author's Perceptual Model Of The Interaction Manager-Task

The manager in a way is creating the task, and the task is not independent of the manager. It is his capacity to perceive or recognise that particular task which is going to influence the magnitude, scope and development of that task. The manager has an influence on the shape that that task is going to have. It is the manager himself that can transform the particular task into a sort of exciting, creative type of task or into a dull routine type of task. Thus there is no obejctive definition of that manager's task in that sense. What exists and what can be examined is the way the manager perceives and defines his task (from his viewpoint). Managerial tasks are very much defined by the manager himself, but

at the same time there is a degree of expectation and perception (represented by the viewpoints of other organisational members) towards that task in an organisation. This takes shape in the form of particular expectations of what that particular manager is supposed to be doing, and thus indirectly defining his 'role'.

However, this in no way defines the manager's task, for the manager is operating in a certain environment, and the task he accepts, in which he gets involved in, has some inherent complexity, which arises not because that complexity is an objective thing, but because the manager accepts and perceives the situational task from a particular perspective.

The manager, having created a model of the situation that he perceives as his task and his job to control (the model is a mental construct), adopts particular strategies to handle the complexity implied by that model. The strategies he uses represent the way he regulates the situation. The manager, no matter what position he holds in an organisation, has basically the job of handling complexity, and the strategies that he uses to handle that complexity represent the way the manager goes about controlling the situation. Now the strategies used by the manager can be effective or ineffective. How effective the strategy is, is very much dependent on a number of factors. It is quite possible that the manager can structure his task to his preference and use whatever strategy to handle its complexity, while at the same time convincing the other organisational members that it is a good way. Or he could disagree with other organisational members on strategy while at the same time achieving the level of performance necessary to satisfy their expectations.

Given the above hypothetical understanding of how managers shape and develop their tasks and strategies, the author sets out below a framework to examine the strategies used by managers to handle the complexity implied by their task.

3.3   A Framework To Guide The Study of Managerial Strategies

Fig 3.1 shows in diagrammatical form the framework to be used to guide the study of strategies used by managers to handle the complexity of their task. It is a three level model that incorporates many of the ideas of Beer, Espejo and a number of other authors. The basis of the model is the manager himself. The manager has a viewpoint, and this viewpoint coupled with the viewpoints of other organisational members define and shape for the researcher the cybernetics of the organisation. What is meant by this is, that in order to understand how managers operate in organisations, the researcher needs to carry out a detailed analysis of the organisation in which the manager is embedded. An understanding of the cybernetics of the organisation, that is how control is distributed within the architecture of the organisation (based on cybernetic laws) is a prerequisite to the enquiry on the manager himself. The reason is that organisations consciously or unconsciously camouflage the real identity and purpose of a particular position by the way they structure and name the various structural positions. Beer's Viable System Model (Beer, 1979) offers a way of overcoming this problem. By analysing the formal organisation structure and then cybernetically interpreting it using Beer's model, we can determine and isolate the various managerial functions, roles and activities existing in any organisation, no matter how complex it appears. The uniqueness of this method is that it allows us to view the managerial activities in light of their immediate organisational environment. This method implies modelling the organisation's complexity in terms of its primary activities down to its lowest recursion levels. This method also enables us to have a more complex understanding of the precise nature of a particular manager's task, in terms of complexity and in terms of the mechanisms and responses that are required to control and regulate these tasks. Further analysis of these structural positions will also enable us to examine other factors, for example whether the manager is

Fig 3.1

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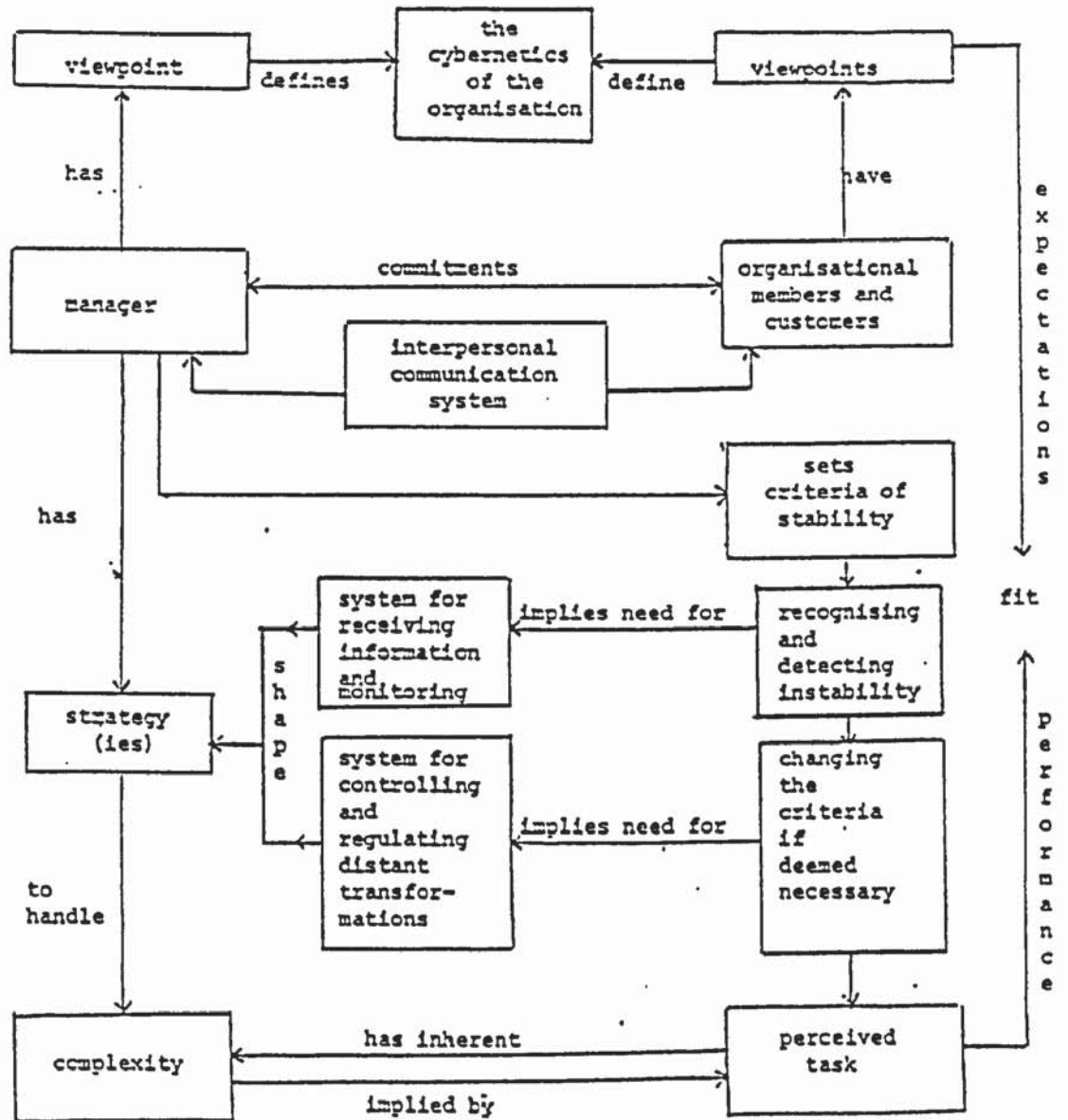
working with autonomy or discretion or the effect cognitive style has on the information processing behaviour of the manager. By cybernetically isolating each manager's job we are enabled not only to study and compare the way the various cognitive styles perceive and control their tasks, but also to study the various strategies that they use to monitor and regulate their tasks.

In order to understand the cybernetics of the organisation, the researcher needs to study and analyse the managerial viewpoints. By viewpoint is meant how the individual manager perceives the situation that he has to regulate. This requires not only an understanding of the task that he perceives, but also important organisational transformations to which he actually gives 'closure' (to use the language of information processing). Together the viewpoints define the way the organisation operates.

The second level of the model incorporates the cybernetic insight that systems are held together by the communication between the parts. Managers communicate both through formal and informal channels. These communications not only lead to commitments but also help the manager to know what is required of him, and what is going on in other parts of the organisation. Managers need the cooperation of their peers, superiors, and others to regulate their tasks effectively. Some of the operations that they control rely on information processed by other managers. Thus it becomes important for the manager to interact with other organisational members to coordinate and facilitate operations. The model requires the researcher to examine the manager's interpersonal communication system in order to understand how the manager operates.

The third level of the model looks at the manager-task interaction in terms of handling complexity. This level is very much based on the purposes that Stafford Beer attaches to the role of the manager, namely that of setting the criteria of stability, recognising and detecting instability, and changing the

criteria of stability. However for the manager to recognise and detect instability he needs to set up a system that enables him to do this. This implies a need for the researcher to examine the manager's system for receiving information on the operations and activities that the manager perceives he is controlling. This system could be based on formal channels of communication, standardised procedures, shopfloor operator informal reports, management information systems or simply information provided by other people such as the organisation's customers. By understanding the manager's system for recognising and detecting instability we can also understand a good deal about how he operates and how he monitors. Once the manager recognises and detects instability he needs to act to bring the system back to the level of stability that he deems necessary to achieve his objectives. This implies for the researcher that the manager has a system for controlling and regulating distant transformations. This could take shape in the form of meetings with his subordinates, or setting out guidelines or his direct intervention on the shopfloor etc.

It is these three operating systems of the manager; his interpersonal communication system, his system for receiving information and his system for controlling and regulating distant transformations, that shape the strategy or strategies used by the manager to handle the complexity implied by his perceived task. It is these three systems that define the manager's operating mode, the way he actually operates. It is by enquiry into the shape that these systems take that we can begin to understand how managers handle the complexities of their jobs.

The model also highlights the idea of a 'fit'. This is based on the idea that a manager operates in a state of natural tension. The manager as an individual processes environmental information in such a way that he necessarily attenuates variety. However in his role as manager in an organisation the individual is often confronted with demands which he is forced to resolve in real-time. How the manager operates, performs and fulfils the expectations other organisational

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members have of him will very much determine the manager's fit in the organisation. If the fit is good and the manager is satisfied with what he is doing and the level of performance he is achieving, and other organisational members are also satisfied, then a state of stability is achieved. Otherwise I would argue, a negative outcome (strain, anxiety) will arise and greatly amplify the natural tension that already exists between the manager's inclination as an individual and what is required of him as a manager.

CHAPTER FOUR

DEVELOPMENT OF TOOLS TO EMPIRICALLY TEST THE MODEL

4.1   Introduction

In the previous chapter the author highlighted the key aspects of his model. This model has highlighted specific areas that need to be examined. The model also reflects a different conceptualisation of management and what managers do. Since this conceptualisation of management totally differs from the main stream of research, it has necessitated the development of new tools and instruments, as those currently employed by researchers in the field of management have proved totally inadequate to test the model. In this chapter the author develops an alternative approach, sub-models and instruments to examine the manager-task interaction. Under the title 'A Method to Study the Interaction "Manager-Task" ' the sub-models and tools are examined and explained. The model in Chapter Three highlighted the need to examine the effect that cognitive style has on the strategies chosen, and a section of this chapter entitled 'A Measure for Cognitive Style' shows a way of examining the manager's cognitive style. The model in Chapter Three also highlighted the need to examine the 'fit' between the manager and the system in which he operates. Under the title 'A Method to Examine the Fit' the author explains a way of examining this fit.

In this chapter the methods outlined to test the model empirically seek only to outline the author's approach and do not reflect a 'best method'. However what it does offer is an alternative approach to those currently being used in the study of how managers operate and the author believes it offers a far richer understanding of the manager-task interaction process.

4.2   A Method To Study The Interaction "Manager-Task"

A pressing problem for any management scholar is determining what instrument to use in order to study how managers operate and how they behave. The number of instruments used, although categorized into one form or another of questionnaires, observation and interviews, appear to be as numerous as there are research papers. Yet when we examine the theories underlying these instruments we find little in terms of a framework to guide future scholars and researchers. This comment applies to such major studies as those of Stewart (1967), Mintzberg (1973) and many others. Yet there are today powerful models which could help researchers to carry out rigorous enquiries in a wide range of settings. These are models based on systems theory and cybernetics. In particular, Stafford Beer's Viable System Model, offers the researcher a framework by which he can study organisations and the way they operate, and in so doing he is not only using a framework that is applicable to all types of organisations but is also based on a rigorously examined theoretical paradigm.

In approaching the problem of examining the ways managers interact with their tasks, the fundamental question the author had to answer was, once the data on how a particular manager operates had been gathered by what standard was the data to be compared, or to put it another way, what principles are needed in order to determine that the manager was handling the complexity of his job efficiently and effectively. Many researchers report for example on managers operating on "routine" tasks or discuss a manager's particular system of communicating by saying that one manager has communication links with a peer's subordinates while his superior has links with subordinate's subordinates. This method of research only reports on particular situations and adds very little to management theory. What is routine to one manager might not be so routine to another. To study the nature of managerial jobs without describing the systems that they are embedded

in coupled with a lack of framework to guide the analysis of data leads only to further confusion and partial answers.

One solution to this problem is to combine the two existing major approaches of studying managerial jobs, behaviour content approach and process characteristics approach (Whitely, 1985) and guide them by using Beer's VSM, which acts as a powerful framework for the analysis. However, to use Beer's model an extensive database of facts is needed to construct the model not only to structure the system, but also to determine the operating modes of the individual managers. Even Beer's most recent book <u>Diagnosing the System for Organisations</u>, (Beer, 1985), while very specific in the actual steps needed to carry out a cybernetic study in an organisation, does not outline in specifics the types of information required. A particular solution to this problem is to use Espejo's VIPLAN model (Espejo, 1984) and in particular his Organisational Data and Technological Data Model. These two models are well described by Chan's (1984) study entitled "Modelling Organisational Complexity", carried out under the auspices of Espejo and shown in diagramatical form in Figs 4.1 and 4.2. As a method to study organisations Espejo's models require the researcher to:

1)   Establish the identity of the organisation, that is by identifying the business areas of the organisation concerned in terms of both structural diagnosis and structural design.

2)   Name those activities that implement the tasks implied by the identity of the organisation.

The Organisational Data Model describes the organisation while the Technological Data Model describes those technological activities recognised by the relevant actors with respect to the business areas that they perceive their organisation is involved in. While at first appearance the models look somewhat
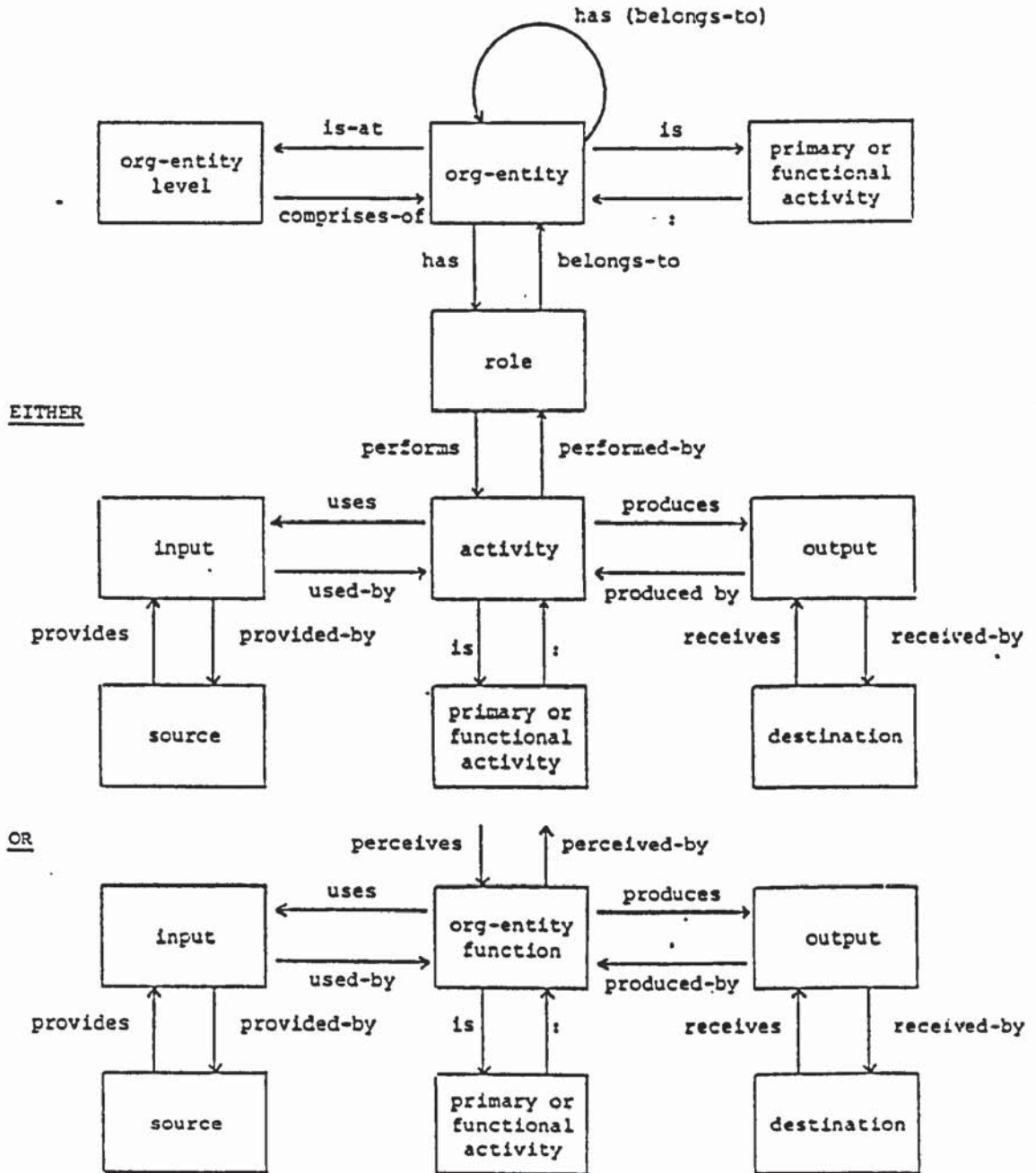
Fig 4.1

TECHNOLOGICAL DATA MODEL

Fig 4.2

43
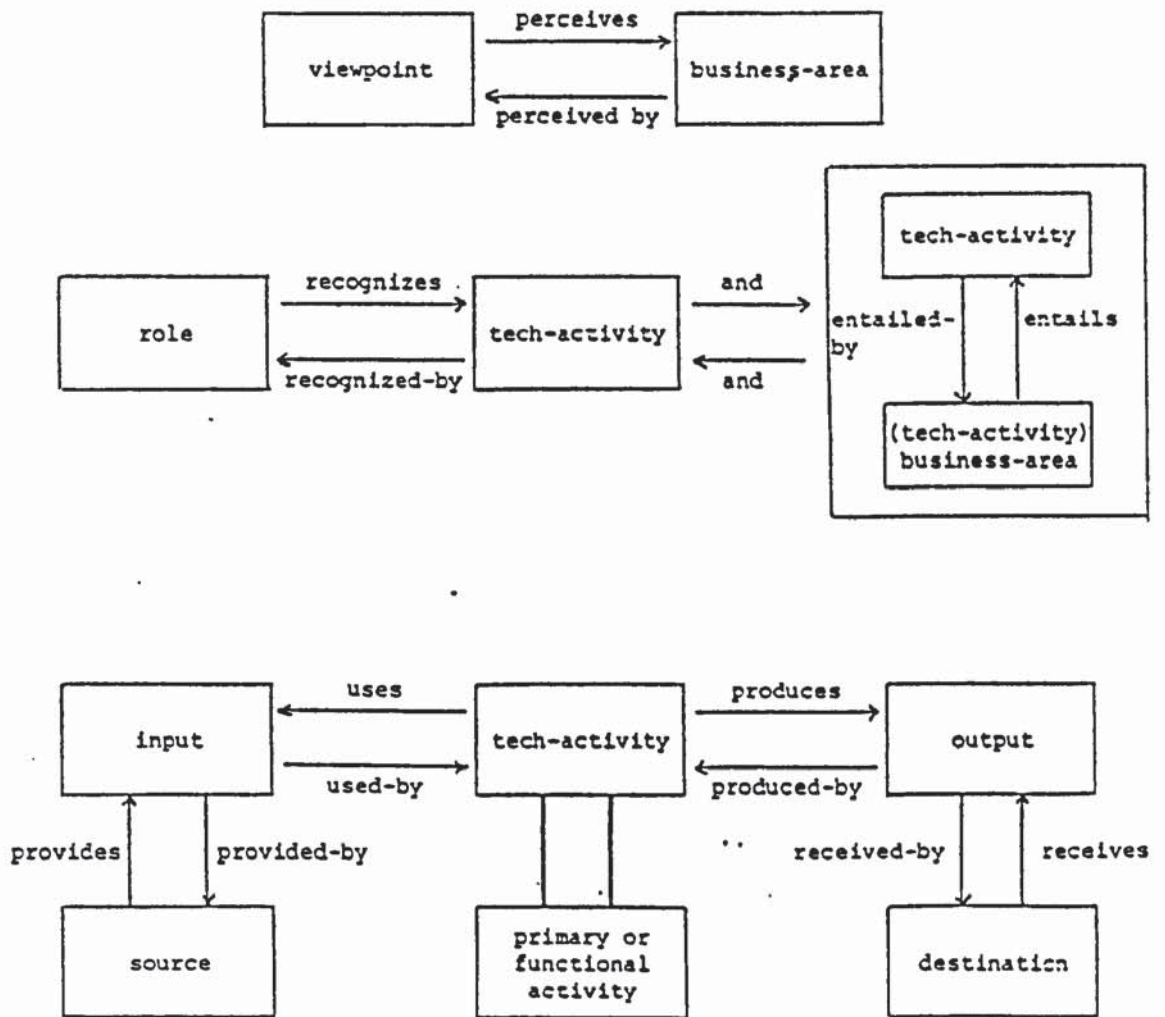
simplistic in relative terms to the whole of the idea of capturing the complexity of a modern organisation, they represent, when applied, an efficient method for organisational analysis. For the primary purpose of this study even this model needs another instrument to be fully implemented with respect to the objectives of this study.

Another model was developed, the Manager-Task Interaction Model, comprising of three sub-models.

1)   The first sub-model examines the manager's system for receiving information on and monitoring of the distant transformations and is shown in Fig 4.3.

2)   The second sub-model examines the manager's system for controlling and regulating the distant transformations and is shown in Fig 4.4.

3)   The third sub-model examines the manager's interpersonal communication system with organisational members and customers and is shown in Fig 4.5.

To capture the data necessary for the implementation of the three sub-models the Manager-Task Analysis instrument (MTAI) was formulated in the form of an interview schedule and is shown in Appendix A.

By now the reader will have observed that all five models, the Organisational Data Model (ODM), the Technological Data Model (TDM) and the three sub-models of the Manager Task Analysis Model (MTAM), are in the form of units linked by key-words such as:

```
                        receives
                  ═══════════════════════>
MANAGER           <───────────────────────          REPORTS
                      received-by
```
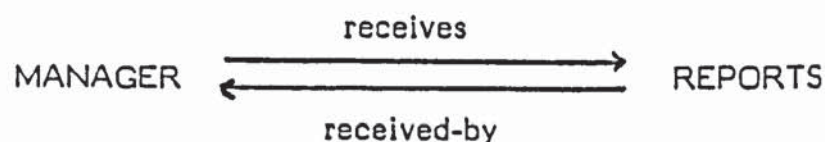
In the above example both MANAGER and REPORTS represent the units of analysis and both are linked by the key-words receives and received-by. They have been written in this form so that the information contained in the database

44
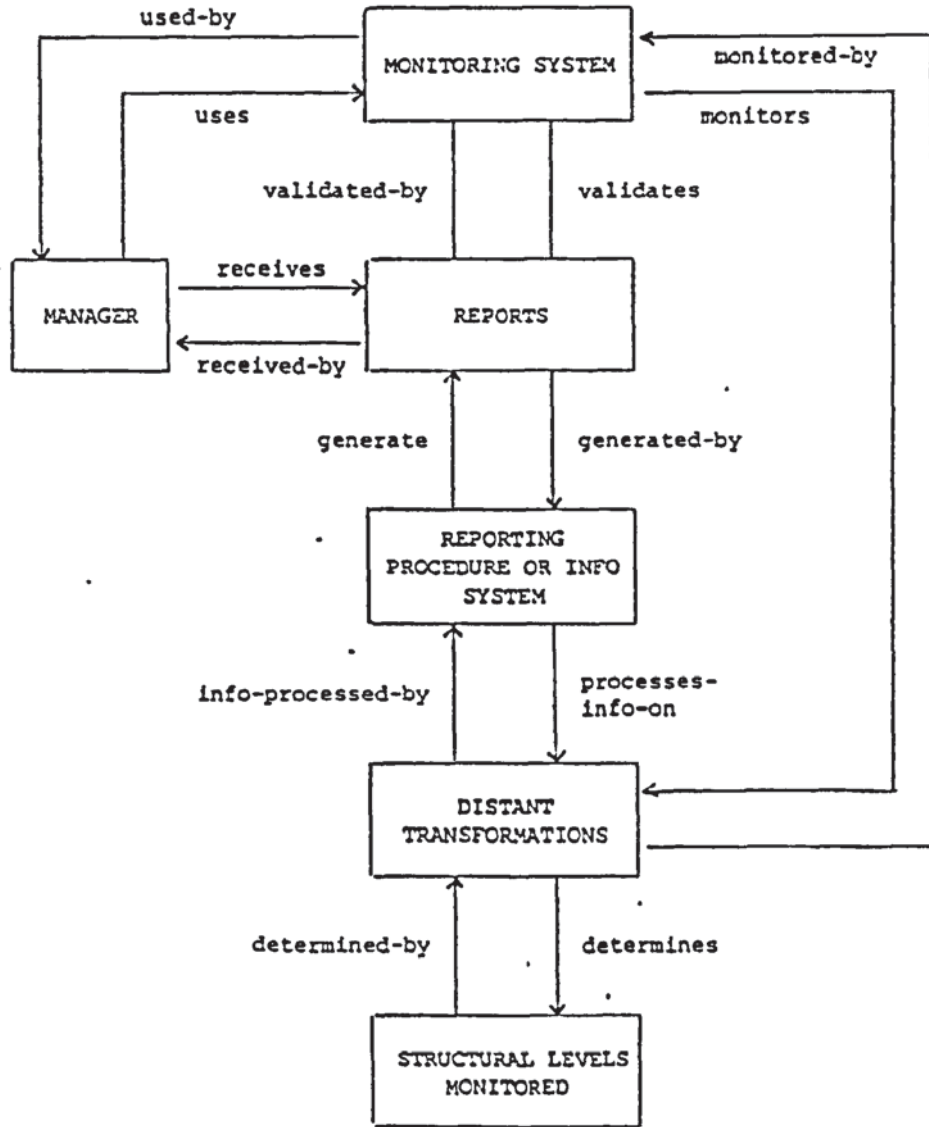
Fig 4.3
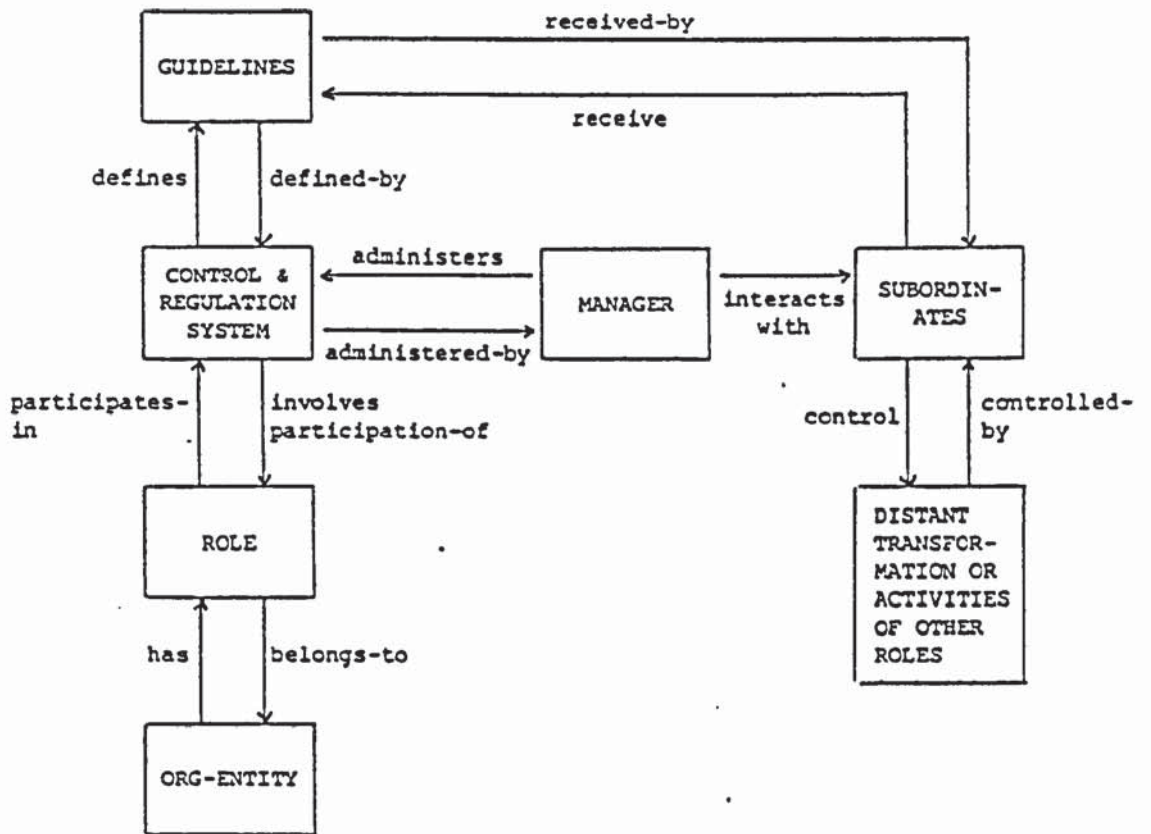
Fig 4.4
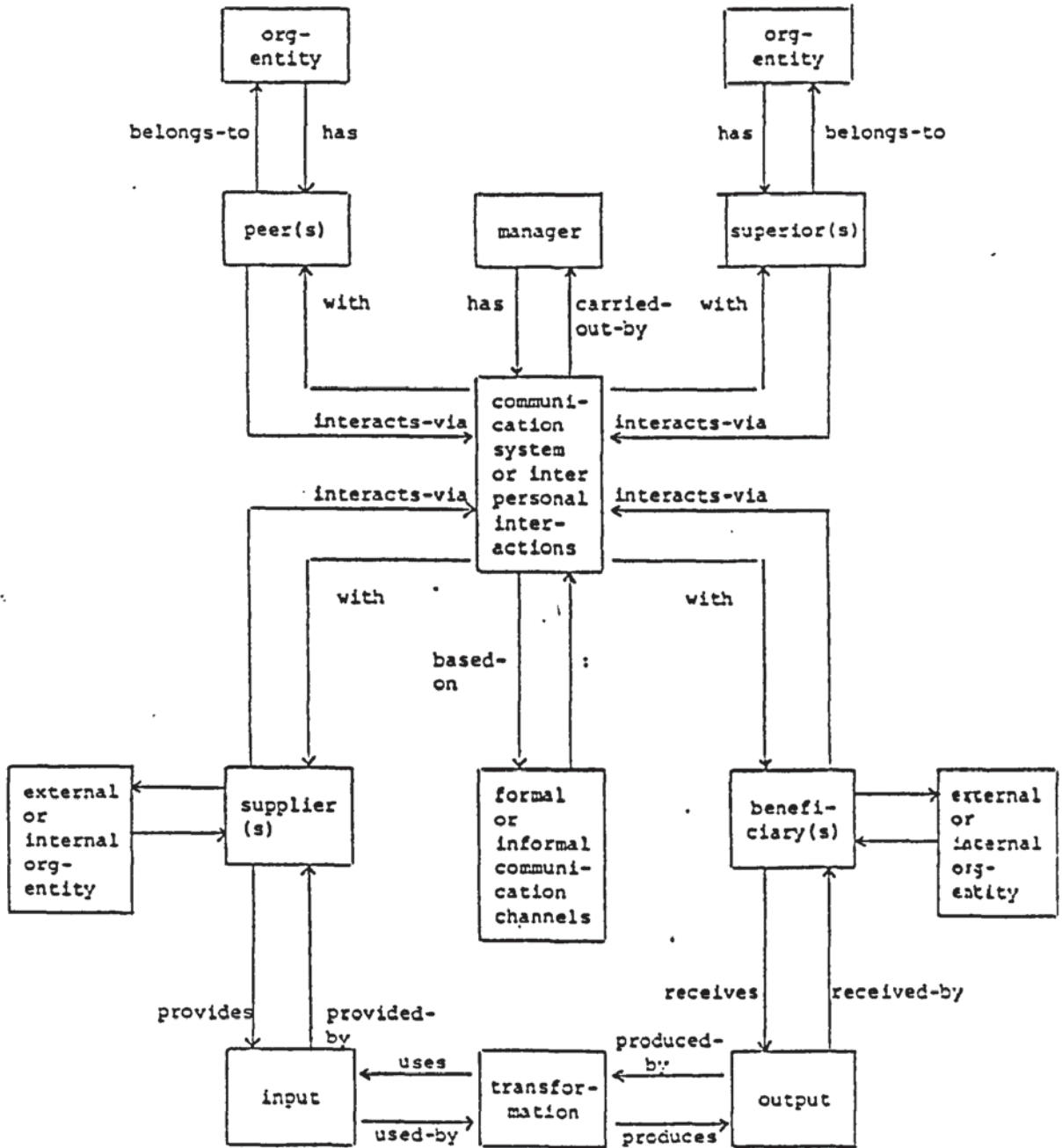
Fig 4.5

can easily be accessed using Electronic Data Processing (EDP). The amount of information that can be collected using the interview method can be quite substantial, and one of the reasons why many researchers favour questionnaires over interviewing as a method of collecting data is the final manageability of the data. So by structuring the models in modes of units and key-words it enables the researcher to re-structure the manager's answers in such a way that they can easily be handled by a computer. For example if in an interview a manager was asked the following question:

Can you describe to me the activities that you perform.

and his answer was:

"Principally I do the buying for the production by placing the orders. I calculate from the sales projection figures given to me by the sales director at the beginning of each month exactly how much material the plant needs and place the material orders accordingly."

