



PERS 326 A MODEL FOR THE PREDICTION OF
EFFECTIVENESS AS A RESEARCH LEADER

001.3072068 CSIR NIPR PERS 326

CSIR Special Report PERS 326 (i - viii; 1 - 117)

UDC 301.172.62: [5.007+6.007] (680)

Johannesburg, Republic of South Africa, September 1981

NASIONALE INSTITUUT VIR PERSONEELNAVORSING
WETENSKAPLIKE EN NYWERHEIDNAVORSINGSRAAD
NATIONAL INSTITUTE FOR PERSONNEL RESEARCH
COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

BIBLIOTEK LIBRARY

RGN

RAAD VIR
GEESTESWETENSKAPLIKE
NAVORSING

HSRC

HUMAN
SCIENCES RESEARCH
COUNCIL



RGN · HSRC



SPECIAL REPORT

PERS 326: A MODEL FOR THE PREDICTION OF
EFFECTIVENESS AS A RESEARCH LEADER



RGN-HSRC

RGN-BIBLIOTEEK

HSRC LIBRARY

VERVALDATUM/DATE DUE

--	--	--	--

CS
UD
Jo

981

NA
COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

0000995745



158.4 80E



* 0 3 3 5 7 4 *

ISBN 07988 1872 7

CSIR Special Report PERS 326

Published by
National Institute for Personnel Research
Council for Scientific and Industrial Research
PO Box 32410
Braamfontein
2017

Printed in the Republic of South Africa by
National Institute for Personnel Research

January 1982

ACKNOWLEDGEMENTS

Director : Dr GK Nelson
Assistant Director : Mr RF Skawran
Head, Management Studies Division: Dr J van Rooyen
Personnel Assessment : Mr J de Jager

This report forms part of a MA dissertation, 'Predicting Effective Research Leadership', accepted by UNISA in June 1981.

RGN BIBLIOTEK HSRC LIBRARY	
1981-10-07	
STANDEKODE 001.5072068 COIN LIBRARY 016	REGISTRASIONUMMER
BESTELNOMMER 3115	056563 6

S U M M A R Y

This study is aimed at predicting effective research leadership potential. Early identification of leadership potential could assist in the purposeful development of individuals with the necessary abilities to progress to management level.

A survey of the literature indicated that recent approaches to leadership stress interaction between the leader and his environment. A model incorporating Fiedler and Leister's (1979) Multiple Screen model and the conceptual framework of Campbell, Dunnette, Lawler and Weick (1970) was developed and tested. This model attempts to account for specific consideration of the job demands, leading, on the one hand, to a suitably adapted leader profile for prediction purposes and, on the other hand, to a basis which could be used for the development of potentially promising leaders.

The leader profile included personal characteristics, modes of behaviour and management style. The main hypothesis stated that the way in which the personality variables interact will result in more or less effective research leadership. These variables dealt with intellectual ability, anxiety, role conflict, technical competence and interpersonal behaviour. The sub-hypotheses tested specific interaction patterns and relationships.

Using a sample of senior research workers (N = 92) the results indicate that apart from above average intellectual ability and the necessary academic qualifications, the management style of the research leader is the most important independent variable influencing performance. Although a management style in which a balance between providing structure and consideration for people was seen as desirable, the emphasis was on compromise and maintaining the status quo.

O P S O M M I N G

Die studie is gemik op die voorspelling van navorsersleierspotensiaal. Vroegtydige identifisering van leierspotensiaal kan bydra tot die doelgerigte ontwikkeling van mense wat oor die nodige vermoëns beskik om te vorder tot bestuursposisies.

'n Oorsig van die literatuur dui daarop dat onlangse benaderings tot leierskap die interaksie tussen die leier en sy omgewing beklemtoon. 'n Model waarin Fiedler en Leister (1979) se "Multiple Screen Model" en konseptualisasie van Campbell, Dunette, Lawler en Weick (1970) geïnkorporeer is, is ontwikkel en getoets. Hierdie model neem spesifiek die taakvereistes in aanmerking wat lei tot 'n aangepaste leiersprofiel, vir voorspellingsdoeleindes, en 'n basis wat gebruik kan word in die ontwikkeling van potensieel belowende leiers.

Die leiersprofiel sluit in persoonlike eienskappe, gedrag en bestuurstyl. Die hoof hipotese stel dat die manier van interaksie tussen die persoonlikheidsveranderlikes dui op die mate van effektiwiteit van effektiewe navorsingsleierskap. Die veranderlikes sluit in: intellektuele potensiaal, angs, rolkonflik, tegniese vaardigheid en interpersoonlike gedrag. Die sub-hipoteses toets spesifieke interaksies.

Die steekproef het bestaan uit senior navorsers (N = 92). Die resultate dui daarop dat benewens intellektuele potensiaal en die nodige formele akademiese kwalifikasies, die bestuurstyl van die navorsingsleiers die belangrikste onafhanklike veranderlike is wat verrigting beïnvloed. Hoewel 'n bestuurstyl waarin 'n balans tussen mense- en produksieoorwegings gesien word as wenslik, is die klem op die aangaan van kompromieë en handhawing van die status quo.

C O N T E N T S

	<u>Page</u>
SUMMARY	i
LIST OF TABLES	vi
LIST OF FIGURES	viii
LIST OF GRAPHS	viii
CHAPTER 1	
1 JUSTIFICATION AND AIMS OF THE STUDY	2
1.1 The need for research leadership	2
1.2 Justification for the study	4
1.3 Aims of the study	6
1.4 Leadership defined	7
1.4.1 Leadership style and leader behaviour	9
1.4.2 Leadership and management	10
1.4.3 Leadership effectiveness	12
CHAPTER 2	
2 THEORETICAL PERSPECTIVES, STATEMENT OF THE PROBLEM, PROPOSED MODEL AND HYPOTHESES	15
2.1 Theoretical principles upon which the study is based	15
2.1.1 Multiple Screen Model	15
2.1.2 The person-process-product model of leadership effectiveness	17
2.1.3 Personality and leadership effectiveness	17
2.1.3.1 Intelligence	18
2.1.3.2 Handling of stress	20
2.1.3.3 Interpersonal relationships	22
2.1.3.4 Leader experience	24
2.1.3.5 Role perception	25
2.2 Model for effective research leadership	26
2.2.1 Job description (process)	27
2.2.2 Leader profile (person)	28
2.2.3 Performance criteria (product)	29
2.3 Statement of the problem	30

	<u>Page</u>	
2.4	Formulation of hypotheses	31
2.4.1	Hypothesis 1	32
2.4.2	Hypothesis 2	33
2.4.3	Hypothesis 3	33
2.4.4	Hypothesis 4	34
2.4.5	Hypothesis 5	34
 CHAPTER 3		
3.	RESEARCH DESIGN	37
3.1	The sample	37
3.2	Testing of the model	37
3.2.1	Measuring instruments - predictors (person)	39
3.2.2	Intellectual ability	39
3.2.3	Personality measurements	40
3.2.4	Management style	47
3.2.5	Role perception	48
3.2.6	Biographical information	50
3.3	Development of the criteria (product)	50
3.3.1	Performance appraisal	51
3.3.2	Rate of advancement in terms of salary	52
 CHAPTER 4		
4.	ANALYSIS OF THE DATA AND RESULTS	55
4.1	The predictor variables	56
4.2	Criterion variables	63
4.3	Correlations between independent and dependent variables	74
4.4	Regression analysis with the criteria as dependent variable	77
4.4.1	Regression analysis with weighted Research Leadership Efficiency as criterion	80
4.4.2	Regression analysis with General Research Efficiency as criterion	81
4.4.3	Regression analysis with Subordinate Efficiency as criterion	84