This can easily be turned into a number of record statements that form the basis of an information base for the researcher and which can later be accessed depending on the nature of the question that the researcher wishes to pose to the computer. In the above example the record statements generated by the models would be:

> production-manager performs buying
> buying performed-by production-manager
> buying uses monthly-sales-projection-figures
> monthly-sales-projection-figures used-by buying
> monthly-sales-projection-figures provided-by-sales-director
> sales-director provides monthly-sales-projection-figures
> buying produces materials-order
> materials-order produced-by buying
> materials-order received-by supplier
> supplier receives materials-order

To generate these statements data sheets were prepared (see Appendix B) to simplify the process somewhat. However as can be seen from the above example

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it takes many record statements both to describe adequately a particular managerial situation and the information processing system and loops that the manager is involved in. What was required was a computer program to generate multiple record statements given a limited amount of information fed in by the researcher. A BASIC program comprising nearly two thousand statements was written using an IBM personal computer (see Appendix C) that had three main functions:

1)   The first function generates record-statements based on the ODM and the TDM.

2)   The second function enables limited analysis of managerial and organisational activities using pre-structured forms of analysis.

3)   The third and main function takes the record-statements and re-write them in the form of prolog statements so that they can be read using a fifth generation computer language called micro-Prolog (McCabe et al, 1984).

The basic structure of the program is shown in Appendix C. The need to link the program with micro-Prolog was necessary to enable flexibility in the structuring of the questions that the researcher can pose. Once the data in the form of prolog record statements are loaded onto micro-Prolog the researcher can then query the database within the limits of the units and key-words. For example if he wanted to find out what reports a particular manager is receiving in order to determine the structural levels he is controlling and monitoring, a query is posed to the computer in the form of:

which (x1 x5: x1 received-by technical-manager and x1 produced-by x2 and x2 performed-by x3 and x4 has x3 and x4 is-at x5)

The computer will then list all the reports and the respective structural level the report was generated from

Using all these instruments the researcher is able to carry out a very extensive and in-depth study of not only the system in which the managerial activities are embedded but also how particular managers are operating. However this is only one of two major steps. The second and more important step is to base the critical analysis and mode of operation in the light of Beer's Viable System Model. For it is this model that acts as a framework, a standard, if you like, to determine whether or not the manager is using his abilities in the management of complexity efficiently and effectively. At present the cybernetic rules necessary to carry out this sort of analysis automatically by the computer, in the form of an expert systems package, is underway by Espejo. However the complexities in producing such a package are immense for the rules must apply to all organisations. In the meantime cybernetic analysis can be carried out manually using an intuitive understanding of Beer's work.

4.3   A Method To Examine The Fit

In the previous chapter the author noted that how the manager operates, performs and fulfills the expectations that other organisational members have of him will very much determine the manager's fit in the organisation. By using cybernetic insights we can gain a valuable understanding that will enable us to create a framework that will facilitate the process of examining this fit.

Managers like other living systems strive for homeostasis. That is, they attempt to maintain a steady state by keeping a number of variables, that represent the conditions of survival, in balance. For the manager these variables are of two major types. The first type is represented by the variables associated with the task of his concern. The second type is represented by the variables associated with the expectations that the organisational members have of him. The manager's behaviour in the organisation reflects the method he uses to

maintain a steady state for both his task and his own position vis-a-vis the organisation. If the manager perceives that the situation which he has to control is not going well, that is homeostasis is not being achieved, then he may start to develop cognitive strain. Cognitive strain comes about as a result of the manager cognitively recognising that what is happening does not meet his cognitive criteria of stability. Since his aim is to maintain homeostasis, he will then employ whatever strategy he can to bring the situation back into what he perceives as its range of stability. Thus continued strain for the manager represents an inability to cope with the task of his concern. This could be as a result of the strategy he is using (not achieving the desired purpose), or it could be as a result of not having the resources to handle the situation.

In Chapter Two the author highlighted the findings of Miller (1960) with respect to the mechanisms used by individuals to handle variety. However managers differ from individuals in that they are provided with information that they have to give closure to. Managers in choosing a strategy are quite often restricted not only by organisational resources at their disposal but also by the very structure that they operate in. By examining the manager's operating mode and the cybernetics of the organisation of which he is part, and relating these to the level of cognitive strain the manager has, not only can we examine how the manager perceives his fit in the organisation but we can also seek to explain the very reason for the strain.

There have already been numerous attempts to construct a 'person-environment fit model' based on occupational stress by psychologists (French et al, 1974 and Van Harrison, 1978). However, many of these models lack the strong theoretical framework of cybernetics, a necessary requisite to isolate and understand the role of an individual manager in an organisation.

The literature in the area of stress/strain is quite vast, and the total number of research papers and books is said to number over half a million.

However, a unique paper in this area by Cummings et al incorporates cybernetic insights in an attempt to bring about a coherent framework for the study of stress/strain. They defined some major terms, quite often confused and not clearly agreed on in the stress literature, which will be referred to throughout the rest of this study:

> "A stress is any force displacing a variable beyond its range of stability.... Stress produces strain within the organism (that which pushes a variable beyond its range of stability).... Coping is when the organism acts to restore its steady state.... and adjustment processes is the individual behaviour directed at maintaining a steady state. These processes are aimed at reducing deviations from the individual's preferred state" (Cummings et al, 1979: 397-398).

These terms imply to a certain extent the need to examine the natural cognitive state of the individual manager (how he normally feels) and the situational cognitive state (which is the state he is at following stress). The difference between the two determines whether that individual is strained or not, and to what extent he is strained. But managers face many different kinds of stresses when interacting with their working environment. It thus becomes important to recognise and to isolate those type of stresses, if not specifically then at least by category. This is not an easy task, as many existing strain instruments developed by psychologists were not specifically targeted for managerial samples, but rather for general populations. One way to partially overcome this problem is to use established and good measures of strain and validate the results by reviewing them with the manager concerned. This would permit the filtering out of any kind of strain that arises from non-work situations, such as death of a spouse, family problems and so on.

Having reviewed many stress/strain/anxiety instruments in the literature it was decided by the author that two instruments, the State Trait Anxiety Inventory (STAI) and the Personal Strain Questionnaire (PSQ), could be used as measures of fit.

4.3.1 The State-Trait Anxiety Inventory (STAI)

With respect to the STAI, the concepts of state and trait anxiety were first introduced by Cattell (1966), and later further elaborated by Spielberger (1966) who is the author of the STAI. Spielberger in the STAI manual defines both concepts of state and trait anxiety:

> "Trait anxiety (T-anxiety) refers to relatively stable individual differences in anxiety-proness, that is, to differences between people in the tendency to perceive stressful situations as dangerous or threatening and to respond to such situations with elevations in the intensity of their state anxiety (S-anxiety) reactions" (Spielberger, 1983: 1)

Joesting (1975) and Metzger (1976), while agreeing with Spielberger on the definition of trait anxiety, put forward a definition of state anxiety:

> "A transitory emotional state that is characterized by consciously perceived feelings of tension and apprehension" (Joesting, 1975: 270).

> "A momentary condition of the organism. This condition is subject to continual fluctuation as a result of temporal changes in the environment" (Metzger, 1976: 276).

The STAI (see Appendix E) is a self-report questionnaire consisting of forty questions and is divided into two scales. The S-anxiety scale consists of twenty questions whose purpose is to determine how the individual feels at the moment of responding, and the T-anxiety scale consists of twenty questions whose purpose is to determine how the individual generally feels. The STAI is widely used by psychologists and other researchers as noted by Katkin:

> "Research with the State-Trait Anxiety Inventory has been proliferating to the point where there is probably more published research on the STAI, and more ongoing research now on the STAI, than any other commercially available anxiety inventory" (Katkin, 1978: 1096).

The basic reason for this is not only the availability of a large number of validity papers on it but also to some extent the wide acceptance of the underlying theory on which it is based.

With respect to validity studies carried out on the STAI, Spielberger (1983)

reports on internal consistency using alpha reliability coefficients on a sample of 377 high school juniors, 982 college freshmen and 484 college students taking a psychology course as being:

State Anxiety	.83 to .92
Trait Anxiety	.86 to .92

Newmark also reports on alpha reliability coefficients ranging from .89 to .94 based on 186 university students tested on four different occasions (ranging from 1 day to 10 months) and concludes:

> "The results generally support Spielberger's (1966) theoretical conceptualization of anxiety phenomena that posits two anxiety constructs and demonstrated that A-state measures, even though appearing stable over a relatively short period of time, were sensitive to changes in environmental stress of every day living."

he continues by stating:

> "The findings further suggest the reasonably good internal consistency of both STAI subscales as evidenced by the high alpha coefficients" (Newmark, 1972: 198).

Bartsch et al's study, using a sample of 104 college students and attempting to clarify the nature of the state-trait anxiety distinction using an R-technique factor analysis procedure, gives support to the construct validity of the STAI:

> "(a) the trait-state distinction in anxiety research manifests a degree of construct validity both in terms of differential tendency of individuals classified on the trait dimension to exhibit adaptation, in terms of state anxiety responses, to the experimental setting and
> (b) the current trait and state anxiety questionnaires do define measurably distinct constructs (factors) which manifest appropriately different levels of temporal stability" (Bartsch et al, 1973: 63).

However a study by Barker et al (1977), using a sample of 207 graduate students, while agreeing with Spielberger's A-State concept, identified two separate factors neither of which was consonant with Spielberger's concept of A-Trait. The first is that it appeared to tap state anxiety as remembered over an indefinite period of time, the second is that it could be interpreted as a measure of neuroticism. Kendall et al (1976) also conclude with respect to the STAI that:

"the A-trait scale measures only one dimension of trait anxiety, a cognitive dimension of ego involvement or fear of failure" (Kendall et al, 1976: 407).

With respect to test-retest reliabilities on the STAI there are numerous studies. Spielberger reports in the manual of the STAI test-retest reliabilities ranging from .73 to .86 on the trait scale and .16 to .31 on the state scale. Joesting (1977) reports on a 45 minute interval test-retest correlations for 105 students as ranging from .66 to .83.

With respect to the concurrent validity of the STAI Spielberger reports on correlations between the trait anxiety scale and other measures of trait anxiety as being:

	126 college females	80 college males
IPAT Anxiety Scale	.75	.76
Manifest Anxiety Scale	.80	.79
Affect Adjective Check List	.52	.58

However one problem that does exist with using the STAI is its proness to faking as noted by Smith based on a sample of 283 paid student volunteers:

> "the findings indicate that STAI scores are quite susceptible to intentions to exaggerate stress effects, just as these scores are readily influenced by other response sets. It is also clear that the STAI user can screen records for the "fake bad" type of bias with relatively little effort and with considerable effectiveness" (Smith, 1974: 244).

4.3.2 The Personal Strain Questionnaire (PSQ)

The Personal Strain Questionnaire (PSQ), see Appendix F, is one of three instruments, the other two being the Occupational Environment Scale and the Personal Resources Questionnaire, that were developed by Osipow et al (1983) in an attempt to develop a rationale to link stress, coping and strain and measure them in a consistent fashion.

The initial intention of the author of this study was to use all three instruments. However, upon examination of the total number of questions

involved in the three instruments (one hundred and forty questions), coupled with the number of questions on the State-Trait Anxiety Inventory (forty questions) and the measure for cognitive style, the Myers-Briggs Type Indicator, (one hundred and twenty-six questions), it was decided that it would be too much for the potential managers to respond to. It was thus decided to just use the PSQ as it served the initial purpose of the study and because the PSQ manual states that "each of the scales is self-contained and self-administered and can be used separately if desired".

Osipow et al classified strain into four major categories, these being:

(a)   Psychological

(b)   Physical

(c)   Interpersona/behavioral

(d)   Vocational.

The PSQ consists of four sub-scales, each dealing with one of the above-mentioned categories and consisting of ten questions per sub-scale, and whose purpose is to "measure the extent to which the respondent is having problems in work quality or output (Vocational Strain), measure the extent of psychological adjustment and or mood problems (Psychological Strain), measure the extent of disruption in interpersonal relationships (Interpersonal Strain), and measure complaints about physical illness (Physical Strain)".

The purpose of using the PSQ is to isolate, at least by category, the basis of the stresses originating from the manager's working environment. Thus by using the two major questionnaires, the STAI and the PSQ, not only can the author determine if the manager is strained but also identify the source of that strain.

The only problem resulting from the use of the PSQ is that it is a fairly new questionnaire and few validation studies exist on it. The majority of studies carried out using the PSQ seem to be concentrated at the University of Maryland in the form of thesis and dissertations and carried out probably under the auspices

of the authors of the PSQ. However, this should not deter researchers from using the instruments as they are based on strong theoretical works of a number of authors in the stress/strain literature. Studies such as this one can only help to falsify this instrument and add to the corpus of theory.

Osipow and Spokane report in the manual on the internal consistency of the PSQ, using Cronbach Alpha coefficient and an initial sample of 201 employed adults as being .92 . The two week test-retest reliability they report as ranging from a low of .56 to .94 . They also report on correlation studies in an effort to "form a nomological network of relationships to a number of work related variables". One study examined the relationship between personal strain and two psychological variables, locus of control and person-environment congruence. No significant relationship was found between personal strain and the two psychological variables.

4.4   A Measure For Cognitive Style

Choosing a valid and accurate measure for cognitive style is of critical importance for this study. However the task has not been easy. There are numerous instruments, each supported by a large number of researchers and specific schools of thought. The choice of an appropriate measure has been one of considerable debate in the management literature (Keen et al, 1981; Robey et al, 1981, 1983; Schweiger, 1983). The 1981 Robey et al study provides a good analysis of some of the major instruments that have been used. Two major approaches have been used; physiological state indicators such as EEG monitoring and psychological tests such as Huysman's measurement, the Embedded Figures Test, Vasarhelyi Questionnaire, Minnesota Questionnaire, the Myers-Briggs Type Indicator, the Keen tests and the Kolb Learning Style Inventory.

However, in many of the above-mentioned instruments there exists

fundamental problems which do not lend themselves to be used in an empirical study of this nature. As Taylor et al correctly conclude, many cognitive style research studies suffer from two major problems that must be clearly recognised in choosing an appropriate measure for cognitive style. They write:

"(1)   Most cognitive styles are loosely defined and based upon only rudimentary theories.
(2)   To be interpreted meaningfully, measures of psychological characteristics must demonstrate adequate reliability and validity" (Taylor et al, 1980: 84-85).

Keen et al reviewed and critically examined cognitive style research instruments. They made a strong case "for the use of the Myers-Briggs Type Indicator as the base for cognitive style research".

The logic behind their proposition is that:

(1)   It is based on a theoretical strong paradigm of psychological type derived from Jung that has been of substantial influence on research in or related to the MIS field.
(2)   The MBTI has been shown to be a reliable measure.
(3)   Empirical results gathered by a number of authors over a period of five years indicate the power of the MBTI to "discriminate behaviour relevant to information systems design and use". (Keen et al, 1981: 24).

Using Bagozzi's framework (1980), which identifies six aspects of validity in behavioural measures, the authors evaluated the various existing cognitive models and concluded that the only measure, apart from the MBTI, that merits serious consideration is the Witkin's Enbedded Figures Test (EFT) (1964). However, they continue:

"The overall case for EFT has not been made yet. If it can be, the EFT may be better suited to studies of the psychology of individual cognitive differences where performance rather than preference or behaviour is the focus of interest than is the MBTI" (Keen et al, 1981: 47).

In a review of what the author believes to be among the most relevant papers in the area of management cognitive research, seventeen out of twenty-four papers either proposed or used the MBTI as the cognitive measure for their research (see Table 4.6). Major findings by a number of authors using the MBTI are summarised in Tables 4.7 to 4.11.

	Bariff & Lusk	1977	EFT + Bieri Cognitive Complexity Test
	Blaylock & Winkofsky	1983	MBTI
	Davis	1982	MBTI
	Dermer	1973	Rokeach's Dogmatism Scale
	Doktor & Hamilton	1973	EFT
*	Ghani & Lusk	1982	EFT
	Gruenfeld	1975	EFT
	Hellriegel & Slocum	1980	MBTI
	Henderson & Nutt	1980	MBTI
*	Keen & Bronsema	1981	MBTI
*	Kilmann & Mitroff	1976	MBTI
	Kleiner	1983	MBTI
	Lewis & Hibbert	1980	MBTI
	Margerison et al	1978	MBTI
*	Mason & Mitroff	1973	MBTI
	McGhee et al	1978	Intolerance of Ambiguity Test + Integrative Style Test
	McKenney & Keen	1974	MBTI
	Mintzberg	1976	-
	Mitroff & Kilmann	1975	MBTI
	Mitroff et al	1977	MBTI
	Nugent	1981	-
	Slocum	1978	MBTI.
	Steckroth et al	1980	MBTI
	Taggart & Robey	1981	MBTI

* denotes, author proposes the use of the MBTI.

Table 4.6

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VARIABLE	SENSATION/THINKING	INTUITION/THINKING	SENSATION/FEELING	INTUITION/FEELING
TYPE OF ROLES INDIVIDUAL USUALLY FOUND IN	APPLIED SCIENCE. PRODUCTION (7) WHERE THERE IS NO UNCERTAINTY AS TO WHAT IS EXPECTED (3)	PHYSICAL SCIENCE. RESEARCH MANAGEMENT. FORECASTS & ANALYSIS. (7) DEALING WITH ENVIRONMENTAL UNCERTAINTY AND NO PRECISE METHOD TO SOLVE THE PROBLEMS. (4)	SALES (7)	BEHAVIORAL SCIENCE. RESEARCH (7)
PERCEIVED AS	PRACTICAL (3) TRADITIONALIST JUDICIAL (8)	THEORETICAL (3) VISIONARY (8)	SOCIAL (3) TROUBLE-SHOOTER. (8)	IDEALISTIC (3) CATALYST (8)

*** PLEASE NOTE THAT THE TYPE OF COGNITIVE OR PROCESSING STYLE WAS DETERMINED USING THE MYERS-BRIGGS TYPE INDICATOR (MBTI) BASED ON CARL JUNG'S PHYCHOLOGICAL TYPES.

REFERENCES

1. TAGGART; ROBEY (1981)
2. SLOCUM (1978)
3. MITROFF; KILMANN (1975)
4. HELLRIEGEL; SLOCUM (1980)
5. MITROFF; BARBARA; KILMAN (1977)
6. BLAYLOCK; WINKOFSKY (1983)
7. MYERS (1962)
8. BATES; KEIRSEY (1974)

Table 4.7

VARIABLE	SENSATION/THINKING	INTUITION/THINKING	SENSATION/FEELING	INTUITION/FEELING
FOCUS OF ATTENTION	FACTS (1,7) SPECIFICS & FACTUAL DETAILS. (2,3) ORGANIZING & KEEPING THE SYSTEM RUNNING. (4)	POSSIBILITIES (1,7) GENERAL CONCEPTS & ISSUES. (2,3) POLITICAL & POWER COALITIONS THAT FORM IN ORGANIZATIONS. (4)	FACTS (1,7) DETAILED HUMAN RELATIONS IN THEIR ORGANIZATION OR DEPARTMENT. (2,3)	POSSIBILITIES (1,7) BROAD GLOBAL THEMES. (2,3)
APPROACH	IMPERSONAL ANALYSIS. (1,7) ANALYSIS, LOGIC, AND DECISIVENESS. (7)	IMPERSONAL ANALYSIS. (1,7) LOGICAL, CRITICAL, DECISIVE DETERMINED. (7)	PERSONAL WARMTH. (1,7) LOYALTY, CONSIDERATION & THE COMMON WELFARE. (7)	PERSONAL WARMTH. (1,7) GLOBAL APPROACH TO ISSUES & PROBLEMS. (5)

Table 4.8

VARIABLE	SENSATION/THINKING	INTUITION/THINKING	SENSATION/FEELING	INTUITION/FEELING
HAS CONCERNS IN		THE INTELLECTUAL AND THEORETICAL CONCEPTS OF ORGANIZATIONS IN GENERAL THAN WITH EFFICIENCY. (3)	HUMAN QUALITIES OF THE SPECIFIC PEOPLE WHO FILL THE ROLES. THE INTERPERSONAL ENVIRONMENT. (3)	LONG-TERM ORIENTATION OF THE ORGANIZATION. (2)
HAS TENDENCIES	TO ESTABLISH ELABORATE SET OF RULES & PROCEDURES TO CREATE A STABLE AND PREDICTABLE SET OF ROLES. (4)	TO ESCALATE STANDARDS & STAND BY THEIR DECISIONS. (4)		TO TREAT PROBLEMS FROM A PERSONAL, HUMAN, MORAL & ETHICAL POINT OF VIEW. (5)
VALUES	RELATEDNESS SOCIAL BELONGING. (8)	COMPETENCY ABILITY KNOWLEDGE CAPABILITIES. (8)	FREEDOM SPONTANEITY ACTION. (8)	INTEGRITY AUTHENTICITY MEANING WORTH. (8)
THE CEREBRAL HEMISPHERE PROCESSING USED	LEFT (1)	LEFT (1)	RIGHT (1)	RIGHT (1)

Table 4.9

VARIABLE	SENSATION/THINKING	INTUITION/THINKING	SENSATION/FEELING	INTUITION/FEELING
TYPE OF ORGANIZATION PREFERRED	ONE IN WHICH EVERYBODY KNOWS EXACTLY WHAT HIS JOB REQUIRES & THE DETAILS ARE SET IN A MANUAL OF RULES AND NEGOTIATIONS (2,3) HIGH DEGREE OF STRUCTURE AND WELL ESTABLISHED COMMUNICATION CHANNELS. (6) BUREAUCRATIC. (3)	IMPERSONALLY IDEALISTIC. (3) ONE THAT ENCOURAGES CONSTANT FEEDBACK AND PROVIDES ITS OWN GOALS, CONTROLS, DIVISIONS OF LABOUR AND MOTIVATION AND REWARD STRUCTURES. (2,3) COMPLEX. (3)	WELL DEFINED SET OF RULES & REGULATIONS A CENTRALIZED ORGANIZATION. (4) FRIENDLY, HIERARCHICAL BUT OPEN. (3)	COMPLETELY DECENTRALIZED. NO CLEAR LINES OF AUTHORITY NO CENTRAL LEADER, AND NO FIXED, PRESCRIBED RULES OF BEHAVIOR. (2,3) NO STRONG LEADERSHIP. (4) IDEALISTIC. ORGANIC, ADAPTIVE INSTITUTIONS. (3) DEMOCRATICALLY RUN. (4)
PREFERS ORGANIZATIONAL GOALS TO BE	REALISTIC DOWN-TO-EARTH LIMITED AND MOST OFTEN NARROWLY ECONOMIC (2,3)	DEVELOPED IN RESPONSE TO THE INTERRELATION BETWEEN ENVIRONMENTAL AND MEMBER GENERATED FACTORS (2,3)		SERVING THE PERSONAL & SOCIAL NEEDS OF PEOPLE (2,3)

Table 4.10

VARIABLE	SENSATION/THINKING	INTUITION/THINKING	SENSATION/FEELING	INTUITION/FEELING
TYPE OF REPORTS PREFERRED	HIGHLY DETAILED & SPECIFIC, & WHICH OVERWHELMINGLY DEAL WITH TECHNICAL OR SCIENTIFIC ISSUES. (5)	HIGHLY GLOBAL, BROAD, FAR-RANGING & WHICH DEAL WITH A WIDE RANGE OF OVERWHELMINGLY TECHNICAL/ SCIENTIFIC ISSUES. (5)	HIGHLY DETAILED & SPECIFIC, & WHICH OVERWHELMINGLY DEAL WITH INDIVIDUAL PERSON ISSUES. (5)	HIGHLY GLOBAL, BROAD, FAR-RANGING & WHICH DEAL WITH A WIDE RANGE OF OVERWHELMINGLY HUMAN, MORAL & ETHICAL ISSUES. (5)
AS A PROBLEM ANALYST HE PREFERS	DEFINING SOLUTIONS (8)	DEFINING PROBLEMS (8)	IMPLEMENTING SOLUTIONS (8)	PROBLEM AWARENESS (8)
WEAKNESSES	IMPATIENT WITH PROJECTS DELAYED BY COMPLICATIONS. INCLINED TO DECIDE ISSUES TOO QUICKLY. NOT RESPONSIVE TO RAPID CHANGE. (8)	POOR EVALUATOR & DAY-TO-DAY ADMINISTRATOR. (6) IMPATIENT WITH ERRORS AND GOING OVER THE SAME TERRITORY ONCE A DECISION HAS BEEN MADE. (4)	REFUSES TO ACKNOWLEDGE UNPLEASANT FACTS OR SITUATIONS. AVOIDS DIRECT CONFRONTATION LEAVING RESPONSIBILITY TO SOMEONE ELSE. (6) DISLIKE FOR RADICAL, CHANGE AND NEW FANGLED IDEAS. (4)	POOR DAY-TO-DAY ADMINISTRATIVE CAPABILITIES. (6) VULNERABLE TO SUBORDINATE EMOTIONS. ALWAYS SEEKING SUPPORT. (4)

Table 4.11

The MBTI, see Appendix D, is a self-administering questionnaire consisting of one hundred and twenty-six forced-choice items (Form G). According to Myers the purpose of the indicator is

> "to implement Jung's theory of type (1923). The gist of the theory is that much apparently random variation in human behaviour is actually quite orderly and consistent, being due to certain basic differences in the way people prefer to use perception and judgement" (Myers, 1962: 1).

Many researchers note two main advantages in using the Jungian typology, here briefly summarized by Kilmann et al

> "(1) the dimensions of the Jungian typology can be directly related to different managerial and organizational styles; as a result, the system helps to shed light on a wide variety of organisational and managerial phenomena;
> (2) the Jungian typology does not prescribe one of the four major personality types as superior or better than any of the others but instead points out that each type has major strengths as well as weaknesses" (Kilmann et al, 1976: 18).

The MBTI consists of four separate indices:

-   The Thinking-Feeling (T-F) Scale   which measures the person's preferred approach to information evaluation.

-   The Sensation-Intuition (S-N) Scale which measures the person's preferred way of information gathering.

-   The Judgement-Perception (J-P) Scale which measures the way the individual goes about his decision-making process.

-   The Extroversion-Introversion (E-I) Scale which measures a person's preferred orientation towards interpersonal interactions.

Given that there are two attitudes to each of the above mentioned functions, and the different ways that they can be combined, ie ESTJ, ISTJ etc,

this leads to sixteen possible Jungian Types that can be identified using the indicator. The indicator comes with an answer sheet and scoring keys for translating the different answers into preference scores.

There exists a considerable research base dealing with reliability and validity studies for the MBTI. Apart from those reported by Myers (1962) in the accompanying manual, there are two major studies, (Stricker et al, 1963) and (Carlyn, 1977) that have been carried out. It is the objective of this section of the study to examine the following for the MBTI:

A) Reliability

    (i)   Stability over time.

    (ii)   Internal Consistency.

B) Validity

    (i)   Predictive Validity.

    (ii)   Concurrent Validity.

    (iii)   Construct Validity.

Carlyn (1977) reports of four studies dealing with the stability of type-category scores. Using test-retest data, Levy et al (1972), Stalcup (1967), Stricker et al (1964) and Wright (1966) examined the proportion of agreement between the original and the retest, and found the MBTI to have the following ranges for each of the four indexes:

Extroversion-Introversion	62% to 83%
Sensation-Intuition	57% to 89%
Thinking-Feeling	61% to 90%
Judgement-Perception	66% to 90%.

Howes et al (1979) found that the MBTI scores of psychology students changed somewhat less than scores using the Sixteen Personality Factors Test. As to the stability of the continuous scores only two studies are reported, Levy et al (1972) and Stricker et al (1964). Their results between the original and the retest was found to have the following ranges for each of the four indexes.

Extroversion-Introversion	73% to 83%
Sensation-Intuition	69% to 78%
Thinking-Feeling	48% to 82%
Judgement-Perception	69% to 82%.

In terms of internal consistency of the type-category scores, three studies are reported, Stricker et al (1963), Webb (1964) and Myers (1963). The Stricker et al (1963) and Webb (1964) studies used a lower bound estimates of reliability with Guttman's procedures, and reported reliabilities in the 40s and 50s (Stricker et al study). Webb (1964) and Myers (1963) estimated split-half reliabilities by calculating phi correlation coefficients and applying the Spearman-Brown prophecy formula. In fact it is Myers (1962) who recommends when determining the internal consistency of the type-category scores, to use estimate split-half reliabilities by calculating tetrachoric correlation coefficients and applying the Spearman-Brown formula. Three researchers, Hoffman (1974), Myers (1962) and Webb (1964) reported the following results by applying the Spearman-Brown Prophecy formula to:

	Phi Coefficients	Terachoric r
Extroversion-Introversion	.55 to .65	.70 to .81
Sensation-Intuiton	.64 to .73	.82 to .92
Thinking-Feeling	.43 to .75	.66 to .90
Judgement-Perception	.58 to .84	.76 to .84

As to the internal consistency of continuous scores three studies are reported, Myers (1962), Webb (1964) and Stricker et al (1963). Myers and Webb developed a split-half procedure involving Pearson product-moment correlations, while Stricker et al used Cronbach's coefficient alpha. The Stricker et al study gave coefficients in the following ranges:

Extroversion-Introversion	.76 to .83
Sensation-Intuition	.74 to .80
Thinking-Feeling	.64 to .74
Judgement-Perception	.78 to .84

Predictive Validity studies were carried out by Goldschmid (1967), Conary (1966), Stricker et al (1965), Myers et al (1964), Carlson et al (1973), and Saunders (1957); all used students as their subjects, and all coming up with a moderate predictive ability. However there are numerous studies that support the predictive validity of the MBTI but a large proportion of them use students as their subjects, with practically none existing using managers as their subjects.

Concurrent Validity studies are quite numerous, showing comparisons of the MBTI with similar scales. Myers (1962) reports on correlations with the Gray-Wheelwright Psychological Type Questionnaire which has the same purpose as the MBTI, that is to identify the Jungian types. The following results were obtained:

EI	SN	TF	JP
.79	.58	.60	No scale

Other correlations are reported with interests as shown by Strong Vocational Interest Blank, with needs as measured by Edwards Personal Preference Schedule, the Personality Research Inventory and the Allport-Vernon-Lindzey Study of

Values. Steele et al (1976) also demonstrate a high extroversion-introversion correlation between the MBTI and the Eysenck Personality Questionnaire, and Lake et al (1973) report correlations of .63 to .75 with the extroversion scale of the Maudsley Personality Inventory.

Research papers dealing with the construct validity of the indicator, that is whether the four indexes really measure the various cognitive types postulated by Carl Jung's theory, are numerous. But one major paper by Stricker et al (1964b) is widely quoted in the literature and is one of considerable debate. Based on the analysis of these authors only the SN and TF scales may actually reflect those postulated by Jung's theory (the EI and JP are questionable). However Carlyn's study, which is based on a review of a large number of studies, concluded:

> "the numerous studies of construct validity summarized above suggest that the individual scales of the Myers-Briggs Type Indicator measure important dimensions of personality which seem to be quite similar to those postulated by Jung" (Carlyn, 1977: 471).

Keen et al make an important point in their review of the Construct Validity of the MBTI:

> "Construct validity: The MBTI seems methodologically sound in this respect. It must be acknowledged, of course, that personality and trait-based theories in general and style models in particular are contentious and in some respects the preference for a particular psychological tradition is a matter of axioms and taste" (Keen et al, 1981: 45).

The MBTI has been shown to have the necessary reliability and validity requirements necessary for this research study. Not only has it been shown to be methodologically sound but is based on a well-based theoretical paradigm of psychological types postulated by Carl Jung. While it continues to suffer from some criticism, mainly because of the nature of its forced-choice questions and at times the relationship between personality and type preference is questionable, it has, however, emerged as the standard for cognitive style research.

CHAPTER FIVE

METHOD OF DATA COLLECTION, PREPARATION AND ANALYSIS

5.1   Introduction

The objective of this chapter is to show the three major stages that were used in the handling of the empirical data. The three stages being data collection, data preparation and data analysis. The objective of this chapter is not to show a "best method" in applying the scientific models discussed in the previous chapter but rather to show how the author went about the process of applying the models and to show the advantages and disadvantages of using such a method.

5.2   Stage One : Data Collection Process

In December of 1984 a letter was sent out to twenty organisations in the West Midlands area outlining the purpose of the study and requesting each organisation to participate in the study by allowing their managers to be interviewed and allowing the author access to necessary organisational information. The organisations were chosen at random from a catalogue and listing of organisations in the West Midlands area. This drew only seven responses of which all were negative mainly due to the fact that they were either carrying out a major reorganisation (and thus felt it was an inappropriate time to carry out the study), or were at the time either participating in some form of university research or had just finished doing so and felt that they could not afford further managerial time.

In February two organisations were approached through personal contacts at Aston University. Both organisations agreed to a preliminary meeting to discuss the study. For this meeting a two page report on the study was prepared

at the request of the respective managing directors. The report gave:

(1) A brief background and introduction to the study

(2) Information on the purpose of the study

(3) Background and information on the instruments to be used in the collection
of the data

(4) And amount of time required to carry out the study in the organisation.

The first organisation (Company A) agreed during the preliminary meeting to the study and went ahead and scheduled all of its managers for interviews. However the total number of managers in Company A was rather small with only eight managers, and it was decided that it would be best to treat it as a pilot study with the purpose of testing the instruments and learning from the process. Although the managing director agreed to the study he pointed out that in the end it would be up to the individual manager and my ability to convince the other managers to participate in the study. Copies of the two page report were then distributed by the managing director to each individual manager. Following the eight managers' approval to participate in the study the interviews were scheduled. At the interview each manager was told that the results of the questionnaires were to be treated in strict confidence and only he would have access to the results, however the results of the interviews were to be incorporated into a final report for the organisation as a whole. The method of responding to the three questionnaires was then explained and each manager was asked to have them ready for collection approximately a week after the interview. Permission was then requested from each manager to carry out the interview on tape. A small micro recorder was used to record the interview data and in no case did any manager refuse the use of the tape recorder. The taping of the interviews appeared to have had little effect in the response of the managers to the questions and most managers in all the organisations were very frank and open in their responses. The first part of the interview was directed at

establishing the position and responsibilities of the individual manager. The interview schedule was used as the framework in posing the questions to the manager. That is, the questions shown in the interview schedule (Manager-Task Analysis Instrument) were not actually put forward in the manner shown but rather modified depending on the person being interviewed. With some managers it was necessary to spend a greater amount of time in establishing their positions and activities. For example when interviewing a senior manager or director a greater emphasis was put on trying to capture his involvement in the formulation of policies and System 4 intelligence activities, while with lower level managers a greater emphasis was put on trying to understand how the technological activities are actually carried out. Some managers had no subordinates reporting to them so greater emphasis was put in understanding their peer and superior relationships. The sequence of the questions was very dependent on the response of the manager. That is, it was sometimes necessary with one manager to have a lengthy discussion on his system for controlling and regulating the distant transformations before examining his interpersonal communication system with organisational members, while with another manager it could have been vice-versa. What was important for the author during the interview was to pose the necessary questions in such a way that, by the end of the interview, the information required for the models discussed in the previous chapter had been collected. This was no easy task because many managers use different names for departments, processes and documents and at times managers had to be interrupted for further clarification of sources and destinations. Most of the interviews went on for about an hour with some as long as three hours. By the end of May 1985 all the interviews in Company A had been completed and all the questionnaires received.

With Company B lengthy discussions on the study were carried out with the managing director and it was decided by him that the author should schedule the interviews rather than the organisation. This proved to be very difficult as many

managers were often away on sales visits or too busy to carry out the interview, so what should have taken a few days of interviewing time lasted over two months and the interviews were not completed until the end of July 1985. In this company sixteen managers were interviewed. The same method of administering the questionnaires and carrying out the interview in Company A was used in Company B.

Following the analysis of the Myers-Briggs Type Indicator results it was found that nearly all the cognitive styles of the managers interviewed in Companies A and B were of the Sensation-Thinking types (that is predominantly Logical types) and there was insufficient data on the operating modes of the Intuitive Types (for example NT types). It was then felt necessary to approach some other organisations in the hope of finding Intuitive types in their managerial teams. A further four organisations were approached through personal contacts to participate in the study. All four agreed during the preliminary meetings for the study to be carried out. However the method of data collecting was changed. That is, all four organisations were asked to fill in the questionnaires first and if the cognitive results proved interesting (which to the author meant that the organisation had a fair proportion of intuitive type managers) then the interviewing process would be carried out. Company C was a large communications corporation and agreed that the questionnaires should be only administered to its top managers and directors. The results of the questionnaires showed a large proportion of the managerial team were of intuitive types but during later discussions the organisation felt that the nature of the questions to be used in the interview were of too detailed a nature (and thus could be of use to competitors) and refused permission for the interviews to be carried out. The cognitive results of Company D (a large manufacturing company) and Company E (a large service and manufacturing company) showed a small proportion of intuitive types in the management teams and were thus ruled out for the interview

process. This left Company F which was a medium sized manufacturing company and about the same size in personnel numbers and amount of sales as Company B as the only choice. Company F was structured totally differently from Company B and had a much more informal structure than Company B. Following the analysis of the cognitive results it was found that it had a good proportion of intuitive types in the management team. Interviews were carried out with sixteen managers and directors during November and December of 1985.

One of the main problems faced in the data collection was getting all the managers to carry out the interview and to respond to all of the questionnaires. This was not always possible. In some cases the manager responded to the questionnaires but was not available for the interview. In other cases the manager carried out the interview but refused to respond to the questionnaires or responded to one questionnaire and not to another. Although these managers represented a small percentage of the total sample it severely limited the analysis of their data. The main problem seems to have been the length of the questionnaires, especially the Myers-Briggs Type Indicator. In responding to this questionnaire some managers did not respond to all the questions, leaving some answers blank, and so many questionnaires were discarded. All the managers who did not respond to the questionnaires were contacted either by a follow-up visit or by phone to encourage them to respond. By doing this over half of them responded but some just kept postponing it leading the author to believe that they did not wish to respond and were thus not contacted again.

5.3   State Two : Data Preparation

This stage only dealt with the organisational and managerial information collected through the interview process. Once data was captured on tape it had to be prepared so that it could be analysed using micro-Prolog. This involved a very

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detailed and often lengthy process of data preparation. The interviews were transcribed exactly in the same way as the individual manager responded, that is word-by-word. This was quite a long and tedious process but it was felt to be very important because each specific managerial answer contained valuable information and it was necessary to have it in exactly the same form as the manager had put it across during the interview. This proved to be extremely worthwhile when it came to tracking specific points concerning how the organisation operates and the manager's method of control. Altogether some four hundred pages of transcriptions were written-up. The next step was to go through each interview and pick out pieces of information concerning managerial activities, information flows, organisational hierarchial structure etc. that are necessary for the scientific models described in the previous chapter. These pieces of information were then entered onto the data sheets (see Appendix B). Following the completion and analysis of all the interviews the information contained in all the data sheets was keyed into the BASIC Viplan Program. The amount of information entered was quite substantial and often involved some eight hours of continuous data entering. However the Viplan Basic Program was easy to use and it was found that all the information could be entered into the Organisation Data Model. Thousands of prolog statements representing important organisational transformations were thus prepared, checked and then converted using Viplan's conversion program into micro-Prolog statements (see Appendix G for examples of the prolog statements on Company B). Many of the prolog statements were computer generated. For example, the computer program would ask for the name of the managerial role and the activity performed only once while generating multiple relationships with these two bits of information without the programmer having to remember the key-words needed to link them as required by the Organisational Data Model. Using this method the programmer could always guarantee that the necessary statements are being generated and recorded.

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This method of data preparation was carried out on Companies A, B and F and thus interview data in the form of transcripts was transformed into Micro-Prolog statements ready for preliminary Cybernetic analysis. Only the transcription of the tapes was lengthy and could possibly be greatly facilitated by the development of a questionnaire that could capture necessary managerial and organisational information with the same efficiency as the interview schedule but with less physical effort.

5.4 Stage Three: Data Analysis

Once the data had been collected and prepared, it became very clear that a tremendous amount of information had to be analysed. First of all there was data on the organisations that needed to be cybernetically analysed. Secondly, the data on how the managers operated, communicated, influenced policy etc needed to be examined. Thirdly, the data obtained by means of the questionnaires had to be statistically analysed, and also compared to the results obtained by carrying out a cybernetic analysis. These three sub-stages of the data analysis are reviewed below.

5.4.1 Cybernetic Analysis Of The Organisation

Once data was prepared using the Viplan front-end BASIC program, and the data converted into micro-Prolog statements, the cybernetic analysis of the organisational data began.

The first process entailed the analyst to gain an understanding of the unfolding of complexity within the system under study. Using the Technological Data Model as a model of reference, it was necessary to understand what the organisation was actually producing in terms of products or services, and to

isolate its main business areas. Once this was done, it became very important to analyse the transcripts of the interviews to determine, from the viewpoints of the managers, what activities the organisation was trying to make viable. This meant looking at all the organisational entities and deciding whether they were to be treated as primary activities or functional activities. Primary activities were those entities or technological operations that represented units or objects of control and which produce the missions of the organisation. The examination of the unfolding of complexity, within the system under study, meant isolating those primary activities at each level of complexity (such as corporate level, division level, section level, shop level etc). This was not always so clear-cut as it seems, for quite often very detailed analysis on operating methods and viewpoints was necessary to determine whether an activity was a primary or a functional activity. Functional activities were those entities or services that supported or gave service to primary activities. For example, if a manufacturing division was designated as a primary activity, then all the activities at the same level of complexity that were supporting the manufacturing division in terms of sales, accounting etc. were then treated as functional activities. However this was not always the case, as in Company F, for some activities or entities that would normally be seen as functional activities, such as a sales department, turned out to be primary activities because the organisation was trying to make them viable. No clear-cut rule was found to distinguish between the two in all cases. Only an intuitive understanding of Beer's and Espejo's work facilitated the process of analysis, and each case had to be treated based on a deep understanding of the purpose of the unit, and what it appeared to be doing.

Having modelled the organisation and isolated its primary activities at different levels of recursion, it was then necessary to examine how requisite variety was achieved at each level of complexity or recursive level. For this kind of analysis Beer's most recent book (Beer, 1985), which included some very useful

diagrams of the Viable System Model, and Espejo's paper on the cybernetics of a small company (Espejo, 1980) proved very useful and acted as frames of reference. At each recursive level and for each business area of the organisation, many questions were posed to the computer using the micro-Prolog programming language to see what information was flowing from one department to another. This was where Viplan proved very useful, because it facilitated the analysis of data without having to constantly refer back to the interview transcripts. The questions posed to the computer were also based on the three sub-models of the Manager-Task Interaction Model, described in an earlier chapter. Since only relevant data was entered into the Organisational Data Model using the Viplan program, it was thus possible to follow through with particular organisational transformations until it became clear what was really going on at each recursive level.

In order to determine how requisite variety was achieved at each level of complexity, a very systematic investigation was conducted. First of all it was necessary to determine all the units and individuals that were controlling particular aspects of system one, i.e. implementation, activities. Once these were isolated it was then necessary to find out who they were being regulated by (thus isolating their system three controllers) and what information was flowing between them. It became very apparent quite early on that system three was often composed of a number of managers and departments, each regulating a particular aspect of the operations. How these managers were monitoring the operations was determined from the interview transcripts and data obtained from the computer files. It was system two, i.e. coordination, activities that were often difficult to isolate, because these often were not clear to the managers themselves.

Information on the organisation's system four, i.e. intelligence, activities were obtained solely from the interview transcripts and by understanding the

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purpose of many of the manager's activities. At lower levels of recursion, these activities were quite often non-existent.

Following the cybernetic analysis of Company A it became very clear that there were certain areas, such as system two and system four activities, that the analyst needed to concentrate on when posing questions to the managers in the interviews. That is, a great deal of learning was going on from case to case, so that by the time the cybernetic analysis of Company F was carried out, many points unclear in previous cases were overcome. Even when writing up the case (and presenting copies of the report to the individual companies) different approaches were used, until an adequate method of presentation was established in Company F.

The cybernetic analysis carried out in each organisation is shown in the form of case studies in Appendices H to J.

Following the analysis of Company A, it became very clear that when carrying out a cybernetic analysis on any organisation a tremendous amount of information is required to determine its cybernetics. When carrying out the interview the researcher has little idea of the cybernetics of that organisation. He is unable to handle the complexity of the information he is receiving when carrying out the interview. When posing the questions he could miss out significant areas, which become evident later when the analysis of data begins. As a way of overcoming this problem the author went back to the managers, when possible, for further clarification. When analysing Company B and F this was the strategy that was used.

5.4.2 Analysis Of How The Managers Operated

Once the cybernetics of the organisation was established, the analysis of how the managers operated began. First of all the cybernetics of the organisation

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clearly established the role which the individual manager was carrying out. However, how the manager operated was found to be very much dependent on how he perceived his task. Managers as a matter of fact define their tasks by the information loops and activities to which they gave closure.

To understand how the manager operated it was necessary to examine the kind of information he was receiving, the committees he was involved in, whom he communicated with and the activities he carried out. By understanding his information loops it was possible to establish the recursive levels he was operating at, the recursive level he was monitoring at, the amount of autonomy he allowed his subordinates and the operations he perceived to be under his control.

A great deal of the information on how the manager operated was available through the Viplan data files. However further clarification on particular points was established by going back to the original interview transcripts. With respect to how the manager influenced policy, communicated, and set up guidelines, the author was totally reliant on information provided in the interview transcripts.

In the case studies each managerial position is examined, outlining the manager's role, his information loops and his method of operation.

5.4.3 · Statistical Analysis Of The Questionnaires

All three questionnaires were scored manually and based on the scoring guidelines set out in their respective manuals. As previously noted, many questionnaires were discarded as they did not meet the criteria set out in the manuals with respect to the maximum number of unanswered questions not answered. However their overall percentage was very small when compared to the numbers that actually responded fully.

With respect to the Myers-Briggs Type Indicator (MBTI), the author used both the type and the continuous scores option, thus it was possible not only to

identify the manager's cognitive style but also to examine if there were any particular trends in the data.

Once the questionnaires were scored, the results were then coded and entered to data files on the university's main-frame HARRIS computer. A small program was written to analyse the data using the SPSS - Statistical Package for the Social Sciences (Nie et al, 1975). Frequencies, standard deviations, t-tests, and Pearson correlation coefficients were thus obtained for the data.

With respect to those managers that filled out the MBTI and the other two questionnaires, graphical representations of their individual scores were prepared using the IBM personal computer and the graphics option on the OPEN ACCESS software program. This was done to examine if there were any particular trends in the data. These graphs are shown in Appendix K together with tables of their individual scores on all the questionnaires. These graphs were very useful in identifying not only trends, but also those managers whose strain scores were quite high.

The statistical results obtained are reviewed below under three categories, the managerial sample, cognitive style of the manager, and strain results of the managers.

5.4.3.1   The Managerial Sample

Altogether some eighty-two managers from six different organisations participated in the study. Cybernetic analysis, using Beer's Viable System Model, was carried out on three of the six organisations. The managers from the three organisations (Company A, B and F) represented 47.6% of the total managerial sample. The total number of managers that participated in the study is shown in Table 5.1. 82% of the managers had worked with their organisations for less than fifteen years, with the mode having worked somewhere between one and five

<u>SIZE OF SAMPLE</u>

ORGANISATION	NUMBER OF MANAGERS	%AGE OF TOTAL SAMPLE
A	8	9.8
B	17	20.7
C	22	26.8
D	8	9.8
E	13	15.9
F	14	17.1
TOTAL	82	100%

<u>Table 5.1</u>

years. Actual distribution for length of service is shown in Table 5.2. All the organisations that participated had annual sales in excess of ten million pounds with two organisations having sales in excess of one hundred million pounds (Companies C and E). Most of the organisations the managers worked for were involved in manufacturing products, with some involved also in services and retailing. The number of employees in the organisations ranged from seventy-five (Company A) to many thousands (Company C). With respect to the three organisations where a cybernetic study was carried out (Company A, B and F) further details can be obtained on the nature of the organisation by examining the introduction section of the case study. However it must be understood that the results in Table 5.1 represent the number of managers that participated in the study from each organisation, and do not necessarily reflect the total number of managers in the respective organisation.

5.4.3.2 Cognitive Styles Of The Managers

Table 5.3 shows the cognitive styles of the managers as determined by the Myers-Briggs Type Indicator. Altogether twelve different cognitive styles appeared in the sample (out of a possible sixteen styles). However, 65.7% of the cognitive styles were made up of three styles, these being ISTJ, ISTP and ESTJ. When taking out the extroversion-introversion (EI) scale and the judgement-perception (JP) scale, STs (sensation-thinking types) represented 69.8% of the cognitive styles, with the remaining 30.2% distributed mostly between NTs (intuitive-thinking types) and SFs (sensation-feeling types). With respect to the individual scales of the Myers-Briggs Type Indicator distribution between the two categories is shown in Table 5.5. As can be seen from the results there was a bias in the sample towards sensation types as these represented 74% of the sample. This was through no choice of the author but rather reflects what actually

PERIOD OF TIME SPENT BY MANAGERS
WITH THEIR RESPECTIVE ORGANISATIONS

LENGTH OF SERVICE	NUMBER OF MANAGERS	RELATIVE FREQUENCY	ADJUSTED FREQUENCY
Less Than 1 Year	12	14.6	20.7
1 To 5 Years	17	20.7	29.3
6 To 10 Years	10	12.2	17.2
11 To 15 Years	9	11.0	15.5
16 To 20 Years	2	2.4	3.4
Greater Than 20 Years	8	9.8	13.8
Unknown (Missing Data)	24	29.3	MISSING
TOTAL	82	100.0%	100.0%

Table 5.2

COGNITIVE STYLES OF MANAGERS AS DETERMINED BY
THE MYERS-BRIGGS TYPE INDICATOR FOR
THE TOTAL SAMPLE

COGNITIVE STYLE	NUMBER MANAGERS	RELATIVE FREQUENCY	ADJUSTED FREQUENCY
ISTJ	16	19.5	21.9
ISTP	10	12.2	13.7
ESTP	3	3.7	4.1
ESTJ	22	26.8	30.1
ISFJ	1	1.2	1.4
ESFP	1	1.2	1.4
ESFJ	1	1.2	1.4
INFP	1	1.2	1.4
INTJ	7	8.5	9.6
INTP	5	6.1	6.8
ENTP	1	1.2	1.4
ENTJ	5	6.1	6.8
(MISSING DATA - UNKNOWN)	9	11.0	MISSING
TOTAL	82	100.0%	100.0%

Table 5.3

emerged. When carrying out a Pearson correlation coefficients test on the results (see Table 5.4) it was found that the sensation-intuition scale was very dependent on the organisation variable. That is, the number of sensation types or intuitive types that one actually got depended very much on which organisation was studied. In some organisations (i.e. Company A) no intuitive types appeared in the sample. It is probably quite possible to find some organisations where intuitive types represent the majority of cognitive styles. However this has to be examined. The Pearson correlation coefficients test also highlighted that there is a strong relationship between the sensation-intuition scale and the judgement-perception scale for the managers. It appears from the results that managers who are of intuitive types also rely on the perceptive mode in their approach to decision-making, while the sensation types rely on the judgement mode. However both the extroversion-introversion scale and the thinking-feeling scale were found to be independent of the sensation-intuition scale. While there was a near fifty-fifty split on the extroversion-introversion scale, with respect to the thinking-feeling scale it would appear that managers overwhelmingly rely on the thinking dimension (T) rather than the feeling dimension (F) in their approach to information evaluation. 94.5% of the managers were of the thinking mode, while only 5.5% were of the feeling mode (see Tables 5.5 and 5.6).

In examining the results it would appear that the sensation-intuition scale (SN) (which highlights mode of information gathering) is the most significant when examining managerial cognitive styles. This coupled with the thinking mode of the thinking-feeling scale gives two major types existing in organisations, the sensation-thinking type (ST) and the intuitive-thinking type (NT). While there exists other types (i.e. sensation-feeling types and intuitive-feeling types) these however represent only a small percentage of managerial types. These two types, STs and NTs, accounted for 94.4% of the total managerial styles.

PEARSON CORRELATION COEFFICIENTS FOR THE TOTAL SAMPLE

VARIABLE	EI	SN	TF	JP
Organisation	.002 P=.49	.272 P=.01	.135 P=.13	.043 P=.36
EI		.056 P=.32	.101 P=.20	.148 P=.11
SN	.056 P=.32		.217 P=.03	.362 P=.00
TF	.101 P=.20	.217 P=.03		.271 P=.01
JP	.148 P=.11	.362 P=.00	.271 P=.01	
State Anxiety	.198 P=.05	-.169 P=.08	.006 P=.48	-.043 P=.36
Trait Anxiety	.231 P=.03	-.057 P=.32	-.123 P=.16	-.019 P=.44
Vocational Strain	.202 P=.05	-.094 P=.22	-.035 P=.39	-.041 P=.37
Psychological Strain	.223 P=.03	-.061 P=.31	.004 P=.49	-.142 P=.12
Interpersonal Strain	.245 P=.02	.127 P=.15	.166 P=.08	-.006 P=.48
Physical Strain	.065 P=.30	-.014 P=.46	.114 P=.17	-.008 P=.47
PSQ Total Score	.223 P=.03	-0.015 P=.45	.078 P=.26	-.066 P=.29

EI   Extroversion-Introversion Continuous Score
SN   Sensation-Intuition Continuous Score
TF   Thinking-Feeling Continuous Score
JP   Judgement-Perception Continuous Score
TYPE   Cognitive Style as Determined by the Myers-Briggs Type Indicator
PSQ   Personal Strain Questionnaire

Table 5.4

MYERS-BRIGGS TYPE INDICATOR RESULTS FOR
TOTAL SAMPLE

SCALE	NUMBER OF MANAGERS	RELATIVE FREQUENCY	ADJUSTED FREQUENCY
EXTROVERSION-INTROVERSION			
EXTROVERSION	34	41.5	46.6
INTROVERSION	39	47.6	53.4
(UNKNOWN - MISSING DATA)	9	11.0	MISSING
SENSATION-INTUITION			
SENSATION	54	65.9	74.0
INTUITION	19	23.2	26.0
(UNKNOWN - MISSING DATA)	9	11.0	MISSING
THINKING-FEELING			
THINKING	69	84.1	94.5
FEELING	4	4.9	5.5
(UNKNOWN - MISSING DATA)	9	11.0	MISSING
JUDGEMENT-PERCEPTION			
JUDGEMENT	52	63.4	71.2
PERCEPTION	21	25.6	28.8
(UNKNOWN - MISSING DATA)	9	11.0	MISSING
TOTAL·ON EACH SCALE	82	100.0%	100.0%

Table 5.5

MEANS AND STANDARD DEVIATIONS FOR THE MYERS-BRIGGS TYPE INDICATOR USING CONTINUOUS SCORES OPTION

	RAW SCORES	
SCALE	MEAN	STANDARD DEVIATION
EXTROVERSION-INTROVERSION	102.1	21.0
SENSATION-INTUITION	82.9	26.2
THINKING-FEELING	70.2	19.5
JUDGEMENT-PERCEPTION	86.3	23.9

Table 5.6

5.4.3.3 Strain Results Of The Managers

With reference to Table 5.7, the mean strain and anxiety scores for the total sample were slightly lower than those shown for working populations in the questionnaire manuals. Spielberger reports in the State-Trait Anxiety Inventory (STAI) manual that the anxiety means and standard deviations based on a sample of 1,387 male working adults were:

S-Anxiety	
Mean	35.72
Standard Deviation	10.40
T-Anxiety	
Mean	34.89
Standard Deviation	9.19

This was quite surprising, because the review of the stress/strain literature appeared to show that managers worked in somewhat stressful occupations, and were thus expected to have higher anxiety/strain scores than the average working adults. While it is clearly understood that the author's sample is rather small, it nevertheless represented a number of different organisations and managers from different structural levels.

When the author decided to use the Personal Strain Questionnaire (PSQ) it was clearly understood that it was a relatively new questionnaire and there were few validity studies on it. However the nature of the questions appeared to be suitable for the kind of study that was being undertaken, and was thus adopted. It was extremely important right from the beginning that the PSQ results needed to be correlated with the STAI, to identify whether both questionnaires were measuring the same kind of variables.

With reference to Table 5.8 showing pearson correlation coefficients for the two questionnaires the results appear to show that trait anxiety is very highly linked with psychological strain. However votational strain and state anxiety, although both highly correlated with psychological strain, are not alone sufficient

MEANS AND STANDARD DEVIATIONS FOR ANXIETY AND STRAIN
QUESTIONNAIRES FOR THE TOTAL SAMPLE

QUESTIONNAIRE AND SCALE	MEAN	STANDARD DEVIATION
STATE-TRAIT ANXIETY INVENTORY		
S-Anxiety Scale (Form Y-1)	32.2	6.7
T-Anxiety Scale (Form Y-2)	33.5	6.4
PERSONAL STRAIN QUESTIONNAIRE		
Vocational Strain	16.2	3.6
Psychological Strain	17.1	4.9
Interpersonal Strain	16.5	3.9
Physical Strain	16.6	4.8
TOTAL SCORE	66.46	14.0

TOTAL NUMBER OF MANAGERS RESPONDING TO QUESTIONNAIRES

STATE-TRAIT ANXIETY INVENTORY	
S-Anxiety Scale (Form Y-1)	80
T-Anxiety Scale (Form Y-2)	77
PERSONAL STRAIN QUESTIONNAIRES	78

Table 5.7

PEARSON CORRELATION COEFFICIENTS FOR THE ANXIETY AND STRAIN QUESTIONNAIRES

Instrument	S-Anxiety	T-Anxiety	Vocational Strain	Psychological Strain	Interpersonal Strain	Physical Strain	PSQ Total
S-Anxiety		.681 P=.00	.569 P=.00	.688 P=.00	.446 P=.00	.574 P=.00	.7.0 P=.00
T-Anxiety			.596 P=.00	.730 P=.00	.548 P=.00	.633 P=.00	.781 P=.00
Vocational Strain				.584 P=.00	.401 P=.00	.400 P=.00	.714 P=.00
Psychological Strain					.556 P=.00	.638 P=.00	.877 P=.00
Interpersonal Strain						.591 P=.00	.703 P=.00
Physical Strain							.837 P=.00

Table 5.8

to account for it. That is to say whatever the stresses of the job, psychological strain does not necessarily follow. Vocational strain does not appear to be correlated with any of the other variables except with the PSQ total score. Although all the correlations are highly significant ($p \leqslant .001$), they are nevertheless, with the exception of the PSQ score, relatively low. The factor which is most implicated in psychological strain is trait anxiety (correlation = .73), which seems to indicate that psychological strain is a matter of dispositional reactions to environmental stress, which really means that some individual managers are better able to cope with the strain of their jobs or tasks than others.

An examination was made to see if there was any relationship between cognitive style and strain/anxiety for the sample. Pearson correlation coefficients were calculated to test this (see results in Table 5.4). Although the correlations for the extroversion-introversion scale (EI) are highly significant ($p \leqslant .05$), they are nevertheless very low. The Pearson correlation coefficient results appear to show that there is no significant relationship between the cognitive style variable and the various scales on both the strain and the anxiety questionnaires. T-tests were also carried out to test this relationship and appear to show that the extroversion-introversion scale is significant when examining trait anxiety and interpersonal strain, as significant levels appear quite high as $p \leqslant .05$ (see Tables 5.9 to 5.11). However when looking at the means for both the extroverted and the introverted managers on these scales it was found that introverted managers were only slightly more strained than extroverted managers. The overall conclusion based on the two types of tests carried out would appear to show that cognitive style has little or no effect on strain/anxiety levels or scores for the sample.