	<u>Page</u>
4.4.4 Regression analysis with Interpersonal Efficiency as criterion	85
4.4.5 Multiple regression analysis with Task Efficiency as criterion	86
4.4.6 Multiple regression analysis with Salary Progress as criterion	87
4.5 Regression analysis with the management style as as dependent variable	87
4.6 Testing of the hypotheses	92
4.7 Conclusion	94
 CHAPTER 5	
5. DISCUSSION OF RESULTS, CONCLUSION AND RECOMMENDATIONS	97
5.1 Discussion of results	97
5.1.1 Criterion for research leadership effectiveness	98
5.1.2 General profile of an effective research leader	99
5.1.3 General profile of an effective senior researcher	100
5.1.4 Discussion of the differences	104
5.1.5 Implications	105
5.2 Conclusion	106
5.3 Recommendations	108

LIST OF TABLES

	<u>Page</u>	
4.1	Statistical description of Mental Alertness, Deductive Reasoning, SAPQ and Willemse Board	56
4.2	Statistical description of SMI	58
4.3	Frequency table of sibling rank	60
4.4a	Intercorrelations between predictor variables	61
4.4b	Intercorrelations between predictor variables	62
4.5	Statistical properties of the ratings of the importance of each work aspect by the supervisors	64
4.6	The difference in rating work aspects between research disciplines	65
4.7	Discriminant functions evaluated at group centroids for the research disciplines	67
4.8	Distance between centroids of disciplines	67
4.9	Eigen values and percentage of variance yielded by factor analysis of questionnaire	69
4.10	Oblique factor structure matrix after rotation with Kaizer normalisation on the effectiveness ratings	70
4.11	Intercorrelation matrix of the factors extracted	71
4.12	Statistical properties of the additional criteria	72
4.13	Correlation matrix of the variables in the regression analyses	72
4.14	Summary of regression analysis with salary as criterion	73
4.15	Intercorrelation matrix of criterion scores	74
4.16	Correlation between component scores of the SMI and criteria	75
4.17	Correlation between predictor variables and criteria	76
4.18	Significant non-linear predictors	79
4.19	Regression analysis - research leader efficiency	80
4.20	Regression analysis - general research efficiency	81

	<u>Page</u>	
4.21	Summary of multiple regression with subordinate efficiency as criterion	84
4.22	Summary of multiple regression with interpersonal efficiency as criterion	85
4.23	Summary of multiple regression with task efficiency as criterion	86
4.24	Summary of multiple regression with salary progress as criterion	87
4.25	Correlations of the variables in the regression analysis	88
4.26	Regression analysis on 9/9 Management Style	89
4.27	Regression analysis on 5/5 Management Style	90
4.28	Regression analysis on 9/1 Management Style	91
4.29	Regression analysis on 1/1 Management Style	91

LIST OF FIGURES

	<u>Page</u>
2.1 Schematic representation of multiple screen model	16
2.2 Schematic representation of the proposed model for research leadership effectiveness	27
3.3 Testing of the model	38

LIST OF GRAPHS

	<u>Page</u>
Graph 1 Example of Willemse Score Plot	43

CHAPTER 1

1. JUSTIFICATION AND AIMS OF THE STUDY
 - 1.1 The need for research leadership
 - 1.2 Justification for the study
 - 1.3 Aims of the study
 - 1.4 Leadership defined
 - 1.4.1 Leadership style and leader behaviour
 - 1.4.2 Leadership and management
 - 1.4.3 Leadership effectiveness

1. JUSTIFICATION AND AIMS OF THE STUDY

1.1 The need for research leadership

In a developing country such as South Africa, with dynamic growth in nearly all fields of industry and commerce, leaders are needed. The development of resources plays an important role, but to ensure progress and growth, knowledgeable people with vision and dynamism are needed for future development.

While it is necessary to identify and train leaders for industry and commerce, those people who manage new technological developments and research are crucial for the future of this country. Research leaders are a scarce commodity. They can be seen as agents of change who can, to a large extent, shape the direction and set the tempo for new developments. The demand for such talent, as is the case with all scarce commodities, outstrips the supply. In order to ensure continued progress, a sound and workable programme for identifying potential research leaders and developing their talents is needed.

The National Institute for Personnel Research (NIPR) has, since its inception in 1945, been involved in research regarding man at work in this country. In this context, personnel assessment research of the Institute played an important role and over the years predictive techniques have been developed for a variety of job categories.

The interpretation of test results in relation to the job demands tends to be relatively restricted as far as research leadership is concerned. This may be due to the fact that job performance on this level cannot easily be translated into testable behaviour. Valid information on a candidate's ability to handle the intellectual demands of the job can easily be obtained, but assessing his problem solving ability or originality in deciding effectively on research management issues still remains problematic.

Although investigations regarding the intelligence of the research scientist, working and thinking habits of researchers, management and training investigations were carried out, the development of a more specific prediction model for research leadership still required investigation.

The research environment itself also plays a role and should be considered. It is reasonable to assume that situational influences may impact ability-behaviour relationships in the same way as personality-behaviour relationships are affected. The research leader is no longer seen as the intellectual working in the relative seclusion of his laboratory and only in contact with others in his field. He must be a dynamic manager of ideas, working with and through people, a person who has a clear understanding of the needs and issues involved not only in his own field of expertise, but also in other fields. He must know and take cognisance of the fact that his research may have an influence on society as a whole and plan accordingly.

The research leader thus has to fill many roles and should have a variety of skills, some unrelated to his field of study and expertise. He must, for example, be:

- a technically competent researcher;
- creative and a generator of ideas;
- an entrepreneur championing projects and see to the execution thereof;
- a planner and co-ordinator of the contributions of others;
- a communicator who relays technical information;
- a budgetor who may also have to find sponsors;
- a supervisor and mentor of people.

The researcher is a specialist but the research leader should be a generalist. In transforming an efficient researcher into a generalist or research leader, certain fundamental value systems might be involved. The scientist, by the nature of his work, is used to furthering knowledge by experimenting, controlling of variables, precise and objective measurements and procedures. He only draws conclusions when the quality and quantity of his data is sufficient. The leader, on the other hand, seeks knowledge in order to act and he has to draw conclusions even if the information at his disposal is incomplete. When investigating research leadership, cognisance should therefore be taken not only of the complexity of the research environment and the special demands this makes on the leader, but also of interaction between the person and his environment.

The dynamics involved in research leadership may differ from those found in management generally and justify separate investigation.

1.2 Justification for the study

"To survive and grow, organizations must engage in continuing research on the relevance of knowledge" (Jun, 1973, p.11).

Organisational effectiveness is therefore directly related to the degree to which organisational goals are realised. The official goals refer to the general purpose of the organisation, and the operative goals to what the organisation is trying to achieve through its operating policies.

Broadly speaking, the official goal of a research organisation can be defined as meeting challenges. The activities of each of the research disciplines within the organisation are, to some extent, dictated by the needs of industry and new developments within the discipline. It is only through utilising human resources that the organisation can accomplish its goal. An operative goal, then, should also be the training and educating of researchers in order to ensure survival of the organisation.

Price (in Lawless, 1979) concluded that productivity, morale, ideological conformity, flexibility and the support an organisation receives from its environment are the most relevant indices of organisational effectiveness. Organisation effectiveness is also related to the effectiveness of its management system which, in turn, is dependent on the management team. The management team, in turn, consists of individual managers. The individual thus forms the basis upon which an organisation is built. Both Argyris (1964) and Likert (in Lawless, 1979) have emphasised human behaviour and the interaction between individual employees and the organisation as the main factor contributing to the effectiveness of the organisation. In addition, organisational goals are more likely to be accomplished when individual members feel that their personal goals and needs are reflected in their organisational role.