However, when taking the individual scores of the managers on each scale and relating them to the structural position the manager holds, coupled with an understanding of the task of his concern and his cognitive style, the results seem

VARIABLE	NUMBER OF MANAGERS	MEAN	STANDARD DEVIATION	T-VALUE	PROBABILITY
Extroversion-Introversion Ccontinuous Score					
Sensation	54	101.0	21.2	-0.73	0.468
Intuition	19	105.1	20.6		
Thinking-Feeling Continuous Score					
Sensation	54	67.6	20.3	-2.33	0.025
Intuition	19	77.3	15.0		
Judgement-Perception Continuous Score					
Sensation	54	83.3	24.7	-2.05	0.047
Intuition	19	94.9	19.7		
S-Anxiety Score					
Sensation	53	32.9	7.5	1.19	0.240
Intuition	18	31.1	4.9		
T-Anxiety Score					
Sensation	51	33.8	6.9	0.07	0.943
Intuition	18	33.7	5.3		
Vocational Strain Score					
Sensation	52	16.4	4.1	0.63	0.533
Intuition	19	15.9	2.7		
Psychological Strain Score					
Sensation	52	17.5	5.3	0.77	0.444
Intuition	19	16.5	4.5		
Interpersonal Strain Score					
Sensation	52	16.4	4.1	-0.53	0.597
Intuition	19	17.0	4.0		
Physical Strain Score					
Sensation	52	16.9	5.4	0.34	0.733
Intuition	19	16.6	3.3		
Personal Strain Questionnaire Total Score					
Sensation	52	67.3	15.7	0.41	0.686
Intuition	19	66.0	10.0		

Table 5.9

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VARIABLE	NUMBER OF MANAGERS	MEAN	STANDARD DEVIATION	T-VALUE	PROBABILITY
Sensation-Intuition Continuous Score					
Extroversion	34	76.3	22.9	-1.9	0.059
Introversion	39	88.2	27.9		
Thinking-Feeling Continuous Score					
Extroversion	34	65.8	18.4	-1.82	0.073
Introversion	39	74.0	19.8		
Judgement-Perception Continuous Score					
Extroversion	34	77.2	19.9	-3.30	0.002
Introversion	39	94.3	24.5		
S-Anxiety Score					
Extroversion	34	31.3	5.7	-1.39	0.170
Introversion	37	33.5	7.9		
T-Anxiety Score					
Extroversion	32	32.0	5.6	-2.21	0.030
Introversion	37	35.4	7.1		
Vocational Strain					
Extroversion	32	15.6	2.9	-1.46	0.148
Introversion	39	16.8	4.2		
Psychological Strain					
Extroversion	32	16.1	4.4	-1.73	0.087
Introversion	39	18.2	5.5		
Interpersonal Strain					
Extroversion	32	15.6	3.6	-1.99	0.050
Introversion	39	17.4	4.2		
Physical Strain					
Extroversion	32	16.6	4.6	-0.44	0.659
Introversion	39	17.1	4.2		
Physical Strain Questionnaire Total Score					
Extroversion	32	63.8	12.7	-1.70	0.093
Introversion	39	69.5	15.2		

Table 5.10

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VARIABLE	NUMBER OF MANAGERS	MEAN	STANDARD DEVIATION	T-VALUE	PROBABILITY
Extraversion-Introversion Continuous Score					
Judgement	52	101.2	22.3	-0.64	0.526
Perception	21	104.3	17.5		
Thinking-Feeling Continuous Score					
Judgement	52	67.5	13.3	-1.87	0.070
Perception	21	77.0	20.0		
Sensation-Intuition Continuous Score					
Judgement	52	78.8	26.5	-2.27	0.029
Perception	21	93.0	23.2		
S-Anxiety Score					
Judgement	52	32.4	7.4	-0.16	0.877
Perception	19	32.6	5.9		
T-Anxiety Score					
Judgement	50	34.1	6.7	0.67	0.506
Perception	19	32.9	6.6		
Vocational Strain Score					
Judgement	50	16.3	3.8	-0.08	0.940
Perception	21	16.3	3.7		
Psychological Strain Score					
Judgement	50	17.7	5.4	1.31	0.198
Perception	21	16.1	4.2		
Interpersonal Strain Score					
Judgement	50	16.8	4.3	0.92	0.363
Perception	21	15.9	3.5		
Physical Strain Score					
Judgement	50	16.9	5.0	0.09	0.925
Perception	21	16.8	4.7		
Personal Strain Questionnaire Total Score					
Judgement	50	67.7	15.4	0.75	0.457
Perception	21	65.2	11.5		

Table 5.11

to point to an interesting relationship. That is, to understand why a particular manager has a high strain or anxiety score, a fundamental understanding of his structural position and how he perceives his task must first be undertaken. First the individual results, shown in graphical representations in Appendix K, seem to indicate that nearly every manager suffers from strain/anxiety, even if it is not excessive strain (calculated by taking the difference between the state and trait score while at the same time examining the individual scores on the Personal Strain Questionnaire), in some form or another.

For example, one manager might have high psychological strain, while another might have high interpersonal strain. These individual scores can be explained if sufficient knowledge exists about how that manager is operating. When the graphs were produced and scores calculated, they were reviewed with their respective managers to help explain why their scores were high on certain scales. For example the Group Training Manager of Company F was asked why he had a high interpersonal strain score. His reply was that he was still relatively new to the job and was finding it a strain to establish his communication channels with his superiors and to negotiate adequate resources necessary to carry out his job. The maintenance manager in Company F was asked why he had high vocational and psychological strain scores. His reply was that his job was very routine and gave him no chance to be creative. This was no surprise because this manager was an intuitive type (NT) and was placed in a role that would probably be more suitable for a logical type (ST).

So what do the above results tell us in terms of the fit between the individual and what is required of him in an organisation. The results seem to indicate when examined on a case by case basis, even though it is not possible to conclude outright, that managers face strain as a result of their relevant organisations not being effective i.e. not following the principles of viability. Managers constantly have to fight for adequate resources, autonomy to carry out

their operations, to establish effective communication channels, and many other factors. These factors are important and necessary for them to carry out their activities and to manage the tasks of their concern. They perceive some kind of strain (the particular type of strain they will face is dependent on the kind of problem they are facing at a particular point in time) when they feel that the cybernetics of their organisation is limiting their ability to attain their needs. If the organisation was structured in a viable manner, each role would be provided with the necessary resources, the communication channels necessary to inform and to be informed, the autonomy to manage and so on. This would be expected to reduce considerably many forms of strain currently faced by managers. Secondly it is possible to hypothesize that both vocational and psychological strain can be minimized by matching particular types of managers to specific positions. Even though it is the manager that shapes and develops the task, the organisation by means of its expectations and assigning a role to that manager can influence, to some extent, the underlying nature of that task. Some cognitive styles, such as STs, appear to fit well with tasks that require constant day-to-day administration, such as a production department or an accounting department, while others, such as NTs, seem to fit better with tasks that require of the manager to be very creative and to distance himself from the operational details, such as developmental work.

CHAPTER SIX

DISCUSSION OF EMPIRICAL RESULTS

6.1   Introduction

In this chapter the author seeks to review the overall results of the study.
The results reviewed are those which had been obtained by carrying out the three
case studies and the statistical results on cognitive styles and strain/anxiety.
Once the overall results are reviewed, the author sets about highlighting some of
the implications of the findings.

6.2   How The Managers Operated

The managers that participated in the study carried out numerous activities
with respect to their tasks. In fact by simply observing them one would conclude
that no two managers carry out the same activities. However this is very much at
the surface level. What tasks they carry out and why, can be understood and put
into perspective by carrying out a cybernetic analysis. It then becomes quite
apparent that the numerous activities they do carry out, are actually related to
the regulation of particular organisational operations, to facilitate the overall
process of regulation.   This seems to support Beer's conceptualisation of
management, that management is the profession of regulation. However what
must be understood is that, too often the regulation of a particular operation or a
business unit does not rely solely on one manager, but the combined efforts of a
number of managers and staff, each regulating a particular aspect of it. It is this
aspect and that of communication between the individuals in an organisation, that
binds the organisation together. The manager's performance and that of the unit

he is controlling is very much dependent on the performance of others. Using Beer's Viable System Model gives meaning and appreciation to what the manager is actually carrying out. Even to the extent of highlighting neglected areas that the manager should be controlling and monitoring, based on the cybernetics of his organisation and cybernetic laws of viability that lie at the heart of any enterprise.

The manager was often perceived by his superiors and peers to be responsible for a particular unit or operation. This unit can be a whole group of companies or it could be a small assembly operation. It is this perception and the expectations that inevitably arise from it that define the role of the manager in a particular organisation. It also establishes the fundamental nature of the problems that he is expected to handle. When things go wrong or not according to the expectations, the members of the organisation cognitively recognise whose problem area it is and expect the manager to handle it. This role is not fixed, it changes with time as expectations change and as new problems are encountered. Once a particular problem area is associated with an individual manager, the only way a manager can distance himself from it is to let the other managers know that he no longer gives closure to its information loops. As long as the manager gives closure to particular problems and information loops, he inevitably continues to reinforce particular aspects of his role.

The manager strives for homeostasis with respect to his task and with respect to his organisational role. If the manager perceives that his organisation has changed its direction or changed its strategy with respect to a particular area, then cognitively his perception towards his task will change. This comes about as a result of the manager facing cognitive strain, resulting from his perception that his perceived criteria of stability is no longer applicable. The manager then acts to change his criteria of stability with respect to the task of his concern, and to bring his unit's performance in line with the organisation's expectations. To what

extent he is successful in overcoming this strain is dependent on a number of factors (e.g. the strategy he uses or the cybernetics of his organisation).

While the expectations that other members have of a particular manager define the role of the manager, this in no way defines the task for the manager. At times the role of the manager (such as managing director or production director) had no resemblance to what the manager was actually regulating. In Company B the managing director was actually carrying out the role of the installation manager, and the production manager of Company F was only regulating one aspect of production, inspection and packaging, and not the whole of production. .The manager defined his task by the series of activities he carried out and involved himself in, and by giving closure to particular organisational transformations. Clearly the managing director of Company B saw his task as one to get involved in the operational aspects of the installation activity and not to manage and monitor the activities of the major divisions, even though his role was clearly established within the company as being the latter.

It was the initial purpose of this study to examine the various strategies used by managers to handle the complexities implied by their tasks. It was perceived by the author very early on that cognitive style might have an effect on these strategies. This hypothesis was confirmed with respect to the sample. It was shown in Chapter Five that there existed two major cognitive styles in the six organisations where the managers were tested. These two styles, sensation-thinking and intuitive-thinking, accounted for 94.4% of the sample. These two styles represented two differing approaches, quite often polar opposites, in variety engineering.

The first style of managers, sensation-thinking (ST), which will be referred to as the logical style, quite often saw their tasks (in terms of activities and operations) as being very much fixed. That is to say they had a very much fixed view of homeostasis. They clearly set boundaries

on their tasks and set out criteria of stability which they sought to maintain. They perceived little change with respect to their working environments and quite often strived to maintain their particular working modes or method of operation. The logical types perceived that control of the task is better achieved by getting closer to the actual operations, and thus were often found to operate at the implementation level. That is, logical types attempted to shorten the communication lines between them and the actual technological operations. In so doing they collapsed their role, to operate at a lower recursion level. An example of this process is when a managing director collapses his role to take on the role of his production manager. In Company A the managing director, a logical type, collapsed his role to that of his production manager, forcing this manager to take on a materials management role. Quite often when the subordinate manager has had his role taken over, and he himself is a logical type, he will then attempt to collapse his role to take over the role of his subordinate. So what happens in some organisation structures is a cascading effect. Given that there is a limit to this cascading affect, what inevitably happens in some organisations is a reduction in the levels of hierarchy, thus bringing senior directors and managers into areas of operational control that they should not be managing. An example of this is the management of the two plant's technological operations in Company F. The exception to this rule, and where the structure of the system becomes extremely important, are those managers who operate in a staff position or who are in control of a support unit, such as an accounting department or a sales department, and who quite often did not have subordinate managers. These managers collapse their role to the extent that they carry out physically the implementation of the task themselves. So that a sales manager takes on the salesman role, and the financial director carries out the bookkeeping function himself, instead of attempting to regulate the activities of the personnel and the department of their concern.

The aspect of involvement in the operational details severely limited the capacity of the logical type managers to think about system four, intelligence, activities. In fact when interviewing the logical types, they constantly stressed the fact that their job was to deal with what was happening at that moment, and that they had little time to think about where the company was heading or what the company should be doing a year later. Planning for the logical type managers was in terms of short term, usually less than three months.

In most cases it was found that logical type managers severely limited the autonomy of their subordinate managers. If we were to agree that managers should have the objective to make the policies of a system viable, by giving discretion to sub-systems to carry out particular areas of policy, then surely logical type managers are restricting the autonomy of their subordinates. In so doing they limit the viability of the system that they are trying to control.

Logical type managers seemed to have a greater need for details on operational aspects than other types. Having recognised this after a number of interviews, the author sought from one manager the answer to why he was collapsing his role and limiting the autonomy of his subordinates. His reply was:

> "I can control it much better that way and point the managers where they are going wrong and teach them where they should be looking, rather than relying on them.... I get the picture, and not the picture people want to present to me. I think if you are dealing with one set of people they get used to you. It's a picture that they see of what's going on on the shopfloor, and unless you go and talk to the people on the shopfloor, and get to talk to the people who work for the managers, you can get different aspects arising. You can get a broader picture. You have to be careful about which picture is coming across and what to do about it."

This statement for the author implies two important points. The first is that logical type managers perceive a great need to monitor. That is they attempt to validate the reports that they are receiving from their subordinate managers by talking to their subordinate's subordinates. However the extent of their monitoring is such that it is not sporadic but rather continuous, to such an extent that a collapsing effect emerges. The second is that logical type managers appear

not to accept other viewpoints concerning the state of the situation. Stafford Beer's model, the author believes, is built on the acceptance of other viewpoints while at the same time monitoring to determine if that viewpoint is a reflection of what is really going on. The author would thus argue that the fundamental strategies used by logical managers, in handling the complexity of their situation, is in conflict with Stafford Beer's democratic notion and acceptance of other people's viewpoint (that is implied by the structure of his model).

The second style of managers, intuition-thinking (NT), which will be referred to as the intuitive style, quite often saw their tasks as ones of constant change. Their criteria of stability was constantly modified, changed as deemed necessary to bring it in line with the operational environment they were operating in. That is, their mental models of their situation appeared very flexible. They did not appear to impose their models on the situation but rather allowed them to be modified by the circumstances of the situation they were tackling at a particular point in time. Evidence of this was in the way they were coordinating particular operations. The logical types quite often set very clear guidelines and rules to coordinate activities, while the intuitive types quite often used committee discussions to handle the coordination of activities. In these committee discussions they made their decisions based on a case by case approach. The intuitive types also perceived that control of the task is better achieved by distancing themselves away from the actual operations. That is, intuitive types maintained the communication lines and did not shorten them by collapsing their roles. They gave adequate autonomy to their subordinates to carry out their function. Typical of the operating mode of the intuitive type is the technical director of Company F who gave sufficient autonomy to his maintenance and safety managers to carry out their activities, with as little interference as possible, while at the same time monitoring their performance, even though not very effectively. Intuitive types wanted to distance themselves

from the people actually implementing the activities or operations. The number and type of reports that intuitive types required were few and far less detailed, and their concentration was on trends rather than raw statistical data (commonly attributed to the needs of the logical type managers).

By distancing themselves away from the implementation of the operations, intuitive types had greater amount of time to concentrate on system four, intelligence, activities. They appeared to be exploring new ideas, new technologies and new strategies to cope with the constantly changing state of the environment. They saw the possibility of planning for the long-term, usually one to five years, and appeared to enjoy working on aspects where the rules were not sharp and not so clear-cut.

The investigation carried out in the three companies confirmed that managers work in a situation where there are no clear or well defined objectives. Managers need to interact with other members of the organisation to help them recognise what needs to be carried out. It is through interpersonal contacts and cooperation with other members that the manager gathered his information, worked out his ideas, got a feel for the other members' concerns, and clarified at least on the short term what he needed to do. It is through these interactions that the manager gained an understanding of what was going well and what problems existed, in real time. The manager gained through the interactions an understanding of the relevant courses of action and the other members' direction in solving particular problems, and facilitated the process of putting across his ideas and seeing how others react to them. The manager also used these interactions to amplify his ideas by stimulating, creating interest, and getting the support of his peers and superiors. Managers communicated with other members to facilitate the carrying out of their task. In so doing they quite often cut across formal communication lines.

Managers, when attempting to communicate with staff or shopfloor

personnel not under their control, always approached the manager in charge of the unit or sub-unit before directly approaching that manager's subordinates. When there was a conflict of direction for the subordinate, the manager withdrew his directive to discuss the situation with that subordinate's superior. This was done for two reasons. The first reason is that managers quite often did not understand the full complexity of the unit they approached, it was to them a black box. In approaching the unit their aim was to effect a change in that unit's output and not to interfere in the method by which it produces that output. If they perceived their interference would drastically affect the regulation of that unit then support must first be obtained from the unit's manager (whom, he assumed, fully understood the complexity of the situation) so as to minimise the disturbances. The second reason was because managers did not want to undermine the authority or directives of the unit's manager to ensure future cooperation.

6.3   Implications Of The Findings

In dealing with the implications of the findings, the author in this section of the study is going to tackle the analysis from the perspective of two viewpoints. The first is the implication of the findings to the users, in this case the three organisations that received reports on the cybernetics of their organisations. The second is the implication of the findings with respect to the theory of managers and management in general.

The power of the model that was used both to collect the data and analyse it, can best be exemplified by the reaction of the managers who received a report on the cybernetics of their organisation. The findings seemed to support their intuitive understanding of their organisation, while highlighting to them the underlying reasons why certain problems occurred. Their initial surprise was the fact that the report accurately reflected what was going on, while at the same

time highlighting the mechanisms that were in operation. Some managers, who had worked for their organisations for many years, recognised that particular problems occurred, but could not understand why they did. It was partly by reading the report that they began to understand why. Many of the recommendations produced in the reports were subsequently adopted. This fact should not be dismissed lightly, for it implies that Beer's viable system model not only gives the researcher an accurate and valid measure for the study of organisations, but that the results achieved could well be adopted to affect a change in those very organisations.

With respect to the implications of the findings for the theory of managers and management there are three major points. The first, if the results can be further substantiated by future researchers in this area, is the importance of recognising that cognitive style is a major and important variable when attempting to study the strategies used by managers in handling variety. This variable is too often ignored by researchers.

The second point is that normative recommendations can be made for the effective placement of individual managers in an organisation if adequate information is provided on the cybernetics of the organisation and the cognitive style of the manager. The evidence seems to support that some cognitive styles are more effective in particular structural positions than others.

The third point is that Beer's model of the viable system, coupled with some of the tools described in earlier chapters, offers a valuable framework for the study of not only how organisations operate, but also at the micro level how the managers themselves operate. This is extremely important because management research, the author believes, lacks such a framework. A framework that can handle the complexity that is implied by the managerial situation at both the abstract and concrete levels, while at the same time offering a valuable alternative and structure that can both improve the effectiveness of the organisation and the managers contained within it.

CHAPTER SEVEN

CONCLUSIONS OF THE STUDY

This study set out to investigate empirically the interaction "manager-task" using a human information processing approach. Specifically it focused on trying to understand how managers handle the complexity implied by the tasks of their concern. In short its focus was in trying to isolate the various strategies used by managers when operating in their organisations. A literature review was carried out to shed light on this area of study. The literature review revealed, that researchers lacked a strong framework to analyse the area of how managers operate adequately, that researchers often ignored the cognitive style variable in their analysis, and that a new approach was required to handle the complexities of the area under study comprehensively. The basis for the new approach was found in the numerous works of two notable management cyberneticians, Stafford Beer and Raul Espejo, and specifically in their work on the Viable System Model.

A model was created to bring together many ideas from a number of authors, and which relied to a considerable extent on Stafford Beer's conceptualisation of management (that management is the profession of regulation). The model highlighted the need to look at the manager's interpersonal communication system, the manager's system for controlling and regulating distant transformations, and the manager's system for receiving information on and monitoring of the distant transformations. It also highlighted the need to examine the effect cognitive style has on the three above systems, and to examine the manager's fit within the organisation. As a method to examine the manager's three systems, a number of tools and instruments were developed to analyse the manager's method of operation. A computer program based on the work of Raul Espejo in the area of viability planning, was written to make feasible the analysis of organisational data. Carl Jung's theory of psychological types formed the basis

of the method to examine the manager's cognitive style. Specifically, the Myers-Briggs Type Indicator was used as a questionnaire to implement his theory of types. As a method to examine the manager's fit within an organisation, it was decided to use two anxiety/strain instruments, the State-Trait Anxiety Inventory and the Personal Strain Questionnaire as a way of gaining from the manager's point of view his "fit" within the organisation.

Many organisations in the area of the West Midlands (England) were approached for permission to carry out empirical research and to test the model. Altogether six organisations decided to participate. Of the six in only three a full cybernetic analysis was carried out and their managers interviewed. The other three agreed only to participate in the response to the questionnaires on cognitive style and anxiety/strain. Altogether some eighty-two managers participated in one form or another in the study. Data on the organisations and the managers was analysed using a variety of methods. The results obtained point to the following general conclusions.

(1) Stafford Beer's conceptualisation of management and his Viable System Model offer a powerful framework for the study of organisations and the manager-task interaction. Beer's Viable System Model gives meaning and appreciation to what the manager is actually carrying out.

(2) Cognitive style appears to be an important variable when analysing the strategies used by managers, in handling the complexity implied by the tasks of their concern.

(3) The manager's task is not independent of the manager, but rather it is the manager who defines the task. The manager does this by the

series of activities he carries out, and the activities he gets involved in, and by giving closure to particular organisational transformations.

(4)   It is possible to make normative recommendations concerning the structural placement of individual managers in an organisation, if sufficient knowledge exists concerning the cybernetics of that organisation and the cognitive style of the manager.

(5)   Many forms of managerial cognitive strain can be explained by the lack of fit between the manager's operating mode and needs, and the structural position (in cybernetic terms) he is operating in.

The results also appear to show the following specific conclusions:

(1)   It is the perception and the expectations of other organisational members that define the role of a manager in a particular organisation.   This role is not fixed.   It changes with time, as expectations change and as new problems are encountered. As long as the manager gives closure to particular problems and information loops, he inevitably continues to reinforce particular aspects of his role.

(2)   Managers work in a situation where there are no clear or well defined objectives.

(3)   It is through interpersonal contacts and cooperation with other members that the manager gathered his information, worked out his ideas, got a feel for the other member's concerns, and clarified at

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least on the short term what he needed to do. The manager uses these interactions to amplify his ideas, by stimulating, creating interest, and getting the support of his peers and superiors.

(4)   Two managerial styles (as defined by the Myers-Briggs Type Indicator) Sensation-Thinking and Intuitive-Thinking appear to represent the majority of cognitive styles in organisations. These two styles represented two different approaches, quite often polar opposites, to organisational variety engineering.

CHAPTER EIGHT

RECOMMENDATIONS FOR FUTURE WORK

There are five recommendations that can be made to other management scholars wishing to undertake similar research. These recommendations are based on an understanding of what has been carried out and on some of the perceived weaknesses of the study. They are put forward in the hope that other researchers will want to research further aspects of the research done by the author.

(a)   The Myers-Briggs Type Indicator was found to be an effective instrument in determining the cognitive style of managers, moreover there is a substantial body of literature centered around this instrument. Further research using this instrument should help to add to the corpus of theory on the cognitive style of managers.

(b)   The findings of this research study show that there is a dominance of two cognitive styles, sensation-thinking and intuitive-thinking, in business organisations. However, further research in this area is needed to substantiate these findings. If these findings are confirmed then greater efforts would be necessary in the understanding of only these two styles.

(c)   The framework that has been used in this study, which relies to a considerable extent on Stafford Beer's Viable System Model (VSM), was found to be powerful and effective to study the interaction "manager-task". Effective from the standpoint that it enables the researcher to examine in some detail the managerial situation at multiple recursive levels in an organisation. Powerful in that it enables the study of a particular manager within his immediate organisational environment, while at the same time it also enables the researcher to examine the effect of the manager's actions on his peers and subordinates. Indeed, the VSM also allows for appreciation of the actions of an individual

manager within the organisational context, because unlike many models commonly found in the management literature, the VSM allows the analysis of individual actions without losing sight of the overall mechanisms of adaptation and control of the whole organisation. If anything the three case studies enforce the importance of the individual manager, and highlight the actions and strategies used by managers with respect to the future viability of their organisation. However, the conclusions regarding the operating modes of managers in an organisation need to be substantiated by further research in this area.

(d)   A better measure of "fit" is needed than the one used in this study. The use of anxiety/strain instruments to capture how a particular manager perceives his fit in his organisation is one way, but it would be better to have a new measure that is independent of the perceptions of the manager. Such a new measure could possibly look at measuring how the manager's actions, with respect to his task(s), contribute to the overall viability of the organisation.

(e)   The above recommendation depends to a larger extent on the measurement of complexity. Greater efforts are required to develop instruments than can make feasible the collection of organisational and managerial data. With the increasing availability of micro-computers and fifth generation computer software, capable of handling large amounts of data, this kind of measurement becomes a real possibility. It would seem necessary for future scholars to develop computer programs that not only capture the necessary data but also analyse it in an expert fashion.

APPENDIX A

MANAGER-TASK ANALYSIS INSTRUMENT

MANAGER-TASK ANALYSIS INSTRUMENT

INTERVIEW SCHEDULE

PREPARED AT THE UNIVERSITY OF ASTON IN BIRMINGHAM

INFORMATION MANAGEMENT DIVISION MANAGEMENT CENTRE

MARCH 1985

INTRODUCTION

This "Interview Schedule" is divided into two sections. The first section consists of questions to ask the interviewee with the specific objective of gathering data to capture the way a manager perceives his/her job. The questions are listed under three different parts. These are:

Part One   .....   The manager's interpersonal interactions with organisational members and others.

Part Two   .....   The manager's system for controlling and regulating the distant transformations.

Part Three   .....   The manager's sytems for receiving information on and monitoring of the distant transformations.

Each area has specific questions that tackle the capturing of data for its own particular system.

The second section has been designed with the specific purpose of facilitating the process of recording and analysing the data for the researcher. Each system area answer is recorded in its allocated space enabling the researcher quick and easy access to relevant data without him/her having to go back to the interview notes.

QUESTIONS TO ASK INTERVIEWEE

PART ONE .....   MANAGER'S INTERPERSONAL COMMUNICATION SYSTEM
WITH ORGANISATIONAL MEMBERS AND CUSTOMERS

---

(1)   Who do you see, both within this organisation and external to it, as being in
your view fundamental to your job in helping to understand what is it that
is required of you, and as to what needs to be carried out in your particular
entity?

Answer = Establishing from the manager's perspective who are the
relevant people and who is in his immediate sphere of interactions.

(2)   How do you influence or communicate with your superior? For example, do
you approach him personally or by exerting some kind of group pressure on
him? What exactly is the method you use to communicate with him?

Answer = "Superior". Establishing the manager's communication system
or interpersonal interaction with his superior(s).

(3)   How extensive is the relationship that you have with your peer(s) and how
do you go about influencing them or getting them to carry out particular
actions that are necessary for the efficient and effective development of
your entity?

Answer = "Peer(s)". Establishing the extent of the manager's
interpersonal interactions with his peers and their subordinates and the
communication system that he has established with them.

(4) For those persons who are the recipients of or benefit from the work that you carry out, what is the method they use to influence the way you carry out your work and what method do you use to communicate with them? How do you go about recognizing if they are satisfied with the product/service that you have produced?

Answer = "Beneficiary". Establishing the manager's interpersonal interactions and communication system with the beneficiaries of his transformation process.

(5) How do you go about interacting with the suppliers ? What system have you established in communicating with them, and what method do they use in influencing the way you carry out your activities?

Answer = "Supplier". Establishing the manager's interpersonal interactions with the suppliers and what communication system he uses to communicate with them.

PART TWO ..... THE MANAGER'S SYSTEM FOR CONTROLLING AND
REGULATING THE DISTANT TRANSFORMATIONS

---

(1)   How do you keep control over the activities that you are responsible for?
Do you think that you maintain adequate control of your personnel and
resources?

Answer = Establishing the manager's perception of his control relationship
vis-a-vis his entity.

(2)   How do you negotiate the allocation of resources to the personnel that you
are responsible for? Is there some kind of overall organistional plan that
guides you or is it something that you have worked out by yourself?

Answer = "Control & Regulation System". The manager establishes the
method he uses in establishing guidelines that control and regulate the
distant transformations.

(3)   To what extent do you take into consideration the views of other
organisational members such as your peers and superiors when drawing up
rules and procedures? And to what extent are your subordinates involved in
this process?

Answer = "Role". Establishing the extent of involvement by external
members (peers and superiors) in shaping the way the manager controls and
regulates his sytem.

(4)   What method do you use in conveying guidelines, rules and procedures to your subordinates. For example is it done by memos or at the weekly departmental meeting? Can you please clarify.

Answer = Establishing the manager's system for conveying control procedures and the communication system he is using.

PART THREE .....THE MANAGER'S SYSTEM FOR RECEIVING INFORMATION ON AND MONITORING OF THE DISTANT TRANSFORMATIONS

---

(1)   With reference to the activities that you are responsible for, what reports do you receive on them and what information value do you obtain from them to enable you to recognize the level of performance that is being carried out in these activities?

Answer = "Reports". Manager defines the nature of the reports he receives.

(2)   How often do you receive these reports, from where do they originate and by what method are they communicated to you?

Answer = "Reporting Procedure Or Information System". Manager defines the reporting procedure and information system he is using.

(3)   Are these reports concerned with a particular activity or a number of activities? Can you clarify which activities do these reports concern.

Answer = "Distant Transformations". Manager defines the distant transformations that the reporting procedure is providing information on.

(4)   How do you know, that the reports are a true reflection of what is really going on? Are there particular methods or procedures that you have adopted to validate the information that is contained in the reports?

Answer = "Monitoring System". Manager defines his method of validating the reports and thus leading to a further discussion of his monitoring loop.

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APPENDIX B
VIPLAN DATA SHEETS

[1]   NAME OF ORGANISATION

```
┌──────────────────────────────────────────────────────────────┐
│                                                              │
│                                                              │
│                                                              │
│                                                              │
└──────────────────────────────────────────────────────────────┘
```

[2]   NAME OF ORGANISATIONAL ENTITY

```
┌────────────────────────────────────────────┬──────────┐
│                                org-entity   │   code   │
│                                             │          │
│                                             │          │
└────────────────────────────────────────────┴──────────┘
```

                                    is-at-level-   has

[3]   ORGANISATIONAL ENTITY LEVEL

```
┌──────────────────────────────────────────────────────────┐
│                                org-entity-level           │
│                                                          │
└──────────────────────────────────────────────────────────┘
```

[4]   ORGANISATIONAL ENTITY HAS MAIN ROLE

```
┌──────────────────────────────────────────────────────────┐
│                                role                       │
│                                                          │
└──────────────────────────────────────────────────────────┘
```

[5]   ORGANISATIONAL ENTITIES BELONGING TO IT

```
┌────────────────────────────────────────────┬──────────┐
│                                org-entity   │   code   │
│                                             │          │
└────────────────────────────────────────────┴──────────┘
```

```
┌────────────────────────────────────────────┬──────────┐
│                                org-entity   │   code   │
│                                             │          │
└────────────────────────────────────────────┴──────────┘
```

ARE THERE ANY MORE ENTITIES   YES/NO

If Yes Continue Onto Next Sheet.

NAME OF ORGANISATIONAL ENTITY

	org-entity	code

has

	org-entity	code

	org-entity	code

	org-entity	code

	org-entity	code

	org-entity	code

ARE THERE ANY MORE ENTITIES   YES/NO

If Yes Continue Onto Next Sheet.

[1] NAME OF ROLE

	role	code

performs

[2] NAME OF ORGANISATIONAL ENTITY ROLE IS RESPONSIBLE FOR

	org-entity	code

[3] NAME OF ACTIVITIES PERFORMED BY ROLE

	activity	number

uses   provided-by   code

input	source

produces   received-by   code

output	destination

ARE THERE ANY MORE ACTIVITIES   YES/NO

If Yes Continue Onto Next Sheet

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---

activity	number

uses   provided-by   code

input	source

produces   received-by   code

output	destination

ARE THERE ANY MORE ACTIVITIES   YES/NO

If Yes Continue Onto Next Sheet.

[1]   NAME OF ROLE

	role code

[2]   ROLE PERCEIVES FUNCTIONS OF ORGANISATIONAL-ENTITY TO BE

	org-entity- number function
	perceives

uses   provided-by   code

input	source

produces   received-by   code

output	destination

ARE THERE ANY MORE ORGANISATIONAL ENTITY FUNCTIONS   YES/NO

If Yes Continue Onto Next Sheet.

```
                                          org-entity-        number
                                          function

        uses                    provided-by              code

        input                   source

        produces                received-by              code

        output                  destination
```

ARE THERE ANY MORE ORGANISATIONAL ENTITY FUNCTIONS   YES/NO

If Yes Continue Onto Next Sheet.

[1] NAME OF MANAGER OR ORGANISATIONAL ROLE

role   code
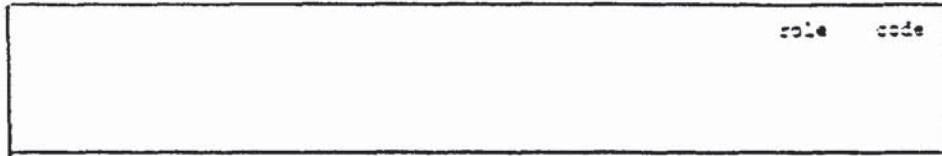
[2] MANAGER'S COMMUNICATION SYSTEM OR INTERPERSONAL
     INTERACTIONS WITH SUPERIOR(s)

communication
system or inter-
personal inter-
actions

has

with

belongs-to

superior(s)   org-entity

based-on

formal or
informal
communication
channels
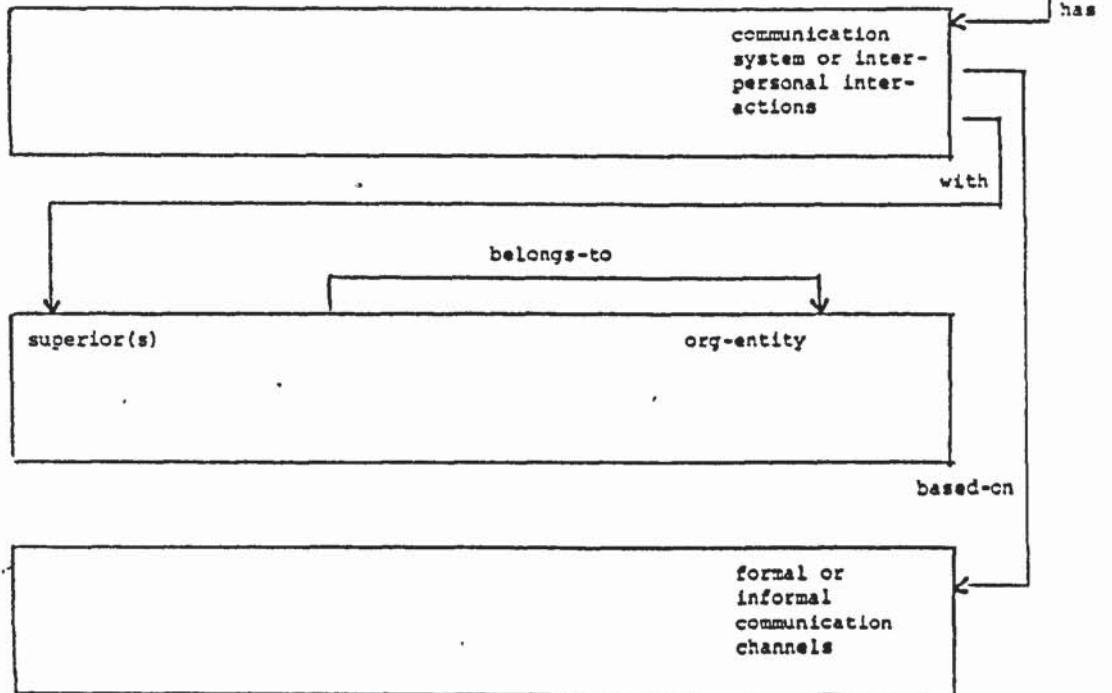
[3] MANAGER'S COMMUNICATION SYSTEM OR INTERPERSONAL
     INTERACTIONS WITH PEER(s)

communication
system or inter-
personal inter-
actions

129

with

belongs-to

peer(s)   org-entity

based-on

formal or
informal
communication
channels
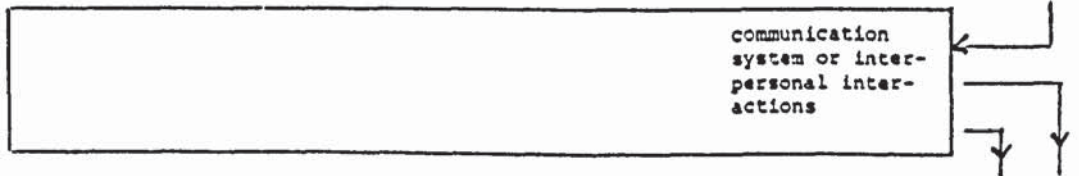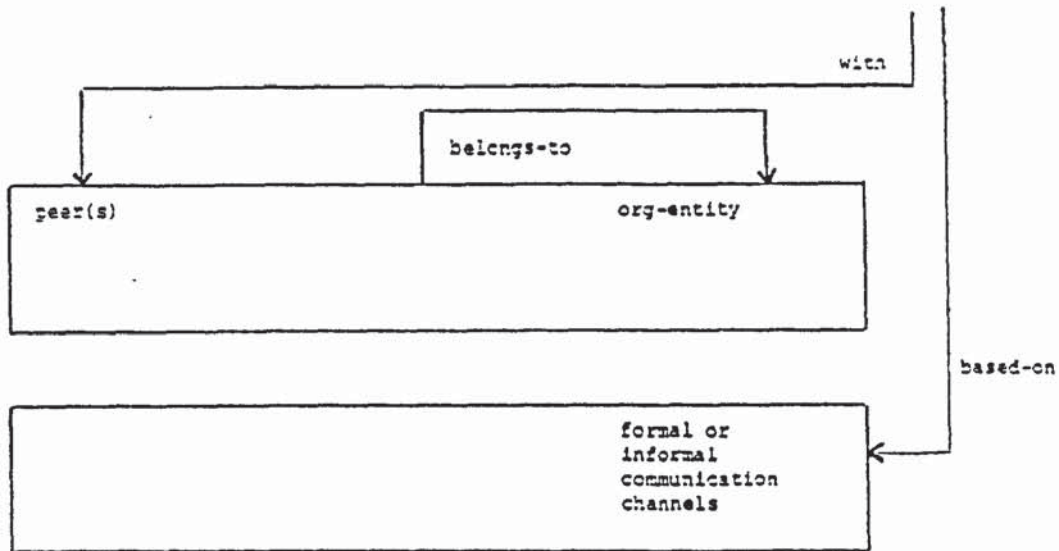
[4] MANAGER'S COMMUNICATION SYSTEM OR INTERPERSONAL
     INTERACTIONS WITH SUPPLIER(s)

communication
system or inter-
personal inter-
actions

with

is

supplier(s)   external or
                                           org-entity

based-on

provides   used-by

transformation

formal or
informal
communication
channels
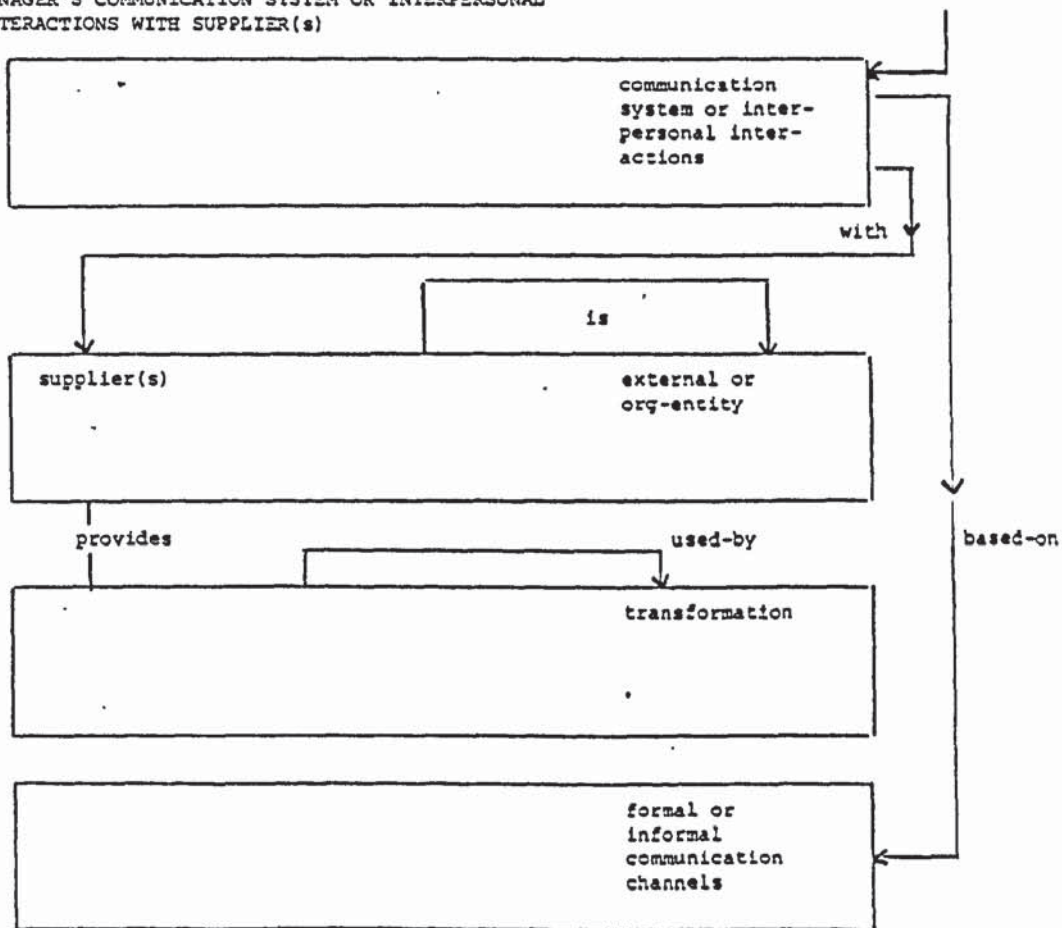
[5] MANAGER'S COMMUNICATION SYSTEM OR INTERPERSONAL
     INTERACTIONS WITH BENEFICIARY(s)
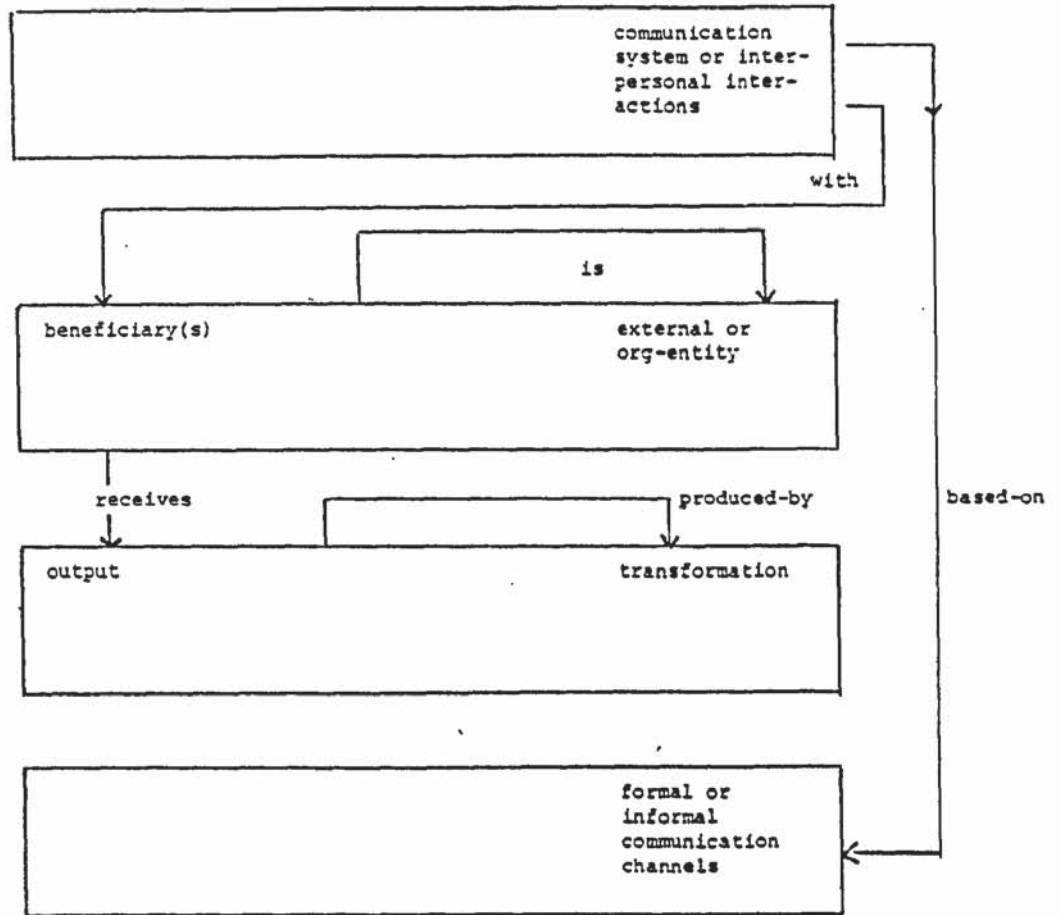
[1] NAME OF ROLE

```
┌─────────────────────────────────────────────────────────────┐
│                                                  role   code │
│                                                              │
│                                                              │
└─────────────────────────────────────────────────────────────┘
```
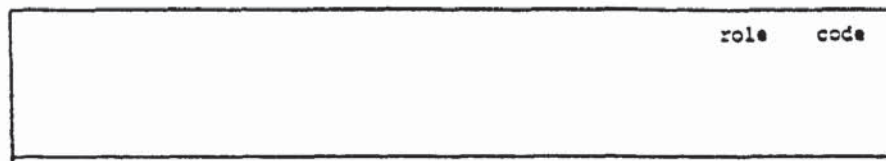
                                                              administers

[2] MANAGER'S CONTROL & REGULATION SYSTEM

```
┌─────────────────────────────────────────────────────────────┐
│                                              (manager's      │
│                                              method of)      │
│                                              controlling &   │
│                                              regulating      │
│                                              (the) system    │
└─────────────────────────────────────────────────────────────┘
```
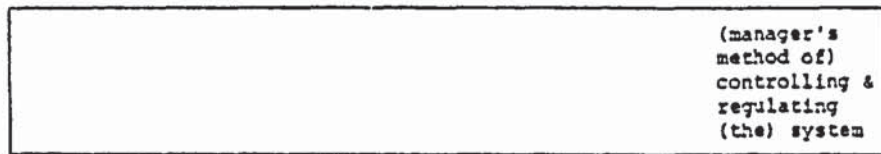
                                              involves participation-of
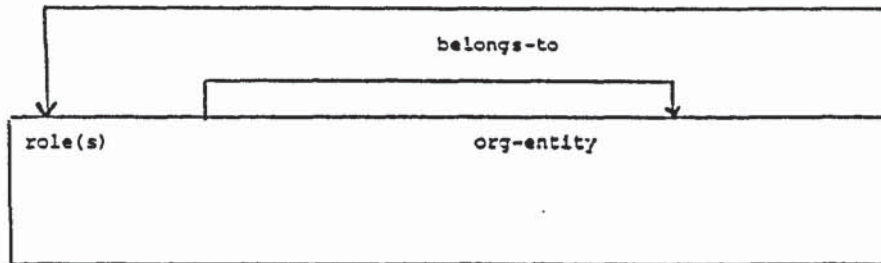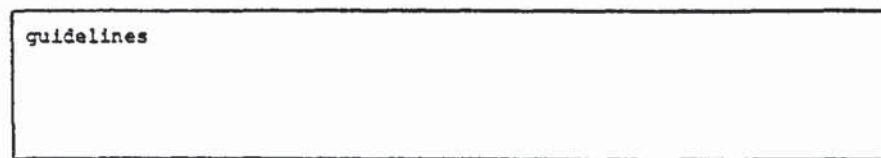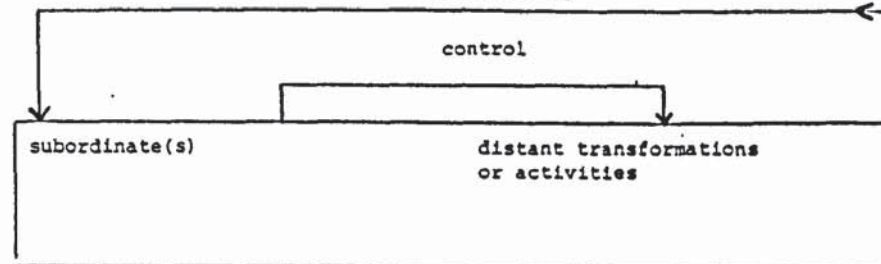
                              belongs-to   defines

```
┌─────────────────────────────────────────────────────────────┐
│  role(s)                    org-entity                       │
│                                                              │
│                                                              │
└─────────────────────────────────────────────────────────────┘
```

```
┌─────────────────────────────────────────────────────────────┐
│  guidelines                                                  │
│                                                              │
│                                                              │
└─────────────────────────────────────────────────────────────┘
```

                              received-by

                              control

```
┌─────────────────────────────────────────────────────────────┐
│  subordinate(s)             distant transformations          │
│                             or activities                    │
│                                                              │
└─────────────────────────────────────────────────────────────┘
```

[1] NAME OF ROLE

```
                                                        role    code
```

belongs-to

[2] NAME OF ORGANISATIONAL ENTITY ROLE
     IS RESPONSIBLE FOR

```
                                                        org-    code
                                                        entity
```

receives

[3] REPORTING AND MONITORING SYSTEMS

```
                                                        report(s)

                                                                        genera-
                                                                        ted-by
                                                        reporting
                                                        procedure or
                                                        information
                                                        system          proces-
                                                                        ses-info
                                                        distant         -on
                                                        transfor-
                                                        mations
                                                                        validated-
                                                                        by
                                                        monitoring
                                                        system                      uses

                                                        structural
                                                        level
                                                        monitored       determines
```

IF THERE ARE MORE REPORTS OR A DIFFERENT
SYSTEM CONTINUE ONTO NEXT SHEET

APPENDIX C
VIPLAN BASIC PROGRAM

```
1 KEY OFF
2 COLOR 3,4,9
100 LOA$ = " "
105 LCE$ = "(("
110 LOS$ = "))"
115 LCB$ = "infix"
120 LOC$ = "postfix"
125 LOD$ = "dict"
130 TA$ = "is-at-level-"
135 TB$ = "is-an"
140 TC$ = "has"
145 TD$ = "belongs-to"
150 TE$ = "org-entity"
155 TG$ = "perceives"
160 TH$ = "perceived-by"
165 TI$ = "uses"
170 TJ$ = "used-by"
175 TK$ = "provides"
180 TL$ = "provided-by"
185 TM$ = "produces"
190 TN$ = "produced-by"
195 TY$ = "receives"
200 TP$ = "received-by"
205 TQ$ = "performs"
210 TR$ = "performed-by"
215 TZZ$ = "controlled-by"
220 TS$ = "recognizes"
225 TT$ = "recognized-by"
230 TU$ = "entails"
235 TV$ = "entailed-by"
240 TW$ = "is-a"
245 TX$ = "technological-activity"
250 TZ$ = "main-role"
255 X = 1
260 CLS
265 LOCATE 4,35  : PRINT"WELCOME TO"
270 LOCATE 6,5  :PRINT"=============================================================
============"
275 LOCATE 9,5  :PRINT"VV    VV   IIIIIIII   PPPPPPP   LL           AAA
NN    NN"
280 LOCATE 10,5 :PRINT"VV    VV      II      PP    PP   LL          AA AA
NN    NN"
285 LOCATE 11,5 :PRINT"VV    VV      II      PP    PP   LL          AA   AA
NN    NN"
290 LOCATE 12,5 :PRINT"VV    VV      II      PPPPPPP   LL          AAAAAAAAA
NNN   NN"
295 LOCATE 13,5 :PRINT" V   V       II      PP        LL          AA    AA
NN N  NN"
300 LOCATE 14,5 :PRINT"  V V        II      PP        LL          AA    AA
NN  N NN"
305 LOCATE 15,5 :PRINT"   VV     IIIIIIII   PP        LLLLLLLL   AA    AA
NN   NNN"
310 LOCATE 18,5 :PRINT"=============================================================
==========="
315 LOCATE 20,12:PRINT"A CYBERNETIC MODEL FOR VIABILITY PLANNING BY RAUL ESPEJO"
```

```basic
320 IF Z = 5  GOTO 340
325 Z = X + 1
330 X = X + 1
335 GOTO 270
340 REM MAIN MENU
341 CLOSE #1
342 CLOSE #2
345 CLS
350 LOCATE 4,33 : PRINT "MAIN MENU"
355 LOCATE 5,33 : PRINT "_____"
360 LOCATE 7,15 : PRINT "[1] ENTERING DATA FOR ORGANISATIONAL DATA MODEL"
365 LOCATE 9,15 : PRINT "[2] ENTERING DATA FOR TECHNOLOGICAL  DATA MODEL"
370 LOCATE 11,15 : PRINT "[3] EXAMINE A DATA FILE OR PREPARE A PROLOG FILE"
375 LOCATE 13,15 : PRINT "[4] TO EXIT TO SYSTEM"
380 LOCATE 17,15 : PRINT "ENTER YOUR CHOICE HERE --->"
385 LOCATE 17,42
390 INPUT A$
395 IF A$ = "1" GOTO 425
400 IF A$ = "2" GOTO 3170
405 IF A$ = "3" GOTO 6615
410 IF A$ = "4" GOTO 6610
415 BEEP
420 GOTO 340
425 CLS
430 LOCATE 4,15 : PRINT "ENTERING DATA FOR ORGANISATIONAL DATA MODEL MENU"
435 LOCATE 5,15 : PRINT "_____"
440 LOCATE 7,15 : PRINT "[1] STRUCTURAL DIAGRAMS OF THE MODEL"
445 LOCATE 9,15 : PRINT "[2] TO BEGIN TO ENTER DATA FOR THE MODEL"
450 LOCATE 11,15: PRINT "[3] TO GO BACK TO MAIN MENU"
455 LOCATE 13,15: PRINT "[4] TO EXIT TO SYSTEM"
460 LOCATE 15,15: PRINT "[5] TO GO TO TECHNOLOGICAL MODEL"
465 LOCATE 19,15: PRINT "ENTER YOUR CHOICE HERE --->"
470 LOCATE 19,42
475 INPUT B$
480 IF B$ = "1" GOTO 515
485 IF B$ = "2" GOTO 860
490 IF B$ = "3" GOTO 340
495 IF B$ = "4" GOTO 6610
500 IF B$ = "5" GOTO 3170
505 BEEP
510 GOTO 425
515 CLS
520 REM STRUCTURAL DIAGRAMS OF THE ORGANISATIONAL DATA MODEL
525 LOCATE 4,22 : PRINT "STRUCTURAL DIAGRAMS OF THE MODEL"
530 LOCATE 5,8  : PRINT"                                   _____ has (belongs-to)
535 LOCATE 6,8  : PRINT"                                        |      |"
540 LOCATE 7,8  : PRINT"_____                       _____  |    _____"
545 LOCATE 8,8  : PRINT"|            |  is-at  |             |--  is  |  ,
     |"
550 LOCATE 9,8  : PRINT"|  org-   |<----------|    org-  |----------->|primary
     or|"
555 LOCATE 10,8 : PRINT"|  entity |---------->|   entity |<-----------|functio
     nal|"
```

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```
560 LOCATE 11,8 : PRINT"|  -level   |comprises-of|            |       :      | activi
ty |"
565 LOCATE 12,8 : PRINT"—————————        —————————————        ——————
———"
570 LOCATE 13,8 : PRINT"                              |     |"
575 LOCATE 14,8 : PRINT"                  controlled-by|     |belongs-to"
580 LOCATE 15,8 : PRINT"                              |     |"
585 LOCATE 16,8 : PRINT"                   —————————————————"
590 LOCATE 17,8 : PRINT"                  |              |"
595 LOCATE 18,8 : PRINT"                  |     role     |"
600 LOCATE 19,8 : PRINT"                  |              |"
605 LOCATE 20,8 : PRINT"                   —————————————————"
610 LOCATE 22,8 : PRINT"PRESS 1 TO CONTINUE TO NEXT DIAGRAM"
615 LOCATE 23,8 : PRINT"PRESS 2 TO EXIT TO MENU"
620 LOCATE 24,8 : PRINT"MAKE YOUR CHOICE HERE ——>"
625 LOCATE 23,36
630 INPUT CS
635 IF CS = "1" GOTO 655
640 IF CS = "2" GOTO 425
645 BEEP
650 GOTO 515
655 CLS
660 LOCATE 4,8 : PRINT"ACTIVITIES THAT ARE PERFORMED BY MANAGERIAL/SUPERVISORY R
OLES"
665 XX = 1
670 LOCATE 6,8 : PRINT"                   —————————————————"
675 LOCATE 7,8 : PRINT"                  |     role     |"
680 LOCATE 8,8 : PRINT"                   —————————————————"
685 IF XX = 2 GOTO 820
690 LOCATE 9,8 : PRINT"                  performs |   | performed-by"
695 LOCATE 10,8: PRINT"————————— uses    ————————— produces    ——————
———"
700 LOCATE 11,8: PRINT"| Input    |<—————————| activity |—————————>| outpu
t  |"
705 LOCATE 12,8: PRINT"|          |—————————>|          |<—————————|
  |"
710 LOCATE 13,8: PRINT"————————— used-by    ————————————produced-by ————————
———"
715 LOCATE 14,8:PRINT"prov|  |provides    |s|  | :        receives|  |
rece"
720 LOCATE 15,8:PRINT"ided|  |            |  |  |                  |  |
ived"
725 LOCATE 16,8:PRINT"-by |  |            |  |  |                  |  |
-by "
730 LOCATE 17,8:PRINT"—————————          ————————————        ——————
———"
735 LOCATE 18,8:PRINT"|          |        |primary or|        | desti-
|"
740 LOCATE 19,8:PRINT"|  source  |        |functional|        | nation
|"
745 LOCATE 20,8:PRINT"|          |        | activity |        |
|"
750 LOCATE 21,8:PRINT"—————————          ————————————        ——————
———"
755 IF XX = 2 GOTO 830
```