In planning the future of a research organisation, where challenges in such areas as space science, thermo-nuclear power, bio-medical engineering, ecology, and dwindling energy resources will have to be met, it is of the greatest importance to bear in mind the identification of the researchers with leadership potential at an early stage. Once researchers with leadership potential are identified, it is of the greatest importance that their potential should be developed in a purposeful manner.

This study is motivated by the perceived need of a large research orientated organisation to identify potential research leaders at the time of appointment, since they constitute a valuable asset not only to the organisation, but to the country as a whole. Early identification could help in the purposeful development of leadership potential and enhance the organisation's ability to meet research challenges of the future.

1.3 Aims of the study

The specific techniques that have been developed over a period of more than thirty years by the NIPR for selecting researchers provide valid predictors for meeting intellectual and routine research demands. However, research leadership has not received the attention such an important area should have. The reasons for this might be that the criterion for effectiveness is multidimensional and that the job demands are of such a nature that it cannot easily be translated into observable or testable behaviour. Hence, the knowledge of research leadership remained

incomplete and the prediction of effectiveness confined to specific areas of functioning. The implication of this might be that human potential is not optimally utilised with the resulting implication that the organisation is less effective than it could be.

By identifying research leadership potential at the time of appointment, organisational effectiveness can be enhanced by timely development of leadership potential. The situation at present, where an employee has to move through the ranks until such a time as he is considered experienced or senior enough to head research, may result in frustration and disenchantment of individuals with leadership aspirations or potential. In addition, the organisation is also, under these circumstances, not utilising its human potential fully and hence functioning at a less effective level.

While this study is aimed at but one aspect concerning organisational effectiveness, it is hoped that by investigating the dynamics involved in research leadership and developing and testing a prediction model, a contribution can also be made regarding the basic knowledge of leadership in research organisations.

1.4 Leadership defined

"There are almost as many definitions of leadership as there are persons who have attempted to define the concept" (Stogdill, 1974, p.7). Although leadership has been defined in numerous ways, each stressing a different aspect of the phenomenon, leadership remains an integral part of all interpersonal behaviour. The notion that leadership is the focus of group processes is shared by most writers on the subject (Stogdill, 1974; Barrow, 1977). Leadership, even though

it cannot emerge in social isolation, has also been described in terms of personality traits, an art, behavioural acts, an instrument of goal attainment (McCall, 1976; Stogdill, 1974). McCall (1976) concluded that the definitional problems with the term leadership have contributed to the proliferation of terms to describe the concept. We thus have a situation where, although leadership acts are taking place all the time in various situations and settings, a parsimonious definition which describes the phenomenon adequately and not in terms of specific situations is still lacking.

Writers such as Bass (Petruccio and Bass, 1961, p.81) have defined leadership in very broad terms: "... the interaction between members of a group", and then explained the interaction process in behavioural terms. Fiedler (1967), in turn, stressed the variables significant to leadership effectiveness without defining the concept "leadership". He sees the variables as leader-member relations, task structure and power position. He defines the leader as "... the individual in the group given the task of directing and co-ordinating task-relevant group activities or who, in the absence of a designated leader, carries the primary responsibility for performing these functions in the group" (Fiedler, 1967, p.8). He thus also concedes that leadership is a social process.

In addition to the definitions, various models, theories and leadership approaches dealing with leader effectiveness, leader impact on the organisation, on subordinates and vice versa, have evolved. It is thus hardly surprising to find that some researchers address themselves to the question of whether leadership is a viable scientific construct (McCall, 1976, 1977; Miner, 1978; Calder, 1977).

Karmel (1978) sees in the ambiguity of the concept "leadership" the possibility of opening up new avenues through which a better understanding can evolve. The ambiguity is seen as resulting from the diversity of purposes for researching leadership. She then proposes that as no single model adequately describes the concept, certain dimensions within general clusters of purpose should be identified. The integration of research results and generalising from one study to the next have always been problematic and it is hoped that with such an approach some progress would be possible.

The strategy to follow seems to be one built on assumptions that have not been questioned. The first assumption being that leadership does matter in achieving organisational effectiveness, and the second that the leader's personal style is a critical variable (McCall, 1977). A third assumption is that the leadership process is an interaction process (Berrien, in Petrullo and Bass, 1961; Cribbin, 1972; Zander, in Rosenzweig and Porter, 1979).

The approach followed in this study is based on interaction, the assumption being that various leader and organisational variables, in interaction, affects leadership outcomes.

1.4.1 Leadership behaviour and leadership style

While leader behaviour and leadership style cannot readily be separated, Fiedler (1967) and Cribbin (1972) suggested that leadership style refers to the personal needs of the leader which he strives to satisfy by utilising his specific leadership style and that behaviour patterns refer to the characteristics that define his daily behaviour.

Taylor (1976) argues that by separating style from behaviour, conceptualisation free from situation dependence can be achieved. Leadership behaviour is also defined by Welte (1978, p.632) as the "amount and type of leader-follower(s) interaction arranged by the leader". If the leadership style evolves from the personal needs the leader tries to satisfy, it should follow that personality factors also play a role in shaping his management (leadership) style.

Bass (in Bass, Cooper and Haas, 1970) suggested that the leader with a task orientated management style derives intrinsic satisfaction from the work itself. His behaviour is characterised by endurance and persistence and not related to a need for achievement. It can thus be seen that leader behaviour and leadership style cannot be totally kept apart.

In this study both leadership style and leader behaviour will be investigated and an attempt made to indicate, where possible, the relationship between leadership style and leader behaviour.

1.4.2 Leadership and management

Some researchers are careful to distinguish between leadership and management (Shriesheim, Toliver and Behling, 1978) and stress that leadership concentrates on interpersonal interactions between leader and subordinate with the purpose of increasing organisational effectiveness. Others, such as Welte (1978), see leadership as the innate, as well as learned, ability, skill and personal characteristics necessary to conduct interpersonal relations which influence people to take desired actions.

According to Cribbin (1972), management and leadership should be kept distinct because they are different, though related, concepts. In theory, according to him, the skills of management can be combined with the "talents" of leadership to attain organisational goals. He sees leadership as primarily relying on personal resources to get people to do as the leader wishes (persuasion), while the manager has ample organisational resources to force subordinates to engage in the desired actions (coercion). Management effectiveness has been related to the leadership style employed by the manager (Megginson, 1968) but the leadership style, in turn, seems to be dependent upon the interaction between characteristics of the manager, characteristics of the subordinate and the situation.

The management style preferred by the manager, according to Cribbin (1972), devolves from the personal needs of the executive which he strives to satisfy as he carries out his leadership function. Management refers to co-ordination of the work performed by the job incumbent (Welte, 1975).

"The term management includes those processes, both mental and physical, which result in other people executing prescribed formal duties for organisational goal attainment" (Schriesheim, Toliver and Behling, 1978, p.34).

To Karmel (1977), leadership is not a single concept but depends on the purpose of the investigation that the term is used for. It could thus be "behaviour that makes a difference in the behaviour of others". In these terms, leadership can be conceptualised as either a process or a determinant of behaviour directed towards attaining certain goals.

Leadership functions seem to form only part of the managerial job, but might encompass one of the most important dimensions of management. In addition, a leadership position is awarded on merit and not birth, political or other affiliations. Management does not necessarily imply leadership (a person can manage without leading people).

For the purpose of this study, the term 'leadership' will be used, and a research leader defined as a person with specialised knowledge who, through the utilisation of physical and human resources, transforms ideas and visions into operational results or useable products.

1.4.3 Leadership effectiveness

Leadership is usually defined as a behavioural process of influencing individuals or groups towards attaining set goals, and effectiveness as how well these goals are attained (Barrow, 1976). However, leadership effectiveness cannot only be an index of group productivity. Leadership effectiveness involves a number of areas of functioning, including non-subordinate relationships.

Only a few studies have attempted to relate leadership effectiveness and criteria of scientific productivity (Pelz and Andrews, 1966; Cotgrove and Box, 1970; Andrews and Ferris, 1967). Most of these studies, while failing to be conclusive, stress the point that leadership behaviour does matter in attaining success in research teams. Leader effectiveness has increasingly been investigated in terms of leader interaction with the group and the resulting impact on the group. Regardless of the researcher's theoretical stance, the definition of what is considered as being effective usually focusses on either the leader behaviour or the effect of the leader on the group processes or outcomes.

Pelz and Andrews (1966) see the effectiveness criteria for research leaders as the evaluation of the scientist's work by his superiors or peers on the contribution to general, technical or scientific knowledge in his field of expertise, their usefulness in helping the organisation carry out its responsibilities, as well as the number of papers published, and the products, (patents, technical papers). Effectiveness, if viewed in terms of these aspects, means not only expertise, vision and creativeness, but also commitment to the goals of the organisation.

Research by Campbell, Dunnette, Lawler and Weick (1970) stresses that leadership effectiveness depends to a large extent on identifying and judging observable actions and behaviours leading to the accomplishment of the goals of the organisation. Leadership effectiveness therefore involves a number of areas of functioning, including how well the leader deals with non-subordinate relationships and how he structures, designs, modifies and develops human resources while coping with and creating change (McCall, 1976).

Research leadership effectiveness in this study is defined as how well the job incumbent is able to conceptualise new ideas in keeping with the organisational goals and is able to transform such ideas and visions into operational results or useable products by utilising his specialised knowledge, and physical and human resources.

CHAPTER 2

- 2. THEORETICAL PERSPECTIVES, STATEMENT OF THE PROBLEM, PROPOSED MODEL AND HYPOTHESES
 - 2.1 Theoretical principles upon which the study is based
 - 2.1.1 Multiple Screen Model
 - 2.1.2 The person-process-product model of leadership effectiveness
 - 2.1.3 Personality and leadership effectiveness
 - 2.1.3.1 Intelligence
 - 2.1.3.2 Handling of stress
 - 2.1.3.3 Interpersonal relationships
 - 2.1.3.4 Leader experience
 - 2.1.3.5 Role perception
 - 2.2 Model for effective research leadership
 - 2.2.1 Job description (process)
 - 2.2.2 Leader profile (person)
 - 2.2.3 Performance criteria (product)
 - 2.3 Statement of the problem
 - 2.4 Formulation of hypotheses
 - 2.4.1 Hypothesis 1
 - 2.4.2 Hypothesis 2
 - 2.4.3 Hypothesis 3
 - 2.4.4 Hypothesis 4
 - 2.4.5 Hypothesis 5

2. THEORETICAL PERSPECTIVES, STATEMENT OF THE PROBLEM, PROPOSED MODEL AND HYPOTHESES

2.1 Theoretical principles upon which the study is based

The selection of people with the greatest potential to become effective research leaders forms the focus of this study. Personnel selection has as one of its most salient features the assessment of individual differences for the prediction of performance.

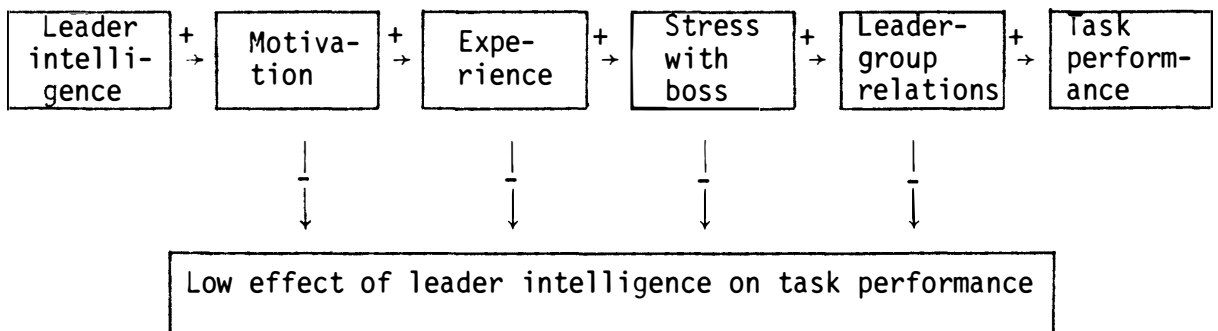
The question as to why some people are effective as leaders while others are not, even if variables such as qualifications, expertise, training, etc. are equal, has not been answered adequately. It is hoped that by studying the conditions which are conducive to the manifestation of research leadership behaviour, it will highlight relevant personality attributes which might, in interaction with certain environmental variables, lead to more or less effective leadership behaviour in a scientific environment. This necessitates a more detailed investigation of the scientific environment and the special demands it makes on the research leader, as well as the basic personality attributes necessary to function in this kind of environment, and subsequently to develop a prediction model.

2.1.1 Multiple Screen Model

The Multiple Screen Model (Fiedler and Leister, 1977) assumes that central to effective leadership functioning is the leader's intelligence. However, effective functioning is not only dependent on the innate cognitive ability level but also on a number of 'screens' (impeding or facilitating variables) which can either emanate from situational or personality factors. Those singled out by Fiedler relate to leader motivation, leader experience, leader-boss relations and leader-group relations.

He claims that these 'screens' or 'intervening variables' have the capacity to block, dilute or divert the product of the leader's intelligence in being translated to effective leader behaviour.

FIGURE 2.1: Schematic representation of Multiple Screen Model (Fiedler and Leister, 1977, p.4)



In developing the model the view that intelligence is linked to the performance of leaders was accepted. The investigators were aware of the disappointing results achieved by "simply correlating the leader's intelligence score with performance" and thus took into account the highly complex interaction of the leaders and the leadership situation, with the result that "intervening processes" which could affect performance formed the crucial focal point in the development of the model.

The idea of interaction raises more questions than it actually solves. It presupposes the ability of measuring the different facets of performance as well as the different and relevant organisational characteristics.

However, certain personality attributes may well hamper or facilitate functioning in a specific situation. Examination of some personality factors which may play a role in the effective functioning in a research leadership position thus seems to be a viable proposition for investigation.

2.1.2 The person-process-product model of leadership effectiveness

Campbell, Dunnette, Lawler and Weick (1970) proposed a person-process-product model of leadership effectiveness.

The person refers to the individual leader's characteristics and traits, the process to his behaviour on the job and the product to his effectiveness.

The process can then be seen as a function of the person, the behaviour, environmental influences and job characteristics. The product is seen as the outcome of his behaviour, his effectiveness. It was also stressed that although leader-specific characteristics may play a role, the job-specific demands, i.e. as they have implications for describing the required leadership qualities (possible predictors) and **the** required performance (possible criteria for success) should be taken into account. This model is closely linked to the theoretical framework of leadership effectiveness as proposed by Korman (1971) where leader characteristics, environmental factors (such as work demands which could be equated to the 'process' of Campbell), and leader behaviour factors which, again, could be linked to some extent to the 'product', are taken into consideration. The framework of Korman, however, provides only a conceptualisation of leadership and explores the possibility of integrating factors from diverse sources, but does not lead to a testable model, such as is possible with the Campbell et al (1970) model.