```
760 LOCATE 23,5:PRINT"ENTER 1 TO CONTINUE & 2 TO EXIT TO MENU"
765 LOCATE 24,5:PRINT"ENTER YOUR CHOICE HERE ————————————>"
770 LOCATE 23,43
775 INPUT D$
780 IF D$ = "1" GOTO 800
785 IF D$ = "2" GOTO 425
790 BEEP
795 GOTO 655
800 CLS
805 LOCATE 4,5 : PRINT"ORGANISATIONAL ENTITY FUNCTIONS PERCEIVED BY MANAGERIAL/S
UPERVISORY ROLES"
810 XX = 2
815 GOTO 670
820 LOCATE 9,8 : PRINT"                          perceives |  | perceived-by"
825 GOTO 695
830 LOCATE 23,5:PRINT"THERE ARE NO MORE DIAGRAMS ——— PRESS 1 TO EXIT TO MENU"
835 LOCATE 23,61
840 INPUT E$
845 IF E$ = "1" GOTO  425
850 BEEP
855 GOTO 800
860 CLS
865 LOCATE 4,15 :PRINT "GIVE ME 1 - 5 CHARACTERS"
870 LOCATE 5,15 :PRINT "TO NAME YOUR NEW COM DATA FILE"
875 LOCATE 6,15 :PRINT "FOR EXAMPLE: TYPE ——>TEST"
880 LOCATE 14,1:PRINT "THE FILES YOU ALREADY HAVE ARE LISTED BELOW:":FILES
885 LOCATE 15,1 :PRINT "——————————————————————————————————————————————"
890 LOCATE 8,15 :PRINT "ENTER HERE THE NAME ———————>"
895 LOCATE 8,43 : INPUT INFILE$
900 CLOSE #1:OPEN INFILE$ FOR APPEND AS #1 LEN=256
905 CLS
910 REM BEGIN TO ENTER DATA FOR ORGANISATIONAL DATA MODEL
915 LOCATE 6,10: PRINT"BEGIN TO ENTER DATA FOR ORGANISATIONAL DATA MODEL MENU"
920 LOCATE 8,15: PRINT"[1] ENTERING ORGANISATIONAL ENTITY HIERARCHY"
925 LOCATE 10,15:PRINT"[2] ENTERING WHAT MANAGER/SUPERVISOR PERCEIVES"
930 LOCATE 12,15:PRINT"[3] ENTERING WHAT MANAGER/SUPERVISOR PERFORMS"
935 LOCATE 14,15: PRINT"[4] TO GO BACK TO ORGANISATIONAL DATA MODEL MENU"
940 LOCATE 16,15: PRINT"[5] TO GO BACK TO MAIN MENU"
945 LOCATE 18,15: PRINT"[6] TO EXIT TO SYSTEM"
950 LOCATE 21,15: PRINT"ENTER YOUR CHOICE HERE ——>".
955 LOCATE 21,42
960 INPUT F$
965 IF F$ = "1" GOTO 1005
970 IF F$ = "2" GOTO 1375
975 IF F$ = "3" GOTO 2275
980 IF F$ = "4" GOTO 425
985 IF F$ = "5" GOTO 340
990 IF F$ = "6" GOTO 6610
995 BEEP
1000 GOTO 905
1005 CLS
1010 LOCATE 4,22  : PRINT "ENTERING ORGANISATIONAL ENTITY HIERARCHY"
1015 LOCATE 5,22  : PRINT "——————————————————————————————————————————"
1020 LOCATE 7,5   : PRINT "EACH TIME YOU ENTER THE DATA IT WILL BE LISTED FOR YO
U IN PROLOG FORM"
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1025 LOCATE 8,5    : PRINT "YOU CAN THEN DECIDE IF THAT IS THE WAY YOU WISH THE D
ATA TO BE ENTERED"
1030 LOCATE 9,5    : PRINT "IMPORTANT: NOTE THAT NO RECORD CAN BE MORE THAN TWENT
Y CHARACTERS LONG"
1031 LOCATE 10,5   : PRINT "AND MAKE SURE THAT CAPITAL LETTERS ARE NOT USED WHEN
ENTERING THE DATA"
1035 IF ZX = 1 GOTO 1040
1040 LOCATE 12,54 : PRINT "_____"
1045 LOCATE 13,5  : PRINT "NAME OF ORGANISATIONAL ENTITY :                    !
                   !"
1050 LOCATE 14,54 : PRINT "_____"
1055 LOCATE 15,5  : PRINT "WHICH ORGANISATIONAL LEVEL IS ENTITY AT    :        !
                   !"
1060 LOCATE 16,54 : PRINT "_____"
1065 LOCATE 17,5  : PRINT "WHAT MAIN ROLE DOES THE ENTITY HAVE :              !
                   !"
1070 LOCATE 18,54 : PRINT "_____"
1075 LOCATE 21,30 : PRINT "MORE QUESTIONS TO COME"
1080 IF ZX = 1 GOTO 1085
1085 LOCATE 13,52
1090 INPUT AB$
1095 LOCATE 15,52
1100 INPUT AC$
1105 LOCATE 17,52
1110 INPUT AD$
1115 CLS
1120 LOCATE 4,10 : PRINT "THE ORGANISATIONAL ENTITY HIERARCHY THAT HAS BEEN ENTE
RED"
1125 IF ZX = 1 GOTO 1130
1130 LOCATE 9,10 : PRINT AB$ " is-at level-"AC$
1135 LOCATE 10,10 : PRINT AD$ " is-a main role"
1140 LOCATE 11,10 : PRINT AB$ " is-an org-entity"
1145 LOCATE 12,10 : PRINT AB$ " controlled-by "AD$
1150 LOCATE 13,10 : PRINT AD$    " belongs-to "AB$
1155 LOCATE 20,2  : PRINT "TO CONTINUE TO ENTER DATA FOR THIS ENTITY PRESS 1"
1160 LOCATE 21,2  : PRINT "TO CHANGE THE ABOVE AND TO REENTER THE DATA PRESS 2"
1165 LOCATE 22,2  : PRINT "IF THE ABOVE ENTITY HAS NO SUB-ENTITIES BUT THERE ARE
 MORE ENTITIES PRESS 3"
1170 LOCATE 23,2  : PRINT "IF YOU WISH TO GO BACK TO THE MENU WITHOUT ENTERING T
HE ABOVE DATA  PRESS 4"
1175 LOCATE 24,2  : PRINT "IF YOU WISH TO GO BACK TO THE MENU AND THE ABOVE ENTE
RED AND SAVED  PRESS 5"
1180 LOCATE 17,2  : PRINT "ENTER YOUR CHOICE HERE ---->"
1185 LOCATE 17,30
1190 INPUT AE$
1195 ZX = 1
1200 IF AE$ = "1" GOTO 4765
1205 IF AE$ = "2" GOTO 1005
1210 IF AE$ = "3" GOTO 4770
1215 IF AE$ = "4" GOTO 905
1220 IF AE$ = "5" GOTO 4775
1225 BEEP
1230 GOTO 1115
1235 CLS
1240 LOCATE 2,2   : PRINT "WHEN YOU FINISH ENTERING THE DATA THE SYSTEM WILL DISP
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LAY THE PROLOG FORM AND"
1245 LOCATE 3,2  : PRINT "THEN BEGINS TO ASK YOU A NUMBER OF QUESTIONS CONCERNIN
G THE REST OF THE DATA|"
1250 LOCATE 6,10 : PRINT "WHAT ORGANISATIONAL SUB-ENTITIES BELONG TO "AB$
1255 LOCATE 8,25 : PRINT "_____"
1260 LOCATE 9,24 : PRINT "|                   |"
1265 LOCATE 10,25: PRINT "_____"
1270 LOCATE 9,24
1275 INPUT AF$
1280 LOCATE 12,24: PRINT AB$ " has "AF$
1285 LOCATE 13,24: PRINT AF$ " belongs-to "AB$
1290 LOCATE 14,24: PRINT AF$ " is-an org-entity"
1295 LOCATE 16,10: PRINT "ENTER YOUR CHOICE HERE ---->"
1300 LOCATE 18,1 : PRINT "ENTER 1 IF ABOVE IS CORRECT AND THERE ARE MORE SUB-ENT
ITIES"
1305 LOCATE 22,1 : PRINT "ENTER 5 IF ABOVE IS CORRECT AND THERE ARE 'NO' MORE SU
B-ENTITIES BUT THERE ARE"
1310 LOCATE 23,12: PRINT "MORE ENTITIES TO BE ENTERED"
1315 LOCATE 20,1 : PRINT "ENTER 3 IF THE ABOVE IS NOT CORRECT AND YOU WISH TO RE
ENTER THE DATA"
1320 LOCATE 21,1 : PRINT "ENTER 4 IF ABOVE IS NOT CORRECT AND YOU WISH TO EXIT T
O MENU WITHOUT SAVING IT"
1325 LOCATE 19,1 : PRINT "ENTER 2 IF ABOVE IS CORRECT AND YOU WISH TO EXIT TO ME
NU"
1330 LOCATE 16,39
1335 INPUT AG$
1340 IF AG$ = "1" GOTO 4820
1345 IF AG$ = "2" GOTO 4825
1350 IF AG$ = "3" GOTO 1235
1355 IF AG$ = "4" GOTO 905
1360 IF AG$ = "5" GOTO 4830
1365 BEEP
1370 GOTO 1235
1375 REM ENTERING WHAT MANAGER/SUPERVISOR PERCEIVES
1380 IF PE$ = "2" GOTO 1400
1385 CLS
1390 LOCATE 2,49 : PRINT "_____"
1395 LOCATE 3,1  : PRINT "NAME OF MAIN ROLE -----------------------> |
     |"
1400 LOCATE  4,49: PRINT "_____"
1405 LOCATE  5,1 : PRINT "WHAT ORG-ENTITY-FUNCTION DOES HE/SHE PERCEIVE  |
     |"
1410 LOCATE  6,49: PRINT "_____"
1415 LOCATE  7,1 : PRINT "WHAT INPUT DOES THE ORG-ENTITY-FUNCTION USE --> |
     |"
1420 LOCATE  8,49: PRINT "_____"
1425 LOCATE  9,1 : PRINT "IS THIS THE ONLY INPUT (y OR n)
   | |"
1430 LOCATE 10,49: PRINT "_____"
1435 LOCATE 11,1 : PRINT "WHAT SOURCE PROVIDES THE ABOVE INPUT ---------> |
     |"
1440 LOCATE 12,49: PRINT "_____"
1445 LOCATE 13,1 : PRINT "IS THIS THE ONLY SOURCE FOR THE INPUT (y OR n)
   | |"
1450 LOCATE 14,49: PRINT "_____"
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1455 LOCATE 15,1 : PRINT "WHAT DOES THE ORG-ENTITY-FUNCTION PRODUCE ---> !
             !"
1460 LOCATE 16,49: PRINT "_____"
1465 LOCATE 17,1 : PRINT "IS THIS THE ONLY OUTPUT (y OR n)
   ! !"
1470 LOCATE 18,49: PRINT "_____"
1475 LOCATE 19,1 : PRINT "WHICH DESTINATION RECEIVES THE OUTPUT -------> !
             !"
1480 LOCATE 20,49: PRINT "_____"
1485 LOCATE 21,1 : PRINT "IS THIS THE ONLY DESTINATION THAT RECEIVES THE OUTPUT
   ! !"
1490 LOCATE 3,47
1495 INPUT AM$
1500 LOCATE 5,47
1505 INPUT AH$
1510 LOCATE 7,47
1515 INPUT AI$
1520 LOCATE 9,57
1525 INPUT AII$
1530 LOCATE 11,47
1535 INPUT AJ$
1540 LOCATE 13,57
1545 INPUT AJJ$
1550 LOCATE 15,47
1555 INPUT AK$
1560 LOCATE 17,57
1565 INPUT AKK$
1570 LOCATE 19,47
1575 INPUT AL$
1580 LOCATE 21,57
1585 INPUT ALL$
1590 CLS
1595 LOCATE 4,10 : PRINT AM$" perceives "AH$
1600 LOCATE 5,10 : PRINT AH$" perceived-by "AM$
1605 LOCATE 6,10 : PRINT AH$" uses "AI$
1610 LOCATE 7,10 : PRINT AI$" used-by "AH$
1615 LOCATE 8,10 : PRINT AI$" provided-by "AJ$
1620 LOCATE 9,10 : PRINT AJ$" provides "AI$
1625 LOCATE 10,10: PRINT AH$" produces "AK$
1630 LOCATE 11,10: PRINT AK$" produced-by "AH$
1635 LOCATE 12,10: PRINT AK$" received-by "AL$
1640 LOCATE 13,10: PRINT AL$" receives "AK$
1645 LOCATE 16,1 : PRINT "PRESS 1  IF ABOVE IS CORRECT & YOU WANT IT SAVED BUT T
HERE IS MORE SUB-DATA"
1650 LOCATE 17,1 : PRINT "PRESS 2  IF ABOVE IS CORRECT & YOU WANT IT SAVED,THERE
 IS NO MORE DATA & EXIT"
1655 LOCATE 18,1 : PRINT "PRESS 3  IF ABOVE IS CORRECT AND YOU WANT IT SAVED BUT
 THERE IS MORE DATA"
1660 LOCATE 19,1 : PRINT "          FOR A DIFFERENT MANAGER/SUPERVISOR OR PREVIOU
S ONE ."
1665 LOCATE 20,1 : PRINT "PRESS 4  IF ABOVE IS INCORRECT AND YOU WANT TO REENTER
 THE DATA"
1670 LOCATE 21,1 : PRINT "PRESS 5  IF ABOVE IS INCORRECT AND YOU DON'T WANT IT S
AVED AND YOU WANT"
1675 LOCATE 22,1 : PRINT "          TO EXIT TO MENU"
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1680 LOCATE 24,1 : PRINT "MAKE YOUR CHOICE HERE ------>"
1685 LOCATE 23,29
1690 INPUT ANS
1695 IF ANS = "1" GOTO 4865
1700 IF ANS = "2" GOTO 4870
1705 IF ANS = "3" GOTO 4875
1710 IF ANS = "4" GOTO 1375
1715 IF ANS = "5" GOTO 905
1720 BEEP
1725 GOTO 1590
1730 IF AIIS = "n" GOTO 1755
1735 IF AJJS = "n" GOTO 1905
1740 IF AKKS = "n" GOTO 2015
1745 IF ALLS = "n" GOTO 2165
1750 GOTO 1590
1755 CLS
1760 LOCATE 4,20 :PRINT "WHAT OTHER INPUT IS USED BY "AHS
1765 LOCATE 6,20 :PRINT "         --------------------------"
1770 LOCATE 7,20 :PRINT "         !                        !"
1775 LOCATE 8,20 :PRINT "         --------------------------"
1780 LOCATE 7,24
1785 INPUT RAHS
1790 LOCATE 11,20:PRINT "WHAT SOURCE PROVIDES "RAHS
1795 LOCATE 12,20:PRINT "         --------------------------"
1800 LOCATE 13,20:PRINT "         !                        !"
1805 LOCATE 14,20:PRINT "         --------------------------"
1810 LOCATE 13,24
1815 INPUT SAHS
1820 LOCATE 15,20:PRINT RAHS " provided-by "SAHS
1825 LOCATE 16,20:PRINT SAHS " provides "RAHS
1830 LOCATE 9,20 :PRINT AHS " uses "RAHS
1835 LOCATE 10,20: PRINT RAHS " used-by "AHS
1840 LOCATE 18,5 : PRINT "PRESS 1 IF THERE ARE MORE INPUTS USED BY "AHS
1845 LOCATE 19,5 : PRINT "PRESS 2 IF ABOVE IS INCORRECT AND YOU WANT TO REENTER
THE DATA"
1850 LOCATE 20,5 : PRINT "PRESS 3 IF THERE ARE NO MORE INPUTS AND ABOVE SAVED"
1855 LOCATE 21,5 : PRINT "PRESS 4 IF ABOVE INCORRECT & TO EXIT WITHOUT SAVING"
1860 LOCATE 23,5 : PRINT "ENTER YOUR CHOICE HERE ---->"
1865 LOCATE 23,33
1870 INPUT TAHS
1875 IF TAHS = "1" GOTO 5310
1880 IF TAHS = "2" GOTO 1755
1885 IF TAHS = "3" GOTO 5315
1890 IF TAHS = "4" GOTO 1735
1895 BEEP
1900 GOTO 1860
1905 CLS
1910 LOCATE 4,20 : PRINT "WHAT OTHER SOURCE PROVIDES "AIS
1915 LOCATE 6,20 : PRINT "         --------------------------"
1920 LOCATE 7,20 : PRINT "         !                        !"
1925 LOCATE 8,20 : PRINT "         --------------------------"
1930 LOCATE 7,24
1935 INPUT RAIS
1940 LOCATE 10,20: PRINT AIS " provided-by "RAIS
1945 LOCATE 11,20: PRINT RAIS " provides "AIS
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1950 LOCATE 18,1 : PRINT "ENTER 1 IF ABOVE IS CORRECT AND THERE ARE NO MORE SOUR
CES"
1955 LOCATE 19,1 : PRINT "ENTER 2 IF ABOVE IS CORRECT & THERE ARE MORE SOURCES"
1960 LOCATE 20,1 : PRINT "ENTER 3 IF ABOVE IS INCORRECT AND YOU WANT TO REENTER
THE DATA"
1965 LOCATE 21,1 : PRINT "ENTER 4 IF ABOVE IS INCORRECT & TO EXIT WITHOUT SAVING
"
1970 LOCATE 23,20: PRINT "ENTER YOUR CHOICE HERE ——>"
1975 LOCATE 23,48
1980 INPUT SAI$
1985 IF SAI$ = "1" GOTO 5345
1990 IF SAI$ = "2" GOTO 5355
1995 IF SAI$ = "3" GOTO 1905
2000 IF SAI$ = "4" GOTO 1740
2005 BEEP
2010 GOTO 1970
2015 CLS
2020 LOCATE 4,20 : PRINT "WHICH OTHER OUTPUTS ARE PRODUCED BY "AH$
2025 LOCATE 6,20 : PRINT "         ———————————————"
2030 LOCATE 7,20 : PRINT "        |              |"
2035 LOCATE 8,20 : PRINT "         ———————————————"
2040 LOCATE 7,27
2045 INPUT UAH$
2050 LOCATE 10,20: PRINT AH$ " produces "UAH$
2055 LOCATE 11,20: PRINT UAH$ " produced-by "AH$
2060 LOCATE 13,20: PRINT "WHICH DESTINATION RECEIVES "UAH$
2065 LOCATE 14,20: PRINT "         ———————————————"
2070 LOCATE 15,20: PRINT "        |              |"
2075 LOCATE 16,20: PRINT "  .      ———————————————"
2080 LOCATE 15,27
2085 INPUT VAH$
2090 LOCATE 17,20: PRINT VAH$ " receives "UAH$
2095 LOCATE 18,20: PRINT UAH$ " received-by "VAH$
2100 LOCATE 19,1 : PRINT "ENTER 1 IF ABOVE IS CORRECT AND THERE ARE NO MORE OUTP
UTS"
2105 LOCATE 20,1 : PRINT "ENTER 2 IF ABOVE IS CORRECT AND THERE ARE MORE OUTPUTS
"
2110 LOCATE 21,1 : PRINT "ENTER 3 IF ABOVE IS INCORRECT AND YOU WANT TO REENTER
THE DATA"
2115 LOCATE 22,1 : PRINT "ENTER 4 IF ABOVE IS INCORRECT & TO EXIT WITHOUT SAVING
"
2120 LOCATE 24,20: PRINT "ENTER YOUR CHOICE HERE ——>"
2125 LOCATE 23,48
2130 INPUT WAH$
2135 IF WAH$ = "1" GOTO 5380
2140 IF WAH$ = "2" GOTO 5385
2145 IF WAH$ = "3" GOTO 2015
2150 IF WAH$ = "4" GOTO 1745
2155 BEEP
2160 GOTO 2120
2165 CLS
2170 LOCATE 2,20 : PRINT "WHAT OTHER DESTINATION RECEIVES "AK$
2175 LOCATE 4,20 : PRINT "         ———————————————"
2180 LOCATE 5,20 : PRINT "        |              |"
2185 LOCATE 6,20 : PRINT "         ———————————————"
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2190 LOCATE 5,24
2195 INPUT RAK$
2200 LOCATE 7,20 : PRINT AK$ " received-by "RAK$
2205 LOCATE 8,20 : PRINT RAK$ " receives "AK$
2210 LOCATE 18,1 : PRINT "ENTER 1  IF ABOVE IS CORRECT AND THERE ARE NO MORE DES
TINATIONS"
2215 LOCATE 19,1 : PRINT "ENTER 2  IF ABOVE IS CORRECT AND THERE ARE MORE DESTIN
ATIONS"
2220 LOCATE 20,1 : PRINT "ENTER 3  IF ABOVE IS INCORRECT AND YOU WANT TO REENTER
 THE DATA"
2225 LOCATE 21,1 : PRINT "ENTER 4  IF ABOVE IS INCORRECT & TO EXIT WITHOUT SAVIN
G"
2230 LOCATE 23,20: PRINT "ENTER YOUR CHOICE HERE ---->"
2235 LOCATE 23,48
2240 INPUT SAK$
2245 IF SAK$ = "1" GOTO 5420
2250 IF SAK$ = "2" GOTO 5425
2255 IF SAK$ = "3" GOTO 2165
2260 IF SAK$ = "4" GOTO 1590
2265 BEEP
2270 GOTO 2230
2275 REM ENTERING DATA FOR WHAT MANAGER/SUPERVISOR PERFORMS
2280 CLS
2285 LOCATE 2,57 : PRINT "----------------------"
2290 LOCATE 3,9  : PRINT "NAME OF MAIN ROLE --------------------------->  |
                 !"
2295 LOCATE 4,57 : PRINT "----------------------"
2300 LOCATE 5,9  : PRINT "WHAT ACTIVITY IS PERFORMED BY MAIN ROLE --->  |
                 !"
2305 LOCATE 6,57 : PRINT "----------------------"
2310 LOCATE 7,9  : PRINT "WHAT INPUT DOES THE ACITIVITY USE ---------->  |
                 !"
2315 LOCATE 8,57: PRINT "----------------------"
2320 LOCATE 9,9  : PRINT "IS THIS THE ONLY INPUT (y OR n)
    ! !"
2325 LOCATE 10,57: PRINT "----------------------"
2330 LOCATE 11,9 : PRINT "WHAT SOURCE PROVIDES THE INPUT -------------->  |
                 !"
2335 LOCATE 12,57: PRINT "----------------------"
2340 LOCATE 13,9 : PRINT "IS THIS THE ONLY SOURCE FOR THE INPUT (y OR n)
    ! !"
2345 LOCATE 14,57: PRINT "----------------------"
2350 LOCATE 15,9 : PRINT "WHAT OUTPUT IS PRODUCED BY THE ACTIVITY --->  |
                 !"
2355 LOCATE 16,57: PRINT "----------------------"
2360 LOCATE 17,9 : PRINT "IS THIS THE ONLY OUTPUT PRODUCED (y OR n)
    ! !"
2365 LOCATE 18,57: PRINT "----------------------"
2370 LOCATE 19,9 : PRINT "WHAT DESTINATION RECEIVES THE OUTPUT -------->  |
                 !"
2375 LOCATE 20,57: PRINT "----------------------"
2380 LOCATE 21,9 : PRINT "IS THIS THE ONLY DESTINATION FOR THE OUTPUT (y OR n)
    ! !"
2385 LOCATE 3,55
2390 INPUT AC$
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2395 LOCATE 5,55
2400 INPUT AP$
2405 LOCATE 7,55
2410 INPUT AQ$
2415 LOCATE 9,65
2420 INPUT AQQ$
2425 LOCATE 11,55
2430 INPUT AR$
2435 LOCATE 13,65
2440 INPUT ARR$
2445 LOCATE 15,55
2450 INPUT AS$
2455 LOCATE 17,65
2460 INPUT ASS$
2465 LOCATE 19,55
2470 INPUT AT$
2475 LOCATE 21,65
2480 INPUT ATT$
2485 CLS
2490 LOCATE 4,10 : PRINT AO$ " performs "AP$
2495 LOCATE 5,10 : PRINT AP$ " performed-by "AO$
2500 LOCATE 6,10 : PRINT AP$ " uses "AQ$
2505 LOCATE 7,10 : PRINT AQ$ " used-by "AP$
2510 LOCATE 8,10 : PRINT AQ$ " provided-by "AR$
2515 LOCATE 9,10 : PRINT AR$ " provides "AQ$
2520 LOCATE 10,10: PRINT AP$ " produces "AS$
2525 LOCATE 11,10: PRINT AS$ " produced-by "AP$
2530 LOCATE 12,10: PRINT AS$ " received-by "AT$
2535 LOCATE 13,10: PRINT AT$ " receives "AS$
2540 LOCATE 16,1 : PRINT "PRESS 1 IF ABOVE IS CORRECT & YOU WANT IT SAVED BUT TH
ERE IS MORE SUB-DATA"
2545 LOCATE 17,1 : PRINT "PRESS 2 IF ABOVE IS CORRECT & YOU WANT IT SAVED,THERE
IS NO MORE DATA & EXIT"
2550 LOCATE 18,1 : PRINT "PRESS 3 IF ABOVE IS CORRECT AND YOU WANT IT SAVED BUT
THERE IS MORE DATA"
2555 LOCATE 19,1 : PRINT "          FOR A DIFFERENT MANAGER/SUPERVISOR"
2560 LOCATE 20,1 : PRINT "PRESS 4 IF ABOVE IS INCORRECT AND YOU WANT TO REENTER
THE DATA"
2565 LOCATE 21,1 : PRINT "PRESS 5 IF ABOVE IS INCORRECT AND YOU DON'T WANT IT SA
VED AND YOU WANT"
2570 LOCATE 22,1 : PRINT "          TO EXIT TO MENU"
2575 LOCATE 24,1 : PRINT "MAKE YOUR CHOICE HERE ——>"
2580 LOCATE 23,29
2585 INPUT AW$
2590 IF AW$ = "1" GOTO 4945
2595 IF AW$ = "2" GOTO 4950
2600 IF AW$ = "3" GOTO 4955
2605 IF AW$ = "4" GOTO 2280
2610 IF AW$ = "5" GOTO 905
2615 BEEP
2620 GOTO 2575
2625 IF AQQ$ = "n" GOTO 2650
2630 IF ARR$ = "n" GOTO 2800
2635 IF ASS$ = "n" GOTO 2910
2640 IF ATT$ = "n" GOTO 3060
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2645 GOTO 2485
2650 CLS
2655 LOCATE 4,20 : PRINT "WHAT OTHER INPUT IS USED BY "AP$
2660 LOCATE 6,20 : PRINT "          _____"
2665 LOCATE 7,20 : PRINT "        |                    |"
2670 LOCATE 8,20 : PRINT "          _____"
2675 LOCATE 7,24
2680 INPUT RAP$
2685 LOCATE 11,20: PRINT "WHAT SOURCE PROVIDES "RAP$
2690 LOCATE 12,20: PRINT "          _____"
2695 LOCATE 13,20: PRINT "        |                    |"
2700 LOCATE 14,20: PRINT "          _____"
2705 LOCATE 13,24
2710 INPUT SAP$
2715 LOCATE 15,20: PRINT RAP$ " provided-by "SAP$
2720 LOCATE 16,20: PRINT SAP$ " provides "RAP$
2725 LOCATE 9,20 : PRINT AP$ " uses "RAP$
2730 LOCATE 10,20: PRINT RAP$ " used-by "AP$
2735 LOCATE 18,5 : PRINT "PRESS 1 IF THERE ARE ANY MORE INPUTS USED BY "AP$
2740 LOCATE 19,5 : PRINT "PRESS 2 IF ABOVE IS INCORRECT AND YOU WANT TO REENTER
   THE DATA"
2745 LOCATE 20,5 : PRINT "PRESS 3 IF THERE ARE NO MORE INPUTS AND ABOVE SAVED"
2750 LOCATE 21,5 : PRINT "PRESS 4 IF ABOVE IS INCORRECT,NOT SAVED AND TO EXIT"
2755 LOCATE 23,5 : PRINT "ENTER YOUR CHOICE HERE ---->"
2760 LOCATE 23,33
2765 INPUT TAP$
2770 IF TAP$ = "1" GOTO 5450
2775 IF TAP$ = "2" GOTO 2650
2780 IF TAP$ = "3" GOTO 5455
2785 IF TAP$ = "4" GOTO 2630
2790 BEEP
2795 GOTO 2755
2800 CLS
2805 LOCATE 4,20 : PRINT "WHAT OTHER SOURCE PROVIDES "AQ$
2810 LOCATE 6,20 : PRINT "          _____"
2815 LOCATE 7,20 : PRINT "        |                    |"
2820 LOCATE 8,20 : PRINT "          _____"
2825 LOCATE 7,24
2830 INPUT RAQ$
2835 LOCATE 10,20: PRINT AQ$ " provided-by "RAQ$
2840 LOCATE 11,20: PRINT RAQ$ " provides "AQ$
2845 LOCATE 18,1 : PRINT "ENTER 1 IF ABOVE IS CORRECT AND THERE ARE NO MORE SOUR
CES"
2850 LOCATE 19,1 : PRINT "ENTER 2 IF ABOVE IS CORRECT AND THERE ARE MORE SOURCES
"
2855 LOCATE 20,1 : PRINT "ENTER 3 IF ABOVE IS INCORRECT AND YOU WANT TO REENTER
THE DATA"
2860 LOCATE 21,1 : PRINT "ENTER 4 IF ABOVE IS INCORRECT,NOT SAVED AND TO EXIT"
2865 LOCATE 23,20: PRINT "ENTER YOUR CHOICE HERE ---->"
2870 LOCATE 23,48
2875 INPUT SAQ$
2880 IF SAQ$ = "1" GOTO 5490
2885 IF SAQ$ = "2" GOTO 5495
2890 IF SAQ$ = "3" GOTO 2800
2895 IF SAQ$ = "4" GOTO 2635
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2900 BEEP
2905 GOTO 2865
2910 CLS
2915 LOCATE 4,20 : PRINT "WHICH OTHER OUTPUTS ARE PRODUCED BY "AP$
2920 LOCATE 6,20 : PRINT "                                      "
2925 LOCATE 7,20 : PRINT "          |                 |"
2930 LOCATE 8,20 : PRINT "                                      "
2935 LOCATE 7,25
2940 INPUT UAP$
2945 LOCATE 10,20: PRINT AP$ " produces "UAP$
2950 LOCATE 11,20: PRINT UAP$ " produced-by "AP$
2955 LOCATE 13,20: PRINT "WHICH DESTINATION RECEIVES "UAP$
2960 LOCATE 14,20: PRINT "                                      "
2965 LOCATE 15,20: PRINT "          |                 |"
2970 LOCATE 16,20: PRINT "                                      "
2975 LOCATE 15,25
2980 INPUT VAP$
2985 LOCATE 17,20: PRINT VAP$ " receives "UAP$
2990 LOCATE 18,20: PRINT UAP$ " received-by "VAP$
2995 LOCATE 19,1 : PRINT "ENTER 1 IF ABOVE IS CORRECT AND THERE ARE NO MORE OUTP
UTS"
3000 LOCATE 20,1 : PRINT "ENTER 2 IF ABOVE IS CORRECT AND THERE ARE MORE OUTPUTS
"
3005 LOCATE 21,1 : PRINT "ENTER 3 IF ABOVE IS INCORRECT AND YOU WANT TO REENTER
THE DATA"
3010 LOCATE 22,1.: PRINT "ENTER 4 IF ABOVE IS INCORRECT,NOT SAVED AND TO EXIT"
3015 LOCATE 24,20: PRINT "ENTER YOUR CHOICE HERE ---->"
3020 LOCATE 23,48
3025 INPUT WAP$
3030 IF WAP$ = "1" GOTO 5520
3035 IF WAP$ = "2" GOTO 5525
3040 IF WAP$ = "3" GOTO 2910
3045 IF WAP$ = "4" GOTO 2640
3050 BEEP
3055 GOTO 3015
3060 CLS
3065 LOCATE 2,20 : PRINT "WHICH OTHER DESTINATION RECEIVES "AS$
3070 LOCATE 4,20 : PRINT "                                      "
3075 LOCATE 5,20 : PRINT "          |                 |"
3080 LOCATE 6,20 : PRINT "                                      "
3085 LOCATE 5,28
3090 INPUT RAS$
3095 LOCATE 7,20 : PRINT AS$ " received-by "RAS$
3100 LOCATE 8,20 : PRINT RAS$ " receives "AS$
3105 LOCATE 18,1 : PRINT "ENTER 1 IF ABOVE IS CORRECT AND THERE ARE NO MORE DEST
INATIONS"
3110 LOCATE 19,1 : PRINT "ENTER 2 IF ABOVE IS CORRECT AND THERE ARE MORE DESTINA
TIONS"
3115 LOCATE 20,1 : PRINT "ENTER 3 IF ABOVE IS INCORRECT AND YOU WANT TO REENTER
THE DATA"
3120 LOCATE 21,1 : PRINT "ENTER 4 IF ABOVE IS INCORRECT,NOT SAVED AND TO EXIT"
3125 LOCATE 23,20: PRINT "ENTER YOUR CHOICE HERE ---->"
3130 LOCATE 23,48
3135 INPUT SAS$
3140 IF SAS$ = "1" GOTO 5560
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3145 IF SASS = "2" GOTO 5565
3150 IF SASS = "3" GOTO 3060
3155 IF SASS = "4" GOTO 2485
3160 BEEP
3165 GOTO 3125
3170 REM MENU FOR TECHNOLOGICAL DATA MODEL
3175 CLS
3180 LOCATE 4,20   :PRINT "TECHNOLOGICAL DATA MODEL MENU"
3185 LOCATE 5,20   :PRINT "———————————————————————————————"
3190 LOCATE 7,15   :PRINT "[1] STRUCTURAL DIAGRAMS OF THE MODEL"
3195 LOCATE 9,15   :PRINT "[2] TO BEGIN TO ENTER DATA FOR THE MODEL"
3200 LOCATE 11,15  :PRINT "[3] TO GO BACK TO MAIN MENU"
3205 LOCATE 13,15  :PRINT "[4] TO EXIT TO SYSTEM"
3210 LOCATE 15,15  :PRINT "[5] TO GO TO ORGANISATIONAL DATA MODEL"
3215 LOCATE 18,15  :PRINT "ENTER YOUR CHOICE HERE ——————————>"
3220 LOCATE 18,53
3225 INPUT BAS
3230 IF BA$ = "1" GOTO 3265
3235 IF BA$ = "2" GOTO 3464
3240 IF BA$ = "3" GOTO 340 .
3245 IF BA$ = "4" GOTO 6610
3250 IF BA$ = "5" GOTO 425
3255 BEEP
3260 GOTO 3170
3265 CLS .
3270 LOCATE 4,15 :PRINT "STRUCTURE OF TECHNOLOGICAL DATA MODEL - DIAGRAM 1"
3275 LOCATE 5,15 :PRINT "————————————————————————————————————————————————"
3280 LOCATE 7,20 :PRINT "——————————   perceives  ——————————"
3285 LOCATE 8,19 :PRINT "|                |——————————>|              |"
3290 LOCATE 9,19 :PRINT "| viewpoint      |           | business-    |"
3295 LOCATE 10,19:PRINT "|                |<——————————|   area       |"
3300 LOCATE 11,20:PRINT "——————————  perceived-by  ——————————"
3305 LOCATE 14,6 :PRINT" ——————————   recognizes  ——————————  entailed-by ——
—————— "
3310 LOCATE 15,6 :PRINT"|                |——————————>|              |——————————>| b
usiness- |"
3315 LOCATE 16,6 :PRINT"|      role      |           |   tech-      |          | a
rea (CR  |"
3320 LOCATE 17,6 :PRINT"|                |           | 'activity    |          | t
ech-     |"
3325 LOCATE 18,6 :PRINT"|                |<——————————|              |<——————————| a
ctivity  |"
3330 LOCATE 19,6 :PRINT" ——————————recognized-by ——————————    entails  ——
—————— "
3335 LOCATE 22,15:PRINT"ENTER HERE 1 TO CONTINUE :2 TO EXIT TO MENU ——>"
3340 LOCATE 22,65
3345 INPUT BBS
3350 IF BB$ = "1" GOTO 3370
3355 IF BB$ = "2" GOTO 3170
3360 BEEP
3365 GOTO 3265
3370 CLS
3375 LOCATE 2,20 :PRINT"STRUCTURE OF TECHNOLOGICAL DATA MODEL - DIAGRAM 2"
3380 LOCATE 5,6  :PRINT" ——————————   uses   ——————————   produces  ——
—————— "
```

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3385 LOCATE 6,6  :PRINT"|                  |<————————|  tech-   |————————>|
         | "
3390 LOCATE 7,6  :PRINT"|   Input    |              | activity |              |
output   |"
3395 LOCATE 8,6  :PRINT"|                  |————————>|              |<————————|
         | "
3400 LOCATE 9,6  :PRINT" ————————   used-by   ————————   produced-by ——
———————— "
3405 LOCATE 10,6 :PRINT"   |    |                        |    |
|    |"
3410 LOCATE 11,1 :PRINT"provided-|    |provides        |s|   | :       rece
Ived-|    |receives"
3415 LOCATE 12,6 :PRINT" by |    |                  |    |              by
|    |"
3420 LOCATE 13,6 :PRINT" ————————             ————————             ——
———————— "
3425 LOCATE 14,6 :PRINT"|                  |   | primary CR |              |
         | "
3430 LOCATE 15,6 :PRINT"|   source   |   | functional |              |
desti-   |"
3435 LOCATE 16,6 :PRINT"|                  |   | activity   |              |
nation   |"
3440 LOCATE 17,6 :PRINT" ————————             ————————             ——
———————— "
3445 LOCATE 20,16:PRINT"PRESS ANY KEY AND 'RETURN' TO EXIT TO MENU"
3450 LOCATE 20,58
3455 INPUT AAA$
3460 GOTO 3170
3464 CLS
3465 LOCATE 4,15 :PRINT "GIVE ME 1 - 5 CHARACTERS"
3466 LOCATE 5,15 :PRINT "TO NAME YOUR NEW TCM DATA FILE"
3467 LOCATE 6,15 :PRINT "FOR EXAMPLE: TYPE ——>TEST.2"
3468 LOCATE 14,1:PRINT "THE FILES YOU ALREADY HAVE ARE LISTED BELOW:":FILES
3469 LOCATE 15,1 :PRINT "————————————————————————————————————"
3470 LOCATE 8,15 :PRINT "ENTER HERE THE NAME ——————>"
3471 LOCATE 8,43 :INPUT INFILES
3472 CLOSE #2:OPEN INFILES FOR APPEND AS #2 LEN=256
3475 REM BEGIN TO ENTER DATA FOR TECHNOLOGICAL DATA MODEL
3480 CLS
3485 LOCATE 6,10 :PRINT"BEGIN TO ENTER DATA FOR TECHNOLOGICAL DATA MODEL MENU"
3490 LOCATE 7,10 :PRINT"————————————————————————————————————————————————"
3495 LOCATE 9,15 :PRINT"[1] ENTERING DATA ON VIEWPOINTS:"
3500 LOCATE 11,15:PRINT"[2] ENTERING DATA ON THE TECHNOLOGICAL ACTIVITIES"
3505 LOCATE 13,15:PRINT"    RECOGNIZED BY ROLE"
3510 LOCATE 15,15:PRINT"[3] ENTERING DATA ON THE TECHNOLOGICAL ACTIVITIES"
3515 LOCATE 17,15:PRINT"[4] TO GO BACK TO TECHNOLOGICAL DATA MODEL MENU"
3520 LOCATE 19,15:PRINT"[5] TO GO TO MAIN MENU"
3525 LOCATE 21,15:PRINT"[6] TO EXIT TO SYSTEM"
3530 LOCATE 23,15:PRINT"ENTER YOUR CHOICE HERE ——————>"
3535 LOCATE 23,44
3540 INPUT CA$
3545 IF CA$ = "1" GOTO 3585
3550 IF CA$ = "2" GOTO 3720
3555 IF CA$ = "3" GOTO 3990
3560 IF CA$ = "4" GOTO 3170
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3565 IF CA$ = "5" GOTO 340
3570 IF CA$ = "6" GOTO 6610
3575 BEEP
3580 GOTO 3480
3585 CLS
3590 LOCATE 2,27 : PRINT"ENTERING DATA ON VIEWPOINTS"
3595 LOCATE 3,27 : PRINT"————————————————"
3600 LOCATE 6,56 : PRINT"————————————————"
3605 LOCATE 7,9  : PRINT"NAME OF INDIVIDUAL REPRESENTING THE VIEWPOINT |
          | "
3610 LOCATE 8,56 : PRINT"————————————————"
3615 LOCATE  9,9 : PRINT"NAME THE BUSINESS AREA PERCEIVED BY VIEWPOINT |
          | "
3620 LOCATE 10,56: PRINT"————————————————"
3625 LOCATE 7,54
3630 INPUT DA$
3635 LOCATE  9,54
3640 INPUT DB$
3645 LOCATE 12,9  : PRINT DA$" perceives "DB$
3650 LOCATE 13,9  : PRINT DB$" perceived-by "DA$
3655 LOCATE 15,1  : PRINT"PRESS 1 IF ABOVE IS INCORRECT AND YOU WANT TO REENTER
THE DATA"
3660 LOCATE 16,1  : PRINT"PRESS 2 IF ABOVE IS INCORECT AND YOU DON'T WANT IT SAV
ED AND TO EXIT TO MENU"
3665 LOCATE 17,1  : PRINT"PRESS 3 IF ABOVE IS CORRECT AND YOU WANT IT SAVED AND
THERE IS MORE DATA"
3670 LOCATE 18,1  : PRINT"PRESS 4 IF ABOVE IS CORRECT AND YOU WANT IT SAVED BUT
THERE IS NO MORE DATA"
3675 LOCATE 20,1  : PRINT"ENTER YOUR CHOICE HERE ———>"
3680 LOCATE 20,30
3685 INPUT DC$
3690 IF DC$ = "1" GOTO 3585
3695 IF DC$ = "2" GOTO 3480
3700 IF DC$ = "3" GOTO 5025
3705 IF DC$ = "4" GOTO 5030
3710 BEEP
3715 GOTO 3675
3720 CLS
3725 LOCATE 2,9   :PRINT"ENTERING DATA ON THE TECHNOLOGICAL ACTIVITIES RECOG'ZED
  BY ROLE"
3730 LOCATE 3,9   :PRINT"————————————————————————————
————————"
3735 LOCATE 4,54  :PRINT"————————————————"
3740 LOCATE 5,9   :PRINT"NAME OF ROLE ————————————————> |
          | "
3745 LOCATE 6,54  :PRINT"————————————————"
3750 LOCATE 7,9   :PRINT"THE TECH-ACTIVITY RECOGNIZED BY ROLE ———> |
          | "
3755 LOCATE 8,54  :PRINT"————————————————"
3760 LOCATE 9,9   :PRINT"THE BUSINESS AREA THAT ENTAILS THE ———> |
          | "
3765 LOCATE 10,54 :PRINT"————————————————"
3770 LOCATE 10,9  :PRINT"TECHNOLOGICAL ACTIVITY."
3775 LOCATE 5,52
3780 INPUT FA$
```

```
3765 LOCATE 7,52
3790 INPUT FB$
3795 LOCATE 9,52
3800 INPUT FC$
3805 LOCATE 12,9 :PRINT FA$" recognizes "FB$
3810 LOCATE 13,9 :PRINT FB$" recognized-by "FA$
3815 LOCATE 14,9 :PRINT FB$" entailed-by "FC$
3820 LOCATE 15,9 :PRINT FC$" entails "FB$
3825 LOCATE 17,1 :PRINT "ENTER 1 IF ABOVE IS INCORRECT AND YOU WANT TO REENTER T
HE DATA"
3830 LOCATE 18,1 :PRINT "ENTER 2 IF ABOVE IS INCORRECT AND YOU DON'T WANT TO SAV
E IT AND TO EXIT"
3835 LOCATE 19,1 :PRINT "ENTER 3 IF ABOVE IS CORRECT AND YOU WANT IT SAVED AND T
HERE IS MORE DATA"
3840 LOCATE 20,1 :PRINT "ENTER 4 IF ABOVE IS CORRECT AND THERE IS NO MORE DATA A
ND TO EXIT "
3845 LOCATE 22,1 :PRINT "ENTER YOUR CHOICE HERE ———>"
3850 LOCATE 22,30
3855 INPUT FD$
3860 IF FD$ = "1" GOTO 3720
3865 IF FD$ = "2" GOTO 3480
3870 IF FD$ = "3" GOTO 5055
3875 IF FD$ = "4" GOTO 5060
3880 BEEP
3885 GOTO 3845
3890 REM ENTERING DATA FOR THE TECHNOLOGICAL ACTIVITIES
3895 CLS
3900 LOCATE 2,18 :PRINT"ENTERING DATA ON THE TECHNOLOGICAL ACTIVITIES"
3905 LOCATE 3,18 :PRINT"————————————————————————————————————————"
3910 LOCATE 5,54 :PRINT"—————————————————————"
3915 LOCATE 6,9  :PRINT"NAME OF TECH-ACTIVITY ————————————————>   |
          |"
3920 LOCATE 7,54 :PRINT"—————————————————————"
3925 LOCATE 8,9  :PRINT"NAME OF INPUT USED BY TECH-ACTIVITY ———>   |
          |"
3930 LOCATE 9,54 :PRINT"—————————————————————"
3935 LOCATE 10,9 :PRINT"IS THE ABOVE INPUT THE ONLY ONE (y OR n)            | |
"
3940 LOCATE 11,54:PRINT"—————————————————————"
3945 LOCATE 12,9 :PRINT"NAME OF SOURCE PROVIDING THE· INPUT ———>   |
          |"
3950 LOCATE 13,54:PRINT"—————————————————————"
3955 LOCATE 14,9 :PRINT"IS THE ABOVE SOURCE THE ONLY ONE (y OR n)           | |
"
3960 LOCATE 15,54:PRINT"—————————————————————"
3965 LOCATE 16,9 :PRINT"WHICH OUTPUT IS PRODUCED BY TECH-ACTIVITY   |
          |"
3970 LOCATE 17,54:PRINT"—————————————————————"
3975 LOCATE 18,9 :PRINT"IS THE ABOVE OUTPUT THE ONLY ONE (y OR n)           | |
"
3980 LOCATE 19,54:PRINT"—————————————————————"
3985 LOCATE 20,9 :PRINT"WHICH DESTINATION RECEIVES THE OUTPUT  —>   |
          |"
3990 LOCATE 21,54:PRINT"—————————————————————"
3995 LOCATE 22,9 :PRINT"IS THE ABOVE DESTINATION THE ONLY ONE (y OR n)      | |
```