2.1.3 Personality and leadership effectiveness

A personality trait is defined by Allport (1937) as being some consistent quality in behaviour which characterises the individual in a wide range of his activities and which remains fairly constant over a period of time. 'Traits' refer to relatively

stable behavioural modes that individuals display over a period of time (Epstein in Magnusson, 1977). Cribbin (1972) stresses that the personality structure of a person is usually too settled to alter radically and that his personality make-up will make certain kinds of behaviour easy for him to engage in while he may find others difficult and others impossible.

The main dimensions of personality thus seem to remain fairly constant over time. These definitions imply that it should be possible to predict what behaviour can be expected of an individual. In selecting research workers for later leadership positions, the main ability traits may, under certain conditions, be of more importance than narrow occupational skills or present scholastic achievement.

2.1.3.1 Intelligence

Lawless (1972) stresses that intelligence is one of the most commonly referred to personality attributes and assumes that a certain level of intellectual functioning is a prerequisite for effectiveness in certain jobs.

From the studies of Mintzberg (1973) it is clear that the activities that leaders engage in are complex. Weick (in Lombardo, 1977) commented that a leader must be as complex as the situation he has to deal with. Mitchell (1972) has found that complex leaders have a higher performance on laboratory tasks than simple leaders. Complexity in this regard is coupled with flexible and open cognitive systems and the use of many dimensions in an integrated and combinational fashion as was defined by Suedfeld and Rank (1976).

Cognitive simplicity, on the other hand, is characterised by concrete responses and over-generalisation.

Cognitive complexity has been related to intelligence (Schroder, Driver and Streufert, 1967), adaptation (Piaget, 1952), and field independence (Wardell and Royce in Lombardo, 1977). Intelligence

is a factor underlying many kinds of cognitive tasks and some researchers believe that cognition can be summarised in a single global concept while others prefer to emphasise the multi-dimensional character of the concept (Carrol and Maxwell, 1979).

Intelligence and cognitive complexity are not identical but many of the same processes are involved, for example, analysing, information processing, analogous thinking, and logical reasoning, to name but a few.

A general definition of intelligence as suggested by Butcher (in Fiedler and Leister, 1977, p.1), "..... the ability to cope with problems in a rational manner by planning, organising, co-ordinating and evaluating alternative modes of action through the use of innate cognitive abilities" implies that the two concepts, though interrelated, cannot be equated.

While Fiedler and Leister (1977) fail to find significant correlations between leader intelligence and job performance, this does not mean that intelligence plays no role in how effective a leader might be in a specific leadership position. The indications rather seem to point in the direction that the most intelligent people are not necessarily the most effective leaders.

Studies of leadership effectiveness indicate that there may be some similarities between creativity and leadership effectiveness (Lombardo, 1977), and that creativity is linked to complexity, information processing, humour, simultaneous categorisation and unique associating ability.

Most leadership studies include a measurement of the level of cognitive functioning as a predictor of leadership functioning. In the proposed study, this is done for the same reason. In line with the Multiple Screen Model (Fiedler and Leister, 1977) it was felt that a model based on merely correlating leader intelligence with task performance is inadequate.

2.1.3.2 Handling of stress

It is a well-known fact that stress, unless successfully handled, can inhibit and interfere with optimal performance. Stress is also known to occur more frequently when an individual is faced with unfamiliar situations or problems; a situation which characterises the one in which the research leader has to function. Leaders may find moderate stress appealing, according to Anderson (1976), because it gives them the opportunity to take calculated risks (Schroder et al, 1967).

Most social psychologists theorise that anxiety is a product of interpersonal relations which later in life is caused by threats to one's security (Maddi, 1972).

Stress, either on the interpersonal or technical level, can be handled in various ways to reduce the frustration and feeling of helplessness associated with it:

- by using goal-directed behaviour - e.g. define the problem, set up structures, specify goals, plan;
- by fighting against it - e.g. aggression, regression, fixation (Behling and Schriesheim, 1976);
- by withdrawal - e.g. withdraw from the situation.

The last two modes mentioned are associated with less effective leadership, and cognitive complex people tend to gravitate towards the first mode mentioned (Lombardo, 1977).

A person's perception of a stressful situation is highly individual. One person might perceive a situation as stressful while another might not do so. The degree to which he feels capable of coping or handling a situation seems to be linked to the amount of stress a person perceives in a situation (Lombardo, 1977; Zuckerman and Mellstrom in Magnusson, 1977). McClelland (1961) postulated that achievers have a preference for situations in which the risk is proportionate to their resources for coping with it.

Freud has found that by separating affect from content, a person may adapt to a situation and the mature ego is described as responding to the affect as a signal which can be controlled (Baldwin, 1967). Although stress may occur on a medical-biological or on a social-psychological level, it is the latter, which is related to external and internal frustrations as well as pressures, which produce stress in a leadership position (Lawless, 1979). Stress arouses emotions such as anger, hostility, fear and anxiety, especially when a person does not feel capable of resolving the issues at stake.

The leadership position is one characterised by ambiguity and task complexity, often with no one to consult regarding important decisions. He may experience conflict regarding making unpleasant decisions, facing realities and this, in turn, may lead to avoidance or procrastination behaviours which may lead to decreased effectiveness. Cribbin (1972) claims that stress forces people to organise their behaviour to meet the situation, but that too much stress can be destructive. He mentions the following coping strategies:

- approach-approach;
- avoidance-avoidance;
- approach-avoidance.

The effects of anxiety on intellectual functioning have been extensively researched and indications are that intelligence scores suffer when anxiety is high. Moderate stress, on the other hand, seem to facilitate information processing (Fiedler, 1967). Stress seems to attenuate a person's ability to utilise his intellectual powers optimally.

2.1.3.3 Interpersonal relationships

Leadership implies interpersonal interaction, as was seen by the definition of leadership. In addition to this, man is, by his nature, committed to social co-existence (Hamburg in McGregor, 1967).

The studies of Mintzberg (1973) indicate that information exchange plays an important role in the activities of leaders. The interpersonal behaviours that a leader must partake in are complex and entails information exchange on a high level, dealing with peers, subordinates and superiors in formal and informal situations.

Pelz and Andrews (1966) report on research done over ten years in a variety of research and engineering organisations and point out that in addition to challenge, congenial working conditions contribute mostly towards productivity. Congenial working conditions are seen in this research as, inter alia, the ability to influence decisions, security and interpersonal cohesiveness.

A study by Barnowe (in Leboyer and Voisin-Vedrenne, 1978) indicates that isolation from the scientific community moderates the measure of assistance provided by the leader (interpersonal interaction) and also the general contribution to knowledge and applied practices.

Introversion/dependency is an indication of how group-dependent a person is and Barrow (1977) identified this as a factor affecting leadership effectiveness.

Introversion is furthermore determined, to some extent, by a lack of flexibility and this rigidity can be seen as a passive attitude towards the environment (Süssenguth, 1972).

The self-orientation of a person may be an indication of his self-concept and self-assuredness.

Fiedler and Leister (1977) used leader-boss and leader-group relationships as moderators in their Multiple Screen Model and stressed the anxiety which may be generated in these relationships. Regarding leader-group relationships, it was reported that leader intelligence and performance is higher in formal leadership groups (Heslin in Fiedler, 1977).

Other studies (Meuwese in Fiedler, 1977) found generally high positive correlations between leader intelligence and task performance in groups which accepted the leader and where harmonious relationships existed. It seems imperative that the leader must know how to obtain the acceptance and co-operation of his group, apart from his ability to organise the work and understand the group processes.

The 'style' a leader uses when dealing with subordinates has been extensively researched and various labels generated to describe what is essentially only two styles of leadership; a task-orientated leadership style and a person-orientated one. The human relations school emphasised a considerate, participative style (McCall, 1976) which provides for participation in decision making and hence accordingly increased satisfaction, but satisfaction does not necessarily lead to increased performance.

The data available at present indicate that leaders change their styles according to the situation that they have to deal with and the subordinate behaviours involved (McCall, 1977). The leader may have to choose between various behavioural 'styles' when dealing with a number of subordinates in different situations. It thus seems safe to conclude that no one leadership style is effective in all situations. However, if a leader does have a specific leadership style which does not allow for both consideration- and setting up structures-behaviour he may be more apt to fail as a leader. On the other hand, a leader who is not predictable and changes too much may also be less effective. Interpersonal competence thus seems to be an important variable in leadership effectiveness.

The global concept of interpersonal competence was offered by Argyris (1964). He described the differences between traditional approaches to interpersonal relations in comparison with the group dynamics approach. The traditional view of good interpersonal relations stressed acceptance of authority, avoidance of conflict while the group dynamics movement stressed awareness, openness to discussion about feelings and consensual solutions to conflict. People with interpersonal competence are willing to depend on trust and shared decision-making and group goal-setting rather than power.

2.1.3.4 Leader experience

To be able to control and master a task, a person should have the training and experience required to do this. A leader without the necessary formal training and experience will not be able to understand his task since he lacks the background required. The experienced and well-trained person should be in a better position to integrate his past experience and apply his knowledge to the demands of the job.

Andrews and Farris (1967) found that the technical skill of the leader is related to the ingenuity of the scientist.

Fiedler and Leister (1977) also included leader experience as a moderator of effectiveness in their Model and see this as a prerequisite for the appropriate use of the leader's intelligence.

The formal training received by the leader in his field of expertise as well as his experience, not only in his field of expertise but also in leading people, could influence his effectiveness as a research leader. An intelligent person without the necessary academic training may well be able to lead certain groups of people but might find his skills inadequate to lead a research team.

2.1.3.5 Role perception

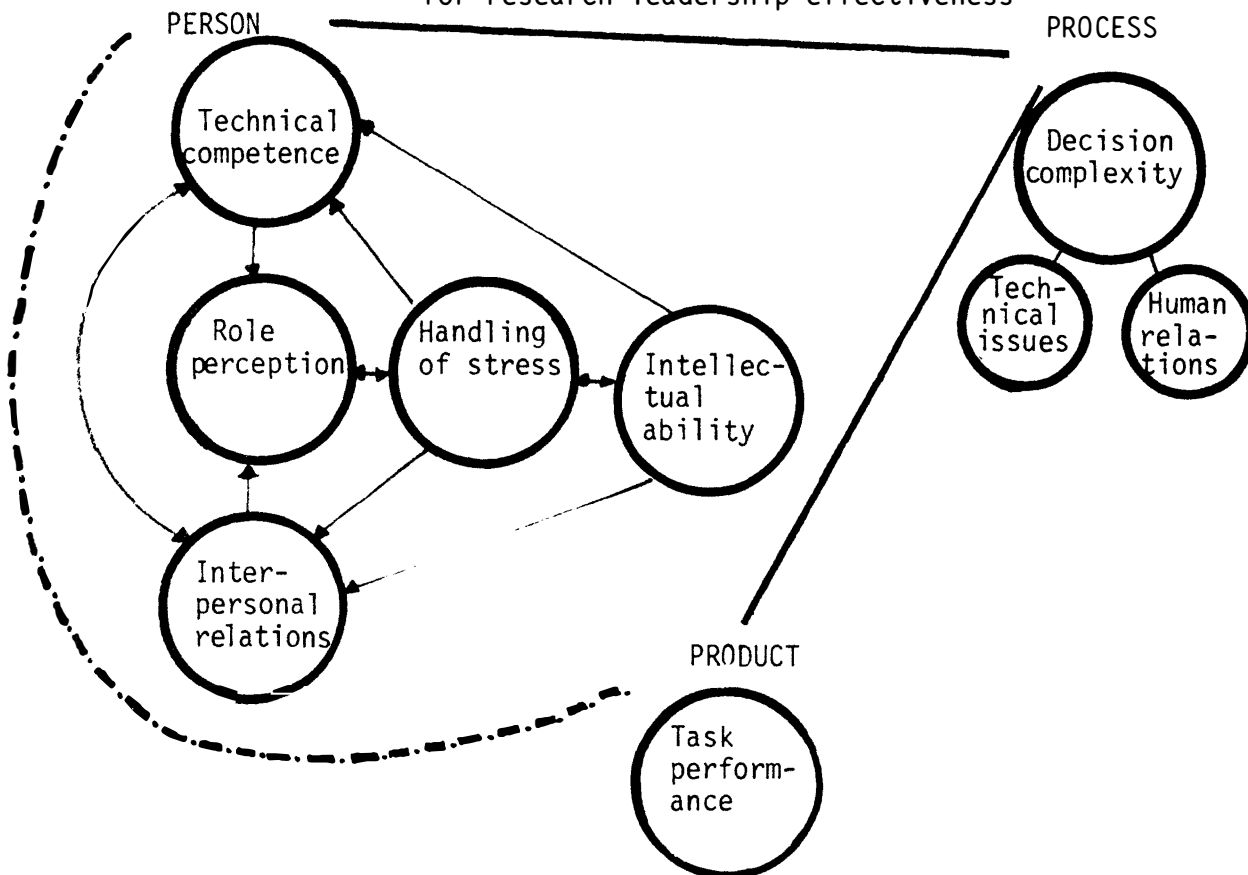
The way in which a person functions may be influenced not only by his abilities, personality, aversions, and needs, but also how he perceives his task. His perception of his task or his role is not only dependent on his personal characteristics, but also depends on the extent to which the performance criteria were made clear to him.

Roles can be defined as "specific tasks defined by a group and consisting of social expectations concerning that task" (Kinloch, 1972, p.28). A role can be assigned on the basis of certain achievements, for example, educational qualifications, or on the basis of factors beyond the control of the individual (e.g. race, age, sex). Roles need modes of behaviour which are ascribed or achieved as well as certain expectations regarding the outcome of these roles. If the leader's perception of his role is not in accordance with the criteria laid down for the role he may be perceived as being less effective, while he himself may be satisfied with his performance. Role conflict may ensue when the expectations of one person are incompatible with the role expectations of another. Role conflict may possibly lead to anxiety and stress and a decrease in effectiveness.

2.2 Model for effective research leadership

The proposed model attempts to account for a more specific consideration of the job demands as they apply to a research leader's position, leading, on the one hand, to a suitably adapted leader profile for prediction purposes and, on the other hand, a basis for the assessment of performance. The basic structure of the model is thus in line with the PERSON-PROCESS-PRODUCT MODEL of Campbell et al (1970).

FIGURE 2.2: Schematic representation of the proposed model for research leadership effectiveness



The 'person' in Campbell's model refers to the individual leader's characteristics and traits. Regarding personal characteristics in the proposed model, an interaction approach will be tested which is more in line with the MULTIPLE SCREEN MODEL of Fiedler (Fiedler and Leister, 1977). Fiedler identified four 'screens' and in the present model these have

been modified to some extent to fit the purposes of this study and a fifth one added. It is suggested that the proposed predictor variables will tend to interact not only as intervening variables on the intelligence factor as Fiedler and Leister (1977) suggested, but also in combinational fashion with each other. Depending on the direction and degree to which this occurs, this will result in more or less effective research leadership.