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"
4000 LOCATE 6,52
4005 INPUT EA$
4010 LOCATE 8,52
4015 INPUT EB$
4020 LOCATE 10,61
4025 INPUT EC$
4030 LOCATE 12,52
4035 INPUT ED$
4040 LOCATE 14,61
4045 INPUT EE$
4050 LOCATE 16,52
4055 INPUT EF$
4060 LOCATE 18,61
4065 INPUT EG$
4070 LOCATE 20,52
4075 INPUT EH$
4080 LOCATE 22,61
4085 INPUT EI$
4090 CLS
4095 LOCATE 4,9   :PRINT EA$" uses "EB$
4100 LOCATE 5,9   :PRINT EB$" used-by "EA$
4105 LOCATE 6,9   :PRINT EB$" provided-by "ED$
4110 LOCATE 7,9   :PRINT ED$" provides "EB$
4115 LOCATE 8,9   :PRINT EA$" produces "EF$
4120 LOCATE 9,9   :PRINT EF$" produced-by "EA$
4125 LOCATE 10,9 :PRINT EF$" received-by "EH$
4130 LOCATE 11,9 :PRINT EH$" receives "EF$
4135 LOCATE 12,9 :PRINT EA$" is-a technological-activity"
4140 LOCATE 15,1 :PRINT "PRESS 1 IF ABOVE IS CORRECT AND THERE IS MORE DATA FOR
THIS TECH-ACTIVITY"
4145 LOCATE 16,1 :PRINT "PRESS 2 IF ABOVE IS NOT CORRECT AND YOU WANT TO REENTER
 THE DATA"
4150 LOCATE 17,1 :PRINT "PRESS 3 IF ABOVE IS NOT CORRECT AND YOU DON'T WANT IT S
AVED AND TO EXIT"
4155 LOCATE 18,1 :PRINT "PRESS 4 IF ABOVE IS CORRECT AND THERE IS MORE DATA FOR
A DIFFERENT TECH-ACTIVITY"
4160 LOCATE 19,1 :PRINT "PRESS 5 IF ABOVE IS CORRECT AND YOU WANT TO EXIT TO MEN
U"
4165 LOCATE 22,1 :PRINT "ENTER YOUR CHOICE HERE ----->" .
4170 LOCATE 22,29
4175 INPUT EJ$
4180 IF EJ$ = "1" GOTO 5095
4185 IF EJ$ = "2" GOTO 3890
4190 IF EJ$ = "3" GOTO 3420
4195 IF EJ$ = "4" GOTO 5100
4200 IF EJ$ = "5" GOTO 5105
4205 BEEP
4210 GOTO 4090
4215 IF EC$ = "n" GOTO 4245
4220 IF EE$ = "n" GOTO 4395
4225 IF EG$ = "n" GOTO 4505
4230 IF EI$ = "n" GOTO 4655
4235 BEEP
4240 GOTO 4090
```

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4245 CLS
4250 LOCATE 4,20 :PRINT "WHAT OTHER INPUT IS USED BY "EAS
4255 LOCATE 6,20 :PRINT "       ———————————————————"
4260 LOCATE 7,20 :PRINT "      |                    |"
4265 LOCATE 8,20 :PRINT "       ———————————————————"
4270 LOCATE 7,24
4275 INPUT EKS
4280 LOCATE 11,20:PRINT "WHAT SOURCE PROVIDES "EKS
4285 LOCATE 12,20:PRINT "       ———————————————————"
4290 LOCATE 13,20:PRINT "      |                    |"
4295 LOCATE 14,20:PRINT "       ———————————————————"
4300 LOCATE 13,24
4305 INPUT EMS
4310 LOCATE 15,20:PRINT EKS " provided-by "EMS
4315 LOCATE 16,20:PRINT EMS " provides "EKS
4320 LOCATE 9,20 :PRINT EAS " uses "EKS
4325 LOCATE 10,20:PRINT EKS " used-by "EAS
4330 LOCATE 18,5 :PRINT "PRESS 1 IF THERE ARE ANY MORE INPUTS USED BY "EAS
4335 LOCATE 19,5 :PRINT "PRESS 2 IF THE ABOVE IS INCORRECT AND YOU WANT TO REENT
ER THE DATA"
4340 LOCATE 20,5 :PRINT "PRESS 3 IF THERE ARE NO MORE INPUTS AND ABOVE SAVED"
4345 LOCATE 21,5 :PRINT "PRESS 4 IF ABOVE INCORRECT,NOT SAVED AND TO EXIT"
4350 LOCATE 23,5 :PRINT "ENTER YOUR CHOICE HERE ——>"
4355 LOCATE 23,33
4360 INPUT ELS
4365 IF ELS = "1" GOTO 5170
4370 IF ELS = "2" GOTO 4245
4375 IF ELS = "3" GOTO 5175
4380 IF ELS = "4" GOTO 4220
4385 BEEP
4390 GOTO 4350
4395 CLS
4400 LOCATE 4,20 :PRINT "WHAT OTHER SOURCE PROVIDES "EBS
4405 LOCATE 6,20 :PRINT "       ———————————————————"
4410 LOCATE 7,20 :PRINT "      |                    |"
4415 LOCATE 8,20 :PRINT "       ———————————————————"
4420 LOCATE 7,24
4425 INPUT ENS
4430 LOCATE 10,20:PRINT EBS " provided-by "ENS
4435 LOCATE 11,20:PRINT ENS " provides "EBS
4440 LOCATE 18,1 :PRINT"ENTER 1 IF ABOVE IS CORRECT AND THERE ARE NO MORE SOURCE
S"
4445 LOCATE 19,1 :PRINT"ENTER 2 IF ABOVE IS CORRECT AND THERE ARE MORE SOURCES P
ROVIDING "EBS
4450 LOCATE 20,1 :PRINT"ENTER 3 IF ABOVE IS NOT CORRECT  AND YOU WANT TO REENTER
 THE DATA"
4455 LOCATE 21,1 :PRINT"ENTER 4 IF ABOVE IS NOT CORRECT AND YOU DON'T WANT IT SA
VED AND TO EXIT"
4460 LOCATE 23,20:PRINT"ENTER YOUR CHOICE HERE ——>"
4465 LOCATE 23,48
4470 INPUT EOS
4475 IF EOS = "1" GOTO 5210
4480 IF EOS = "2" GOTO 5215
4485 IF EOS = "3" GOTO 4395
4490 IF EOS = "4" GOTO 4225
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4495 BEEP
4500 GOTO 4460
4505 CLS
4510 LOCATE 4,20 :PRINT "WHICH OTHER OUTPUTS ARE PRODUCED BY "EA$
4515 LOCATE 6,20 :PRINT "                              "
4520 LOCATE 7,20 :PRINT "      !                    !"
4525 LOCATE 8,20 :PRINT "                              "
4530 LOCATE 7,27
4535 INPUT EP$
4540 LOCATE 10,20:PRINT EA$ " produces "EP$
4545 LOCATE 11,20:PRINT EP$ " produced-by "EA$
4550 LOCATE 13,20:PRINT "WHICH DESTINATION RECEIVES "EP$
4555 LOCATE 14,20:PRINT "                              "
4560 LOCATE 15,20:PRINT "      !                    !"
4565 LOCATE 16,20:PRINT "                              "
4570 LOCATE 15,27
4575 INPUT EQ$
4580 LOCATE 17,20:PRINT EQ$ " receives "EP$
4585 LOCATE 18,20:PRINT EP$ " received-by "EQ$
4590 LOCATE 19,1 :PRINT "ENTER 1 IF ABOVE IS CORRECT AND THERE ARE NO MORE OUTPU
TS"
4595 LOCATE 20,1 :PRINT "ENTER 2 IF ABOVE IS CORRECT AND THERE ARE MORE OUTPUTS"
4600 LOCATE 21,1 :PRINT "ENTER 3 IF ABOVE IS INCORRECT AND YOU WANT TO REENTER T
HE DATA"
4605 LOCATE 22,1 :PRINT "ENTER 4 IF ABOVE IS INCORRECT,NOT SAVED AND TO EXIT'
4610 LOCATE 24,20:PRINT "ENTER YOUR CHOICE HERE --->"
4615 LOCATE 23,48
4620 INPUT ER$
4625 IF ER$ = "1" GOTO 5240
4630 IF ER$ = "2" GOTO 5245
4635 IF ER$ = "3" GOTO 4505
4640 IF ER$ = "4" GOTO 4230
4645 BEEP
4650 GOTO 4610
4655 CLS
4660 LOCATE 2,20 :PRINT"WHAT OTHER DESTINATION RECEIVES "EF$
4665 LOCATE 4,20 :PRINT"                              "
4670 LOCATE 5,20 :PRINT"      !                    !"
4675 LOCATE 6,20 :PRINT"                              " .
4680 LOCATE 5,24
4685 INPUT ES$
4690 LOCATE 7,20 :PRINT EF$ " received-by "ES$
4695 LOCATE 8,20 :PRINT ES$ " receives "EF$
4700 LOCATE 18,1 :PRINT"ENTER 1 IF ABOVE IS CORRECT AND THERE ARE NO MORE DESTIN
ATIONS"
4705 LOCATE 19,1 :PRINT"ENTER 2 IF ABOVE IS CORRECT AND THERE ARE MORE DESTINATI
ONS"
4710 LOCATE 20,1 :PRINT"ENTER 3 IF ABOVE IS NOT CORRECT AND YOU WANT TO REENTER
THE DATA"
4715 LOCATE 21,1 :PRINT"ENTER 4 IF ABOVE IS INCORRECT,NOT SAVED AND TO EXIT"
4720 LOCATE 23,20:PRINT "ENTER YOUR CHOICE HERE --->"
4725 LOCATE 23,48
4730 INPUT ET$
4735 IF ET$ = "1" GOTO 5280
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4740 IF ET$ = "2" GOTO 5235
4745 IF ET$ = "3" GOTO 4655
4750 IF ET$ = "4" GOTO 4090
4755 BEEP
4760 GOTO 4720
4765 LET H = 1 :GOTO 4780
4770 LET H = 2 :GOTO 4780
4775 LET H = 3 :GOTO 4780
4780 WRITE #1,AB$,TA$,AC$
4785 WRITE #1,AB$,TB$,TE$
4790 WRITE #1,AB$,TZZ$,AD$
4795 WRITE #1,AD$,TD$,AB$
4800 WRITE #1,AD$,TW$,TZ$
4805 IF H = 1 GOTO 1235
4810 IF H = 2 GOTO 1005
4815 IF H = 3 GOTO 905
4820 LET H = 4 :GOTO 4835
4825 LET H = 5 :GOTO 4835
4830 LET H = 6 :GOTO 4835
4835 WRITE #1,AB$,TC$,AF$
4840 WRITE #1,AF$,TD$,AB$
4845 WRITE #1,AF$,TE$,TE$
4850 IF H = 4 GOTO 1235
4855 IF H = 5 GOTO 905
4860 IF H = 6 GOTO 1005
4865 LET H = 7 :GOTO 4880
4870 LET H = 8 :GOTO 4880
4875 LET H = 9 :GOTO 4880
4880 WRITE #1,AM$,TG$,AH$
4885 WRITE #1,AH$,TH$,AM$
4890 WRITE #1,AH$,TI$,AI$
4895 WRITE #1,AI$,TJ$,AH$
4900 WRITE #1,AI$,TL$,AJ$
4905 WRITE #1,AJ$,TK$,AI$
4910 WRITE #1,AH$,TM$,AK$
4915 WRITE #1,AK$,TN$,AH$
4920 WRITE #1,AK$,TP$,AL$
4925 WRITE #1,AL$,TY$,AK$
4930 IF H = 7 GOTO 1730
4935 IF H = 8 GOTO 905
4940 IF H = 9 GOTO 1375
4945 LET H = 10 :GOTO 4960
4950 LET H = 11 :GOTO 4960
4955 LET H = 12 :GOTO 4960
4960 WRITE #1,AO$,TQ$,AP$
4965 WRITE #1,AP$,TR$,AO$
4970 WRITE #1,AP$,TI$,AO$
4975 WRITE #1,AO$,TJ$,AP$
4980 WRITE #1,AO$,TL$,AR$
4985 WRITE #1,AR$,TK$,AO$
4990 WRITE #1,AP$,TM$,AS$
4995 WRITE #1,AS$,TN$,AP$
5000 WRITE #1,AS$,TP$,AT$
5005 WRITE #1,AT$,TY$,AS$
5010 IF H = 10 GOTO 2625
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5015 IF H = 11 GOTO 905
5020 IF H = 12 GOTO 2275
5025 LET K = 1 :GOTO 5035
5030 LET K = 2 :GOTO 5035
5035 WRITE #2,DA$,TG$,DB$
5040 WRITE #2,DB$,TH$,DA$
5045 IF K = 1 GOTO 3585
5050 IF K = 2 GOTO 3480
5055 LET K = 3 :GOTO 5065
5060 LET K = 4 :GOTO 5065
5065 WRITE #2,FA$,TS$,FB$
5070 WRITE #2,FB$,TT$,FA$
5075 WRITE #2,FB$,TV$,FC$
5080 WRITE #2,FC$,TU$,FB$
5085 IF K = 3 GOTO 3720
5090 IF K = 4 GOTO 3480
5095 LET K = 5 :GOTO 5110
5100 LET K = 6 :GOTO 5110
5105 LET K = 7 :GOTO 5110
5110 WRITE #2,EA$,TI$,EB$
5115 WRITE #2,EB$,TJ$,EA$
5120 WRITE #2,EB$,TL$,ED$
5125 WRITE #2,ED$,TK$,EB$
5130 WRITE #2,EA$,TM$,EF$
5135 WRITE #2,EF$,TN$,EA$
5140 WRITE #2,EF$,TP$,EH$
5145 WRITE #2,EH$,TY$,EF$
5150 WRITE #2,EA$,TW$,TX$
5155 IF K = 5 GOTO 4215
5160 IF K = 6 GOTO 3890
5165 IF K = 7 GOTO 3480
5170 LET K = 8 :GOTO 5180
5175 LET K = 9 :GOTO 5180
5180 WRITE #2,EK$,TL$,EM$
5185 WRITE #2,EM$,TK$,EK$
5190 WRITE #2,EA$,TI$,EK$
5195 WRITE #2,EK$,TJ$,EA$
5200 IF K = 8 GOTO 4245
5205 IF K = 9 GOTO 4220
5210 LET K = 10 :GOTO 5220
5215 LET K = 11 :GOTO 5220
5220 WRITE #2,EB$,TL$,EN$
5225 WRITE #2,EN$,TK$,EB$
5230 IF K = 10 GOTO 4225
5235 IF K = 11 GOTO 4395
5240 LET K = 12 :GOTO 5250
5245 LET K = 13 :GOTO 5250
5250 WRITE #2,EQ$,TY$,EP$
5255 WRITE #2,EP$,TP$,EQ$
5260 WRITE #2,EA$,TM$,EP$
5265 WRITE #2,EP$,TN$,EA$
5270 IF K = 12 GOTO 4230
5275 IF K = 13 GOTO 4535
5280 LET K = 14 :GOTO 5290
5285 LET K = 15 :GOTO 5290
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5290 WRITE #2,EFS,TPS,ESS
5295 WRITE #2,ESS,TYS,EFS
5300 IF K = 14 GOTO 4090
5305 IF K = 15 GOTO 4655
5310 LET K = 16 :GOTO 5320
5315 LET K = 17 :GOTO 5320
5320 WRITE #1,RAHS,TLS,SAHS
5325 WRITE #1,SAHS,TKS,RAHS
5330 WRITE #1,AHS,TIS,RAHS
5335 WRITE #1,RAHS,TJS,AHS
5340 IF K = 16 GOTO 1755
5345 IF K = 17 GOTO 1735
5350 LET K = 18 :GOTO 5360
5355 LET K = 19 :GOTO 5360
5360 WRITE #1,AIS,TLS,RAIS
5365 WRITE #1,RAIS,TKS,AIS
5370 IF K = 18 GOTO 1740
5375 IF K = 19 GOTO 1905
5380 LET K = 20 :GOTO 5390
5385 LET K = 21 :GOTO 5390
5390 WRITE #1,AHS,TMS,UAHS
5395 WRITE #1,UAHS,TNS,AHS
5400 WRITE #1,VAHS,TYS,UAHS
5405 WRITE #1,UAHS,TPS,VAHS
5410 IF K = 20 GOTO 1745
5415 IF K = 21 GOTO 2015
5420 LET K = 22 :GOTO 5430
5425 LET K = 23 :GOTO 5430
5430 WRITE #1,AKS,TPS,RAKS
5435 WRITE #1,RAKS,TYS,AKS
5440 IF K = 22 GOTO 1590
5445 IF K = 23 GOTO 2165
5450 LET K = 24 :GOTO 5460
5455 LET K = 25 :GOTO 5460
5460 WRITE #1,RAPS,TLS,SAPS
5465 WRITE #1,SAPS,TKS,RAPS
5470 WRITE #1,APS,TIS,RAPS
5475 WRITE #1,RAPS,TJS,APS
5480 IF K = 24 GOTO 2650
5485 IF K = 25 GOTO 2630
5490 LET K = 26 :GOTO 5500
5495 LET K = 27 :GOTO 5500
5500 WRITE #1,AQS,TLS,RAQS
5505 WRITE #1,RAQS,TKS,AQS
5510 IF K = 26 GOTO 2635
5515 IF K = 27 GOTO 2800
5520 LET K = 28 :GOTO 5530
5525 LET K = 29 :GOTO 5530
5530 WRITE #1,APS,TMS,UAPS
5535 WRITE #1,UAPS,TNS,APS
5540 WRITE #1,VAPS,TYS,UAPS
5545 WRITE #1,UAPS,TPS,VAPS
5550 IF K = 28 GOTO 2640
5555 IF K = 29 GOTO 2910
5560 LET K = 30 :GOTO 5570
```

```
5565 LET K = 31 :GOTO 5570
5570 WRITE #1,AS$,TP$,RAS$
5575 WRITE #1,RAS$,TY$,AS$
5580 IF K = 30 GOTO 2485
5585 IF K = 31 GOTO 3060
5590 CLS
5595 LOCATE 5,20 :PRINT "EXAMINE A PREVIOUSLY ENTERED FILE MENU"
5600 LOCATE 6,20 :PRINT "————————————————————————————————————"
5605 LOCATE 8,19 :PRINT "[ 1] ALL THE ORGANISATIONAL ENTITIES"
5610 LOCATE 9,19 :PRINT "[ 2] ALL THE MAIN ROLES"
5615 LOCATE 10,19:PRINT "[ 3] WHAT A PARTICULAR MANAGER PERCEIVES"
5620 LOCATE 11,19:PRINT "[ 4] WHAT A PARTICULAR MANAGER PERFORMS "
5625 LOCATE 12,19:PRINT "[ 5] INPUTS & OUTPUTS FOR AN ACTIVITY OR FUNCTION"
5630 LOCATE 13,19:PRINT "[ 6] ALL SOURCES FOR  A SPECIFIC INPUT"
5635 LOCATE 14,19:PRINT "[ 7] ALL DESTINATIONS FOR A SPECIFIC OUTPUT"
5640 LOCATE 15,19:PRINT"[ 8] ALL ORG-ENTITIES BELONGING TO AN ORG-ENTITY"
5645 LOCATE 16,19:PRINT"[ 9] ALL THE DATA THAT HAS BEEN ENTERED IN THE FILE"
5650 LOCATE 17,19:PRINT"[10] WHAT AN ORG-ENTITY RECEIVES FROM OTHER ENTITIES
5655 LOCATE 18,19:PRINT"[11] WHAT AN ORG-ENTITY PRODUCES
5660 LOCATE 19,19:PRINT"[12] TO GO BACK TO MAIN MENU"
5665 LOCATE 23,19:PRINT"ENTER YOUR CHOICE HERE ———>":LOCATE 23,47
5670 INPUT RTT$
5675 IF RTT$ = "1" GOTO 5795
5680 IF RTT$ = "2" GOTO 5835
5685 IF RTT$ = "3" GOTO 5875
5690 IF RTT$ = "4" GOTO 5950
5695 IF RTT$ = "5" GOTO 6025
5700 IF RTT$ = "6" GOTO 6150
5705 IF RTT$ = "7" GOTO 6225
5710 IF RTT$ = "8" GOTO 6300
5715 IF RTT$ = "9" GOTO 5740
5720 IF RTT$ = "10" GOTO 6375
5725 IF RTT$ = "11" GOTO 6455
5730 IF RTT$ = "12" GOTO 345
5735 BEEP:GOTO 5590
5740 CLS
5745 CLOSE #1,#2
5750 OPEN FILE$ FOR INPUT AS #1 LEN=60
5755 INPUT #1,A$,B$,C$
5760 PRINT A$ SPC(1) B$ SPC(1) C$
5765 IF EOF(1) THEN CLOSE #1 ELSE GOTO 5755
5770 LOCATE  ,30:PRINT "————————————————————————————————————"
5775 LOCATE  ,30:PRINT "PRESS 'RETURN' KEY TO GO BACK TO MENU"
5780 LOCATE  ,30:PRINT "————————————————————————————————————"
5785 LOCATE  ,46:INPUT ZTX$
5786 IF UYTG$ = "1" THEN GOTO 6615 ELSE GOTO 5790
5790 GOTO 5590
5795 CLS
5800 CLOSE #1,#2
5805 OPEN FILE$ FOR INPUT AS #1 LEN=60
5810 INPUT #1,A$,B$,C$
5815 IF B$ = TZZ$ THEN GOTO 5820 ELSE GOTO 5825
5820 PRINT A$
5825 IF EOF(1) THEN CLOSE #1 ELSE GOTO 5810
5830 GOTO 5770
```

```
5835 CLS
5840 CLOSE #1,#2
5845 OPEN FILE$ FOR INPUT AS #1 LEN=60
5850 INPUT #1,A$,B$,C$
5855 IF C$ = TZ$ THEN GOTO 5860 ELSE GOTO 5865
5860 PRINT A$
5865 IF EOF(1) THEN CLOSE #1 ELSE GOTO 5850
5870 GOTO 5770
5875 CLOSE #1,#2
5880 OPEN FILE$ FOR INPUT AS #1 LEN=60
5885 CLS
5890 LOCATE 5,16 :PRINT "WHAT IS THE TITLE OF THE MANAGER YOU WISH TO LOOK A"
5895 LOCATE 6,16 :PRINT "—————————————————————————————————'
5900 LOCATE 9,16 :PRINT "                    —————————————————"
5905 LOCATE 10,16:PRINT "                 !                   !"
5910 LOCATE 11,16:PRINT "                 —————————————————"
5915 LOCATE 10,29:INPUT XRT$
5920 CLS
5925 INPUT #1,A$,B$,C$
5930 IF A$ = XRT$ AND B$ = TG$ THEN GOTO 5935 ELSE GOTO 5940
5935 PRINT A$ SPC(1) B$ SPC(1) C$
5940 IF EOF(1) THEN CLOSE #1 ELSE GOTO 5925
5945 GOTO 5770
5950 CLOSE #1,#2
5955 OPEN FILE$ FOR INPUT AS #1 LEN=60
5960 CLS
5965 LOCATE 5,16 :PRINT "WHAT IS THE TITLE OF THE MANAGER YOU WISH TO LOOK A"
5970 LOCATE 6,16 :PRINT "—————————————————————————————————'
5975 LOCATE 9,16 :PRINT "   •          —————————————————"
5980 LOCATE 10,16:PRINT "         •        !                   !"
5985 LOCATE 11,16:PRINT "                 —————————————————"
5990 LOCATE 10,29:INPUT HHT$
5995 CLS
6000 INPUT #1,A$,B$,C$
6005 IF A$ = HHT$ AND B$ = TQ$ THEN GOTO 6010 ELSE GOTO 6015
6010 PRINT A$ SPC(1) B$ SPC(1) C$
6015 IF EOF(1) THEN CLOSE #1 ELSE GOTO 6000
6020 GOTO 5770
6025 CLS
6030 LOCATE 5,16 :PRINT "WHAT IS THE ACTIVITY OR FUNCTION YOU WISH TO LOOK A"
6035 LOCATE 6,16 :PRINT "—————————————————————————————————'
6040 LOCATE 9,16 :PRINT "            —————————————————"
6045 LOCATE 10,16:PRINT "                 !                   !"
6050 LOCATE 11,16:PRINT "                 —————————————————"
6055 LOCATE 10,29:INPUT CHT$
6060 CLS
6065 PRINT "INPUTS FOR "CHT$
6070 PRINT "—————————"
6075 CLOSE #1,#2
6080 OPEN FILE$ FOR INPUT AS #1 LEN=60
6085 INPUT #1,A$,B$,C$
6090 IF A$ = CHT$ AND B$ = TI$ THEN GOTO 6095 ELSE GOTO 6100
6095 PRINT C$
6100 IF EOF(1) THEN CLOSE #1 ELSE GOTO 6085
6105 PRINT "OUTPUTS FOR "CHT$
```

```
6110 PRINT "——————————"
6115 CLOSE #1,#2
6120 OPEN FILE$ FOR INPUT AS #1 LEN=60
6125 INPUT #1,A$,B$,C$
6130 IF A$ = CHT$ AND B$ = TM$ THEN GOTO 6135 ELSE GOTO 6140
6135 PRINT C$
6140 IF EOF(1) THEN CLOSE #1 ELSE GOTO 6125
6145 GOTO 5770
6150 CLS
6155 LOCATE 5,16 :PRINT "WHICH INPUT DO YOU WISH TO SEE IT'S SOURCES"
6160 LOCATE 6,16 :PRINT "——————————————————————————————————"
6165 LOCATE 9,16 :PRINT "                    ——————————————"
6170 LOCATE 10,16:PRINT "               !              !"
6175 LOCATE 11,16:PRINT "                    ——————————————"
6180 LOCATE 10,26:INPUT JJK$
6185 CLOSE #1,#2
6190 OPEN FILE$ FOR INPUT AS #1 LEN=60
6195 CLS
6200 INPUT #1,A$,B$,C$
6205 IF A$ = JJK$ AND B$ = TL$ THEN GOTO 6210 ELSE GOTO 6215
6210 PRINT C$
6215 IF EOF(1) THEN CLOSE #1 ELSE GOTO 6200
6220 GOTO 5770
6225 CLS
6230 LOCATE 5,13 :PRINT "WHICH OUTPUT DO YOU WISH TO SEE IT'S DESTINATIONS"
6235 LOCATE 6,16 :PRINT "——————————————————————————————————"
6240 LOCATE 9,16 :PRINT "                    ——————————————"
6245 LOCATE 10,16:PRINT "               !              !"
6250 LOCATE 11,16:PRINT "                    ——————————————"
6255 LOCATE 10,26:INPUT JRK$
6260 CLOSE #1,#2
6265 OPEN FILE$ FOR INPUT AS #1 LEN=60
6270 CLS
6275 INPUT #1,A$,B$,C$
6280 IF A$ = JRK$ AND B$ = TP$ THEN GOTO 6285  ELSE GOTO 6290
6285 PRINT C$
6290 IF EOF(1) THEN CLOSE #1 ELSE GOTO 6275
6295 GOTO 5770
6300 CLS
6305 LOCATE 5,13 :PRINT "WHICH ORG-ENTITY DO YOU WISH TO SEE IT'S SUB-ENTITIES"
6310 LOCATE 6,13 :PRINT "——————————————————————————————————"
6315 LOCATE 9,13 :PRINT "                    ——————————————"
6320 LOCATE 10,13:PRINT "               !              !"
6325 LOCATE 11,13:PRINT "                    ——————————————"
6330 LOCATE 10,29:INPUT GLL$
6335 CLOSE #1,#2
6340 OPEN FILE$ FOR INPUT AS #1 LEN=60
6345 CLS
6350 INPUT #1,A$,B$,C$
6355 IF A$ = GLL$ AND B$ = TC$ THEN GOTO 6360 ELSE GOTO 6365
6360 PRINT C$
6365 IF EOF(1) THEN CLOSE #1 ELSE GOTO 6350
6370 GOTO 5770
6375 CLS
6380 LOCATE 5,16 :PRINT "WHAT IS THE NAME OF THE ENTITY YOU WISH TO LOOK AT "
```