The work of the NIPR on job evaluation (Van Rooyen, 1977) is relevant and in support of both Fiedler's and Campbell's approaches. It has been the contention that jobs rate progressively higher to the extent with which the complexity of the decision process of a job incumbent increases. Basic to this model is the rationale that increased decision complexity demands involve the incumbent in increasingly higher levels of intellectual functioning. These studies serve to demonstrate the absolute necessity of studying the job demands to determine both predictor and criterion measures.

2.2.1 Job description (process)

In order to gain more insight into the work of a research leader the job description and evaluation can be used to analyse the job. It is generally accepted that the decision-making process forms the key according to which jobs can be evaluated (Van Rooyen, 1977). This, supplemented with a questionnaire containing statements regarding the relative importance of certain work aspects as they were defined, can be used.

By adopting the job descriptive approach, the rationale is accepted that the study of the decision process involved in a research leader's work serves as an adequate basis for identifying the basic characteristic of the job demands.

In using the decision-making process as a basis for the job demands made on the research leader, the relevant decisions

to be made could be grouped into two broad categories; those concerning research itself and those concerning interpersonal relations.

2.2.2 Leader profile (person)

In this study, the person refers to the individual leader's characteristic traits and abilities. If leadership is to be understood, the causes underlying some of the behaviour involved should be understood.

In the proposed model, technical competence refers to the leader's experience as well as formal training. Fiedler (1977) states that training and experience are prerequisites for the appropriate use of intellectual abilities. In this regard, he also mentions Csoka who pointed out that intelligent leaders without the required background will not be able to integrate past experience in a manner which will facilitate appropriate application.

Interaction between a person's intellectual abilities and the way he perceives his job is also possible and may bear on his effectiveness. For this reason, role perception as a predictor variable is considered. The way in which he sees his role may, in turn, be affected by his skills in interpersonal relationships as well as his technical competence.

Interpersonal relations refer to the formal and informal interpersonal behaviours required of the person. Interpersonal relations may be influenced by the intellectual abilities of the person, his way of handling stress and his technical competence. This, in turn, may interact with the way in which he sees his role as research leader and result in more or less effectiveness as leader.

It is proposed that the way in which a person handles stress influences, in interaction with his intellectual abilities, his effectiveness while, in turn, interpersonal relations and role perception may affect his level of anxiety.

2.2.3 Performance criteria (product)

By this is implied the effectiveness of the research leader regarding how well he meets the performance criteria. The combined criteria of performance are based on rating the effectiveness of the research leader by his supervisor on the various work aspects as it pertains to the task of the research leader as it was identified in the job description, and on his effectiveness in terms of his rate of advancement salary-wise.

Performance ratings have in the past been the most common means of measuring job performance. Despite the popularity of rating scales, they have many disadvantages - their low reliability and validity are generally recognised. The measurement problems involved have lead some researchers to conclude that they cannot be used at all (Ronan and Schwartz, 1971). The rating paradigm, according to Weeks and Mullins (1979), consists of five basic dimensions:

- (1) the rater, his social adjustment, intelligence, similarity with ratee and position relative to that of ratee;
- (2) the ratee - people differ to the degree that they can be accurately evaluated;
- (3) the traits of the tasks to be evaluated - whether the tasks have observable behaviour manifestations. The complexity of the task rated also influences the accuracy of the ratings;
- (4) the social environment in which the ratings are collected. A supportive environment leads to more lenient ratings;
- (5) physical environment. Persons who are less observable are more difficult to rate.

The purpose for which the ratings are done also plays an obvious role. The value of ratings may differ depending on whether they are collected for research or promotion purposes.

Research done by Spool (1978), Pursell, Dossett and Latham (1980), and Latham, Wexley and Pursell (1975), indicate that training of raters can reduce rater errors to a fairly large degree.

Lack of accuracy in ratings, according to Cronbach, Geeser, Nanada and Rajaratnum (in Spool, 1978), is seen as a function of:

- (a) recording-procedure characteristics (complexity of categories and category definitions);
- (b) observer characteristics;
- (c) conditions of observation.

By using more than one rater the risk is run of actually measuring the extent to which the raters conform. These should serve as guidelines for performance appraisal.

2.3 Statement of the problem

From the available literature it has been ascertained that leadership is a complex phenomenon involving numerous variables ranging from personality attributes to environmental determinants and moderators. Leadership can be a dependent variable when the leader adapts to the situational demands, independent when the leader is the instigator of change or a moderator when he modifies the impact of other variables.

It is also apparent that leadership effectiveness measures seem to be influenced by the definition of the investigator. Various measures have been proposed, e.g. group productivity, rate of promotion, number of papers published. Organisational, personal and interpersonal variables may, however, have a bearing on the effectiveness of the research leader.

If the actual leadership functions are described, provision is made for assessing effectiveness in terms of actions. The functions or tasks required of a research leader implies certain personality or personal attributes. Central to the function of the research leader is his intelligence, but in optimally utilising this potential certain modifiers may act as inhibitors or facilitators.

This research is aimed at solving the problem of predicting effective research leadership. Is it possible to identify effective research leaders by firstly describing the job of the research leader, evaluating him in terms of the job demands and then relating his effectiveness to certain personality attributes which may, in combination or interaction, affect his performance as research leader? If it is possible to identify effective research leaders in this manner, what is the contribution of each of these personality attributes towards success in the research leadership position?

The problem may therefore be formulated as: do intelligence handling of stress, role perception, technical competence, and interpersonal relationships have an influence on a research leader's effectiveness?

2.4 Formulation of hypotheses

The proposed research leadership effectiveness model provides for testing the interaction between various leader predictor variables and their role on the effectiveness of the research leader.

The hypotheses take into consideration that a relationship exists between the leader variables. The manner and extent to which the identified predictor variables interact will result in more or less effectiveness in research leadership.

2.4.1 Hypothesis 1

The relationship between leader intelligence and leader effectiveness is moderated by the level of anxiety of the research leader.

Rationale:

Most studies cited by Stogdill (1974) support the evidence that the average leader is more intelligent than the average member of his group. Lombardo (1970) has stated that in order to be effective in a job a person must intellectually at least be as complex as the situation he has to deal with. Taking into consideration the complexity of the decision-making process involved in research leadership, high intellectual potential seems to be a prerequisite. The most intelligent researcher does not, however, make the most effective research leader. Fiedler (1977) has pointed out that although a strong linkage exists between a leader's intelligence and task performance in optimising his potential, numerous factors may play a role. Anxiety is seen as being one of the most important factors which may inhibit performance.

While most people respond to stress with increased anxiety, which is characterised by feelings of apprehension, tension, and activation of the autonomic nervous system (Spielberger, 1966), anxiety can either inhibit or facilitate performance. Ambiguous approach-avoidance situations seem to arouse anxiety. The leadership position, by its nature, is stress provoking and requires decision making at times in areas which are ill-defined, ambiguous and where no previous precedents exist to guide the leader. Information processing becomes less complex under stress (Schroder, Driver and Streufert, 1967), and cognitively complex people can deal with more stress and remain capable of producing high quality decisions (Lombardo, 1977).

2.4.2 Hypothesis 2

The effectiveness of a research leader is influenced by his ability to use goal-directed behaviour when confronted with stress-provoking situations.