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6385 LOCATE 9,16 :PRINT "                                              _____"
6390 LOCATE 10,16:PRINT "                          |    .                      |"
6395 LOCATE 11,16:PRINT "                                              _____"
6400 LOCATE 10,29:INPUT TIT$
6405 CLS
6410 PRINT TIT$ " receives from other crg-entities the following :"
6415 CLOSE #1,#2
6420 OPEN FILE$ FOR INPUT AS #1 LEN=60
6425 INPUT #1,A$,B$,C$
6430 IF A$ = TIT$ AND B$ = TY$ THEN GOTO 6435 ELSE GOTO 6440
6435 PRINT C$
6440 IF EOF(1) THEN CLOSE #1 ELSE GOTO 6425
6445 GOTO 5770
6450 CLOSE #1
6455 CLS
6460 LOCATE 5,16 :PRINT "WHAT IS THE NAME OF THE ENTITY YOU WISH TO LOCK AT "
6465 LOCATE 9,16 :PRINT "                                              _____"
6470 LOCATE 10,16:PRINT "                          |                          |"
6475 LOCATE 11,16:PRINT "                                              _____"
6480 LOCATE 10,29:INPUT TYT$
6485 CLS
6490 PRINT TYT$ " produces the following:"
6495 OPEN FILE$ FOR INPUT AS #1 LEN=60
6500 INPUT #1,A$,B$,C$
6505 TZZ$ = "controlled-by"
6510 IF A$ = TYT$ AND B$ = TZZ$ THEN GOTO 6525 ELSE GOTO 6515
6515 IF EOF(1) THEN CLOSE #1 ELSE GOTO 6500
6520 GOTO 5770
6525 LET ASA$ = C$
6530 CLOSE #1
6535 OPEN FILE$ FOR INPUT AS #1 LEN=60
6540 INPUT #1,A$,B$,C$
6545 TG$ = "perceives"
6550 TQ$ = "performs"
6555 IF A$ = ASA$ AND B$ = TG$ .THEN GOTO 6575 ELSE GOTO 6560
6560 IF A$ = ASA$ AND B$ = TQ$ THEN GOTO 6575 ELSE GOTO 6565
6565 IF EOF(1) THEN CLOSE #1 ELSE GOTO 6540
6570 GOTO 5770
6575 LET AXA$ = C$
6580 INPUT #1,A$,B$,C$
6585 TM$ = "produces"
6590 IF A$ = AXA$ AND B$ = TM$ THEN GOTO 6600 ELSE GOTO 6595
6595 IF EOF(1) THEN CLOSE #1 ELSE GOTO 6580
6600 PRINT C$
6605 GOTO 6540
6610 CLS : SYSTEM
6615 CLS
6620 LOCATE 4,15 :PRINT "EXAMINE A FILE AND PROLOG PREPARATION MENU"
6625 LOCATE 5,15 :PRINT "_____"
6630 LOCATE 7,15 :PRINT "[1] AN ORGANISATIONAL DATA MODEL FILE"
6635 LOCATE 8,15 :PRINT "[2] A TECHNOLOGICAL DATA MODEL FILE"
6640 LOCATE 9,15 :PRINT "[3] A MICRO-PROLOG PREPARED DATA FILE"
6645 LOCATE 10,15:PRINT "[4] TO PREPARE A PROLOG DATA FILE"
6655 LOCATE 11,15:PRINT "[5] TO GO BACK TO MAIN MENU"
6660 LOCATE 16,15:PRINT "ENTER YOUR CHOICE HERE --->"
```

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6665 LOCATE 19,15:PRINT "================================================"
6670 LOCATE 20,15:PRINT "WARNING: PLACE YOUR DATA DISK IN DRIVE A"
6675 LOCATE 21,15:PRINT "           BEFORE CONTINUING"
6680 LOCATE 22,15:PRINT "================================================"
6685 LOCATE 18,43
6690 INPUT MGT$
6695 IF MGT$ = "1" GOTO 6730
6700 IF MGT$ = "2" GOTO 6760
6705 IF MGT$ = "3" GOTO 6790
6710 IF MGT$ = "4" GOTO 6820
6715 IF MGT$ = "5" GOTO 340
6725 BEEP : GOTO 6615
6730 CLS
6735 LOCATE 4,15 :PRINT "WHAT IS THE NAME OF THE COM FILE YOU WISH TO EXAMINE'
6740 LOCATE 5,15 :PRINT "--------------------------------------------------'
6745 LOCATE 8,15 :PRINT "ENTER HERE THE NAME ------->"
6746 LOCATE 14,1 :PRINT "THE NAMES OF THE FILES THAT YOU ALREADY HAVE ARE:"
6747 LOCATE 15,1 :PRINT "--------------------------------------------------"
6748 FILES
6750 LOCATE 8,43 : INPUT FILE$·
6755 GOTO 5590
6760 CLS
6765 LOCATE 4,15 :PRINT "WHAT IS THE NAME OF THE TOM FILE YOU WISH TO EXAMINE'
6770 LOCATE 5,15 :PRINT "--------------------------------------------------'
6775 LOCATE 8,15 :PRINT "ENTER HERE THE NAME ------->"
6776 LOCATE 14,1 :PRINT "THE NAMES OF THE FILES THAT YOU ALREADY HAVE ARE:"
6777 LOCATE 15,1 :PRINT "--------------------------------------------------"
6778 FILES
6780 LOCATE 8,43 :INPUT FILE$
6785 GOTO 8200
6790 CLS
6795 LOCATE 4,15 :PRINT "WHAT IS THE NAME OF THE MICRO-PROLOG FILE"
6800 LOCATE 5,15 :PRINT "--------------------------------------------"
6805 LOCATE 8,15 :PRINT "ENTER HERE THE NAME ------->"
6806 LOCATE 14,1 :PRINT "THE NAMES OF THE FILES THAT YOU ALREADY HAVE ARE:"
6807 LOCATE 15,1 :PRINT "--------------------------------------------------"
6808 FILES
6810 LOCATE 8,43 :INPUT FILE$
6814 UYTG$ = "1"
6815 GOTO 5740
6820 CLS
6823 LOCATE 2,15 :PRINT "GIVE ME TWO NAMES: THE FIRST IS THE NAME TO BE"
6824 LOCATE 3,15 :PRINT "USED TO NAME YOUR NEW MICRO-PROLOG DATA FILE"
6825 LOCATE 4,15 :PRINT "AND THE SECOND NAME FOR THE FILE TO READ FROM."
6830 LOCATE 5,15 :PRINT "EACH FILE NAME SHOULD HAVE 1 - 5 CHARACTERS"
6835 LOCATE 6,15 :PRINT "AND THE FIRST NAME FOLLOWED BY .LOG : FOR EXAMPLE PD1.L
OG"
6840 LOCATE 8,15 :PRINT "ENTER FIRST NAME HERE ------->"
6841 LOCATE 14,1 :PRINT "THE NAMES OF THE FILES THAT YOU ALREADY HAVE ARE:"
6842 LOCATE 15,1 :PRINT "--------------------------------------------------"
6843 FILES
6845 LOCATE 8,43 : INPUT OUFILE$
6846 LOCATE 9,15 :PRINT "ENTER SECOND NAME HERE ----->"
6847 LOCATE 9,43 :INPUT INFILE$
6850 GOTO 6686
```

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6855 CLS
6860 LOCATE 4,15 :PRINT "GIVE ME FIVE CHARACTERS FOLLOWED BY .LOG"
6865 LOCATE 5,15 :PRINT "IN ORDER TO NAME YOUR MICRO-PROLOG FILE"
6870 LOCATE 6,15 :PRINT "FOR EXAMPLE: TYPE ---->TRACK.LOG"
6875 LOCATE 8,15 :PRINT "ENTER HERE THE NAME ---------->"
6876 LOCATE 14,1 :PRINT "THE NAMES OF THE FILES THAT YOU ALREADY HAVE ARE:"
6877 LOCATE 15,1 :PRINT "------------------------------------------------------------"
6878 FILES
6880 LOCATE 8,43 :INPUT FILES
6885 GOTO 8800
6886 CLS
6887 OPEN INFILES FOR INPUT AS #1 LEN=60
6888 OPEN OUFILES FOR OUTPUT AS #3 LEN=60
6889 INPUT #1,A$,B$,C$
6890 IF B$ = TW$ THEN GOTO 6891 ELSE GOTO 6892
6891 PRINT #3,LOE$;B$;LOA$;A$;LOA$;C$;LOS$
6892 IF EOF(1) THEN CLOSE #1 ELSE GOTO 6889
6895 OPEN INFILES FOR INPUT AS #1 LEN=60
6905 INPUT #1,A$,B$,C$
6910 IF B$ = TE$ THEN GOTO 6915 ELSE GOTO 6920
6915 PRINT #3,LOE$;B$;LOA$;A$;LOA$;C$;LOS$
6920 IF EOF(1) THEN CLOSE #1 ELSE GOTO 6905
6925 OPEN INFILES FOR INPUT AS #1 LEN=60
6930 INPUT #1,A$,B$,C$
6935 IF B$ = TA$ THEN GOTO 6940 ELSE GOTO 6945
6940 PRINT #3,LOE$;B$;LOA$;A$;LOA$;C$;LOS$
6945 IF EOF(1) THEN CLOSE #1 ELSE GOTO 6930
6950 OPEN INFILES FOR INPUT AS #1 LEN=60
6955 INPUT #1,A$,B$,C$
6960 IF B$ = TD$ THEN GOTO 6965 ELSE GOTO 6970
6965 PRINT #3,LOE$;B$;LOA$;A$;LOA$;C$;LOS$
6970 IF EOF(1) THEN CLOSE #1 ELSE GOTO 6955
6975 OPEN INFILES FOR INPUT AS #1 LEN=60
6980 INPUT #1,A$,B$,C$
6985 IF B$ = TZZ$ THEN GOTO 6990 ELSE GOTO 6995
6990 PRINT #3,LOE$;B$;LOA$;A$;LOA$;C$;LOS$
6995 IF EOF(1) THEN CLOSE #1 ELSE GOTO 6980
7000 OPEN INFILES FOR INPUT AS #1 LEN=60
7005 INPUT #1,A$,B$,C$
7010 IF B$ = TC$ THEN GOTO 7015 ELSE GOTO 7020
7015 PRINT #3,LOE$;B$;LOA$;A$;LOA$;C$;LOS$
7020 IF EOF(1) THEN CLOSE #1 ELSE GOTO 7005
7025 OPEN INFILES FOR INPUT AS #1 LEN=60
7030 INPUT #1,A$,B$,C$
7035 IF B$ = TG$ THEN GOTO 7040 ELSE GOTO 7045
7040 PRINT #3,LOE$;B$;LOA$;A$;LOA$;C$;LOS$
7045 IF EOF(1) THEN CLOSE #1 ELSE GOTO 7030
7050 OPEN INFILES FOR INPUT AS #1 LEN=60
7055 INPUT #1,A$,B$,C$
7060 IF B$ = TH$ THEN GOTO 7065 ELSE GOTO 7070
7065 PRINT #3,LOE$;B$;LOA$;A$;LOA$;C$;LOS$
7070 IF EOF(1) THEN CLOSE #1 ELSE GOTO 7055
7075 OPEN INFILES FOR INPUT AS #1 LEN=60
7080 INPUT #1,A$,B$,C$
7085 IF B$ = TC$ THEN GOTO 7090 ELSE GOTO 7095
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7090 PRINT #3,LCE$;B$;LCA$;A$;LCA$;C$;LCS$
7095 IF ECF(1) THEN CLOSE #1 ELSE GOTO 7080
7100 OPEN INFILE$ FOR INPUT AS #1 LEN=60
7105 INPUT #1,A$,B$,C$
7110 IF B$ = TR$ THEN GOTO 7115 ELSE GOTO 7120
7115 PRINT #3,LCE$;B$;LCA$;A$;LCA$;C$;LCS$
7120 IF ECF(1) THEN CLOSE #1 ELSE GOTO 7105
7125 OPEN INFILE$ FOR INPUT AS #1 LEN=60
7130 INPUT #1,A$,B$,C$
7135 IF B$ = TM$ THEN GOTO 7140 ELSE GOTO 7145
7140 PRINT #3,LCE$;B$;LCA$;A$;LCA$;C$;LCS$
7145 IF ECF(1) THEN CLOSE #1 ELSE GOTO 7130
7150 OPEN INFILE$ FOR INPUT AS #1 LEN=60
7155 INPUT #1,A$,B$,C$
7160 IF B$ = TN$ THEN GOTO 7165 ELSE GOTO 7170
7165 PRINT #3,LCE$;B$;LOA$;A$;LOA$;C$;LOS$
7170 IF ECF(1) THEN CLOSE #1 ELSE GOTO 7155
7175 OPEN INFILE$ FOR INPUT AS #1 LEN=60
7180 INPUT #1,A$,B$,C$
7185 IF B$ = TK$ THEN GOTO 7190 ELSE GOTO 7195
7190 PRINT #3,LCE$;B$;LOA$;A$;LOA$;C$;LOS$
7195 IF ECF(1) THEN CLOSE #1 ELSE GOTO 7180
7200 OPEN INFILE$ FOR INPUT AS #1 LEN=60
7205 INPUT #1,A$,B$,C$
7210 IF B$ = TL$ THEN GOTO 7215 ELSE GOTO 7220
7215 PRINT #3,LCE$;B$;LOA$;A$;LOA$;C$;LOS$
7220 IF ECF(1) THEN CLOSE #1 ELSE GOTO 7205
7225 OPEN INFILE$ FOR INPUT AS #1 LEN=60
7230 INPUT #1,A$,B$,C$
7235 IF B$ = TY$ THEN GOTO 7240 ELSE GOTO 7245
7240 PRINT #3,LCE$;B$;LOA$;A$;LOA$;C$;LOS$
7245 IF ECF(1) THEN CLOSE #1 ELSE GOTO 7230
7250 OPEN INFILE$ FOR INPUT AS #1 LEN=60
7255 INPUT #1,A$,B$,C$
7260 IF B$ = TP$ THEN GOTO 7265 ELSE GOTO 7270
7265 PRINT #3,LCE$;B$;LOA$;A$;LOA$;C$;LOS$
7270 IF ECF(1) THEN CLOSE #1 ELSE GOTO 7255
7275 OPEN INFILE$ FOR INPUT AS #1 LEN=60
7279 INPUT #1,A$,B$,C$
7280 IF B$ = TI$ THEN GOTO 7285 ELSE GOTO 7290
7285 PRINT #3,LCE$;B$;LOA$;A$;LOA$;C$;LOS$
7290 IF ECF(1) THEN CLOSE #1 ELSE GOTO 7279
7300 OPEN INFILE$ FOR INPUT AS #1 LEN=60
7305 INPUT #1,A$,B$,C$
7310 IF B$ = TJ$ THEN GOTO 7315 ELSE GOTO 7320
7315 PRINT #3,LCE$;B$;LOA$;A$;LOA$;C$;LOS$
7320 IF ECF(1) THEN CLOSE #1 ELSE GOTO 7305
7395 PRINT #3,LCE$;LCB$;LOA$;TW$;LOS$;LOA$;LCA$
7400 PRINT #3,LCE$;LCB$;LOA$;TB$;LOS$;LOA$;LCA$
7405 PRINT #3,LCE$;LCB$;LOA$;TA$;LOS$;LOA$;LOA$
7410 PRINT #3,LCE$;LCB$;LOA$;TD$;LOS$;LOA$;LOA$
7415 PRINT #3,LCE$;LCB$;LOA$;TZZ$;LOS$;LOA$;LOA$
7420 PRINT #3,LCE$;LCB$;LOA$;TC$;LOS$;LOA$;LOA$
7425 PRINT #3,LCE$;LCB$;LCA$;TG$;LOS$;LOA$;LCA$
7430 PRINT #3,LCE$;LCB$;LCA$;TH$;LCS$;LCA$;LOA$
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7435 PRINT #3,LCE$;LCB$;LCA$;TC$;LCS$;LCA$;LCA$
7440 PRINT #3,LCE$;LCB$;LCA$;TR$;LCS$;LCA$;LCA$
7445 PRINT #3,LCE$;LCB$;LCA$;TM$;LCS$;LCA$;LCA$
7450 PRINT #3,LCE$;LCB$;LCA$;TN$;LCS$;LCA$;LCA$
7455 PRINT #3,LCE$;LCB$;LCA$;TK$;LCS$;LCA$;LCA$
7460 PRINT #3,LCE$;LCB$;LCA$;TL$;LCS$;LCA$;LCA$
7465 PRINT #3,LCE$;LCB$;LCA$;TY$;LCS$;LCA$;LCA$
7470 PRINT #3,LCE$;LCB$;LCA$;TP$;LCS$;LCA$;LCA$
7475 PRINT #3,LCE$;LCB$;LCA$;TI$;LCS$;LCA$;LCA$
7480 PRINT #3,LCE$;LCB$;LCA$;TJ$;LCS$;LCA$;LCA$
7485 PRINT #3,LCE$;LCC$;LCA$;TW$;LCS$;LCA$;LCA$
7500 PRINT #3,LCE$;LCC$;LCA$;TB$;LCS$;LCA$;LCA$
7505 PRINT #3,LCE$;LCC$;LCA$;TA$;LCS$;LCA$;LCA$
7510 PRINT #3,LCE$;LCC$;LCA$;TD$;LCS$;LCA$;LCA$
7515 PRINT #3,LCE$;LCC$;LCA$;TZZ$;LCS$;LCA$;LCA$
7520 PRINT #3,LCE$;LCC$;LCA$;TC$;LCS$;LCA$;LCA$
7525 PRINT #3,LCE$;LCC$;LCA$;TG$;LCS$;LCA$;LCA$
7530 PRINT #3,LCE$;LCC$;LCA$;TH$;LCS$;LCA$;LCA$
7535 PRINT #3,LCE$;LCC$;LCA$;TC$;LCS$;LCA$;LCA$
7540 PRINT #3,LCE$;LCC$;LCA$;TR$;LCS$;LCA$;LCA$
7545 PRINT #3,LCE$;LCC$;LCA$;TM$;LCS$;LCA$;LCA$
7550 PRINT #3,LCE$;LCC$;LCA$;TN$;LCS$;LCA$;LCA$
7555 PRINT #3,LCE$;LCC$;LCA$;TK$;LCS$;LCA$;LCA$
7560 PRINT #3,LCE$;LCC$;LCA$;TL$;LCS$;LCA$;LCA$
7565 PRINT #3,LCE$;LCC$;LCA$;TY$;LCS$;LCA$;LCA$
7570 PRINT #3,LCE$;LCC$;LCA$;TP$;LCS$;LCA$;LCA$
7575 PRINT #3,LCE$;LCC$;LCA$;TI$;LCS$;LCA$;LCA$
7580 PRINT #3,LCE$;LCC$;LCA$;TJ$;LCS$;LCA$;LCA$
8020 CLOSE #3
8025 CLS
8030 LOCATE 4,15 :PRINT "==================================================="
8035 LOCATE 5,15 :PRINT "A MICRO-PROLOG FILE HAS BEEN PREPARED FOR YOU "
8040 LOCATE 6,15 :PRINT "ON THE DATA DISK IN THE NAME OF "OUFILE$
8045 LOCATE 7,15 :PRINT "PRESS RETURN KEY TO GO BACK TO PREVIOUS  MENU"
8050 LOCATE 8,15 :PRINT "==================================================="
8055 LOCATE 10,37 : INPUT MICRT$
8060 GOTO 6615
8200 CLS
8205 LOCATE 5,15:PRINT"SORRY...THIS IS NOT READY YET;.PRESS RETURN TO GO BACK TO
     MENU"
8210 LOCATE 6,50: INPUT NOTREADY$
8215 GOTO 6615
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APPENDIX D

THE MYERS-BRIGGS TYPE INDICATOR

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APPENDIX E

THE STATE-TRAIT ANXIETY INVENTORY

APPENDIX F

THE PERSONAL STRAIN QUESTIONNAIRE

APPENDIX G

COMPANY B PROLOG STATEMENTS

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((performed-by analyzing-labour-hours production-manager))
((performed-by reviewing-personnel production-manager))
((performed-by monitoring-expenses-pr production-manager))
((performed-by controlling-slimline production-manager))
((performed-by controlling-stores production-manager))
((performed-by interviews-new-estimat estimating-manager))
((performed-by costing-new-window-range estimating-manager)
((performed-by visting-clients-est estimating-manager))
((performed-by liasing-with-co-peers estimating-manager))
((performed-by reestimating estimating-manager))
((performed-by dealing-with-documents estimating-manager))
((performed-by writing-specifications estimating-manager))
((performed-by processing-enquiries estimating-manager))
((performed-by producing-estimates estimating-manager))
((performed-by processing-client-order gas-production-manager))
((performed-by purchasing & stock-control gas-production-manager))
((performed-by gas-forward-loading gas-production-manager))
((performed-by monitoring-production gas-production-manager))
((performed-by liasing-with-accounts gas-production-manager))
((performed-by preparing-order-sheets gas-production-manager))
((performed-by gas-purchasing gas-purchasing-manager))
((performed-by monitoring-stock-levels gas-purchasing-manager))
((performed-by visiting-gas-suppliers gas-purchasing-manager))
((performed-by revising-costs-lists gas-purchasing-manager))
((performed-by gas-job-assignments gas-planning-manager))
((performed-by advising-on-estimation gas-planning-manager))
((performed-by gas-design-work gas-planning-manager))
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((performed-by answering-gas-cus-query gas-planning-manager))
((performed-by sets-gas-prod-priority gas-planning-manager))
((performed-by new-product-development gas-planning-manager))
((performed-by reports-on-con-status gas-planning-manager))
((performed-by gas-estimating gas-estimating-manager))
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((performed-by gas-monitoring-purch general-manager))
((performed-by gas-monitoring-producti general-manager))
((performed-by gas-sales-function general-manager))
((performed-by setting-margins & discoun general-manager))
((performed-by monitors-industr-relat general-manager))
((produced-by process-status-report reviewing-suppliers))
((produced-by supply-status-request reviewing-suppliers))
((produced-by process-status-report reviewing-suppliers))
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((produced-by contract-coordination liasing-with-peers))
((produced-by workable-program form-workable-programs))
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((produced-by value-of-work-issued valuing-work-issued))
((produced-by work-value valuing-work-issued))
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((produced-by site-due-date valuing-work-issued))
((produced-by mode-of-production valuing-work-issued))
((produced-by fixing-requirements valuing-work-issued))
((produced-by procurement-meeting reviewing-procurement))
((produced-by material-status-report reviewing-procurement))
((produced-by work-load-schedule scheduling-work-loads))
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((provides planning-manager values-of-project))
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((provides supplier materials-accepted))
((provides accounting-dept company-accounts))
((provides accounting-dept analysis-of-overheads))
((provides jgw finance-needs))
((provides accounting-dept accounts))
((provides production-director view-on-expenditure))
((provides sales-director views-on-expenditure))
((provides managing-director view-of-expenditure))
((provides estimating-manager knowledge-on-contract))
((provides managing-director knowledge-on-contract))
((provides sales-director knowledge-on-contract))
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((provides main-contractor site-agent-reports))
((provides sub-contractors-fixer weekly-fixer-status-report))
((provides service-engineers maintenance-reports))
((provides installation-dept monthly-work-completed))
((provides supplier suppliers-invoices))
((provides site-managers field-status-report))
((provides planning-dept order-information-sheet))
((provides despatch-foreman agreement-on-despatch))
((provides site-managers materials-missing))
((provides sub-contractors-fixer materials-missing))
((provides drawing-office-manager weekly-issue-report))
((provides production-manager weekly-productivity-report))
((provides planning-manager weekly-issue-to-factory))
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((provides production-manager gas-meetings-conversat))
((provides general-manager gas-meetings-conversat))
((provides managing-director gas-meetings-conversat))
((provides production-director factory-capability))
((provides production-director factory-limitations))
((provides sales-director sales-forecasts))
((provides unions union-meetings))
((provides production-manager shop-and-staff-reports))
((provides drawing-office-manager staff-and-office-reports))
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((provides sales-director sales-forecasts))
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((provides drawing-office-manager orders-contracts-recvd)
((provides material-planning-mgr orders-contracts-recvd))
((provides supplier chasing-payments))
((provides jgw finance-requests))
((provides gas finances-request))
((provides estimating-dept enquiry-to-be-processed))
((provides sales-director commercially-viable-decision))
((provides estimating-manager commercial-viable-decision)
((provides sales-director decision-to-tender))
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((receives despatch-foreman gas-despatch-coordination))
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((receives gas-production-manager order-intake-sheet))
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((receives accounts-dept gas-manufacturing-order-3))
((receives gas-customer gas-manufacturing-order-4))
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((receives stores gas-stock-order))
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((receives general-manager week-gas-stock-of-bars))
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((receives gas gas-new-product-design))
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((receives gas-architect gas-setting-out-sheet-5))
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((receives managing-director gas-order-intake-by-prod))
((receives managing-director gas-quot-recvd- &- quoted))
((receives managing-director gas-forw-load-analysis))
((receives managing-director gas-margins-set))
((receives managing-director gas-market-status))
((receives financial-director gas-trends))
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((uses valuing-progress advice-notes))
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((uses cash-flow-reporting monthly-applications-submitted))
((uses monitoring-retentions list-of-maintenance))
((uses monitoring-retentions status-of-retention-list))
((uses submitting-claims delays-on-site))
((uses machine-procurement machine-need))
((uses developing-tools contract))
((uses controlling-stores materials-received))
((uses controlling-stores materials-checked))
((uses controlling-stores pre-plan-sheet-st))
((uses checking-prod-quality quality-checks))
((uses machine-repairs request-for-repair))
((uses preparing-time-sheets labour-hours-ms))
((uses preparing-time-sheet-fs labour-hours-fs))
((uses preparing-time-sheet-des labour-hours-despatch))
((uses preparing-time-sheet-ps labour-hours-ps))
((uses coordinating-despatch date-to-send-materials))
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((uses planning-shop-work coordination-meeting))
((uses planning-shop-work planned-production-sheets))
((uses planning-shop-work contract-project-file))
((uses planning-shop-work planned-production-sheets))
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((uses materials-coordination material-status-or-request))
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((uses instructing-foremen project-priority-request))
((uses instructing-foremen production-problems))
((uses instructing-foremen overtime-work-to-do))
((uses valuing-work-completed shop-work-completed))
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((uses reviewing-personnel knowledge-of-personnel))
((uses monitoring-expenses-pr consumable-expenses))
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((uses controlling-stores stores-problems))
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((uses costing-new-window-range labour-costs-est))
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((uses liasing-with-co-peers delivery-time))
((uses liasing-with-co-peers site-time))
((uses liasing-with-co-peers drawing-time))
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((uses dealing-with-documents sub-contract-documents))
((uses writing-specifications client-enquiry))
((uses writing-specifications client-drawings))
((uses processing-enquiries client-enquiry))
((uses producing-estimates processes-enquiry))
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