Rationale:

Eysenck (1975) has indicated that people who are introverted and emotional tend to engage in avoidance behaviour in ambiguous, approach-avoidance situations. The use of goal-directed behaviours when confronted with stress-provoking situations is associated with more effective leadership. The ability to plan ahead, set up structures, and specify realistic goals may be influenced by a person's level of anxiety. But the amount of stress perceived in a situation depends to a large degree on a person's perception of the situation. His assessment of his capability to handle the situation, as well as the importance to him of handling the situation, plays a role. If he feels that he can handle a situation and feels that the consequences are irrelevant (e.g. the reward or failure), he will perceive little or no stress. If it is important to achieve success and the chances of having success are small, severe stress can be perceived. How a person handles a potential stress-provoking situation may thus be indicative of his effectiveness in a research leadership position.

2.4.3 Hypothesis 3

The effectiveness of a research leader is influenced by the way he perceives his role as a research leader.

Rationale:

Role perception in the context of work is defined as the way a person perceives the demands made on him in the job; the performance criteria and the modes of behaviour ascribed to the job.

Role perception is not only dependent on the extent to which the performance criteria were explained to him, but may also depend on his personal characteristics (e.g. intellectual abilities). Role conflict may ensue when the demands made on the job incumbent are incompatible with his perception of his role.

2.4.4 Hypothesis 4

The effectiveness of a research leader is influenced by his technical skills and research experience.

Rationale:

In order to perform well in a job a person must have relevant training and skills. Acquiring the necessary skills for research leadership may not only require academic qualifications but also specific training and experience. It is obvious that a relationship between academic qualifications and intelligence should exist, but experience in actually doing research may be of more value in research leadership than qualifications above a certain level.

2.4.5 Hypothesis 5

If the research leader makes use of the appropriate person-orientated and production-orientated behaviours, he would tend to be more successful.

Rationale:

A healthy balance between concern for people and concern for production is indicative of mature, well-adjusted management (leadership) (Blake and Mouton, 1968). This approach leads to the solving of interpersonal problems in a rational manner by utilising empirical data as basis for decision making. Underlying a preference for a management style geared towards a

greater concern for people than for production is a need for acceptance (Blake and Mouton, 1968) and this kind of person tends to take his cues from outside himself and is more influenced by his social environment than by a sense of inner direction.

The production-orientated leader may, on the other hand, be inflexible in interpersonal relationships (Blake and Mouton, 1968). The extent to which a person enjoys interpersonal interaction is relevant, because leadership implies that through interpersonal interaction the leader guides and directs others.

CHAPTER 3

- 3. RESEARCH DESIGN
 - 3.1 The sample
 - 3.2 Testing of the model
 - 3.2.1 Measuring instruments - predictors (person)
 - 3.2.2 Intellectual ability
 - 3.2.3 Personality measurements
 - 3.2.4 Management style
 - 3.2.5 Role perception
 - 3.2.6 Biographical information
 - 3.3 Development of the criteria (product)
 - 3.3.1 Performance appraisal
 - 3.3.2 Rate of advancement in terms of salary

3. RESEARCH DESIGN

3.1 The sample

The sample consisted of 92 male research workers at a semi-government organisation in South Africa. All subjects have been assessed by the National Institute for Personnel Research prior to appointment to the organisation.

The sample included the following research disciplines: physics, chemistry, engineering (civil, mechanical, chemical, electrical) and architecture.

The criterion for inclusion in the sample was that a subject should be in charge of a research project and responsible for technical or research staff.

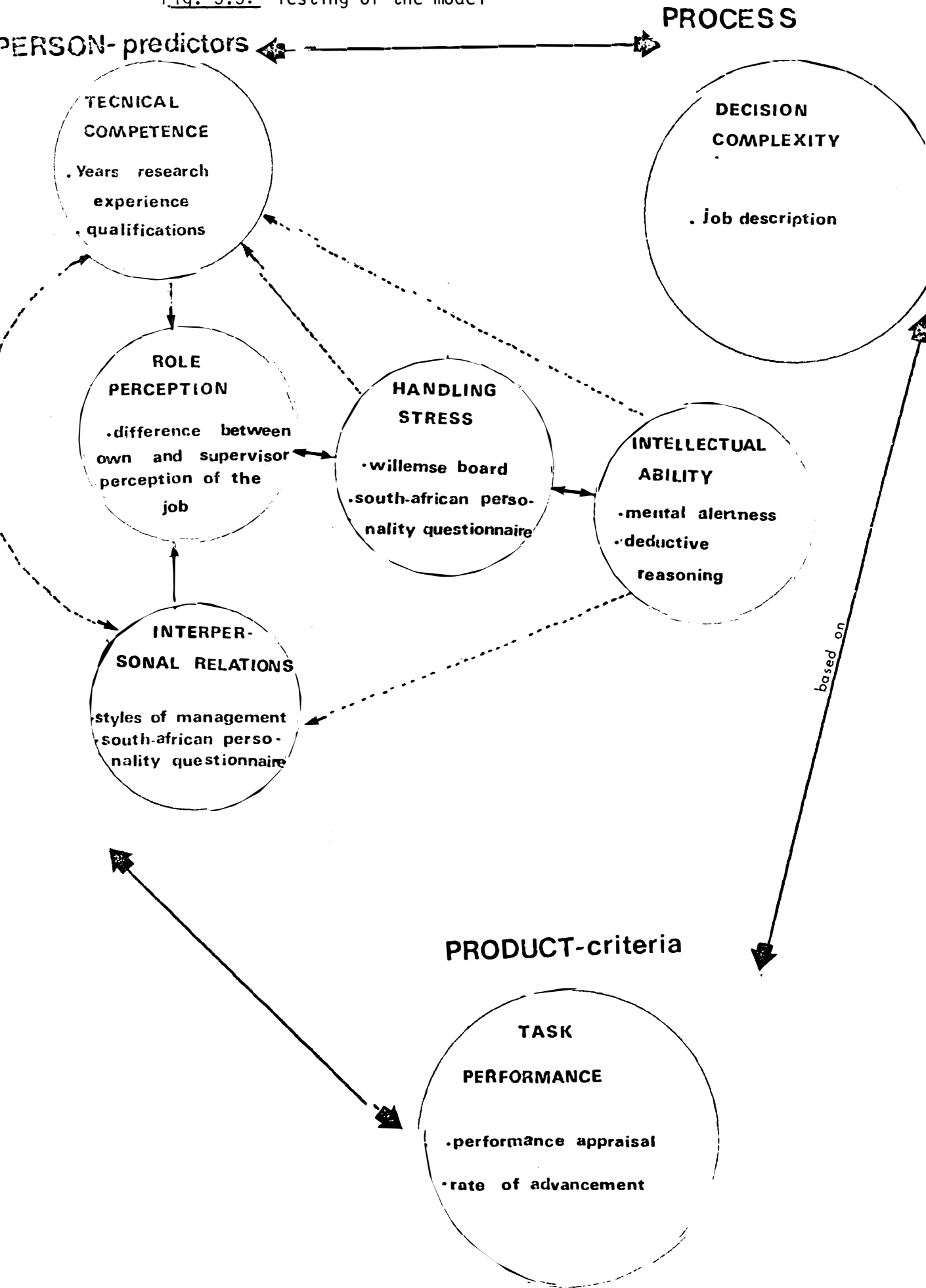
The mean age at the time of testing, and hence appointment, was 31,8 years with a standard deviation of 7,8. The year of birth ranged from 1920 to 1954. The mean age of the sample at the time of the study was 38,9 years, a standard deviation of 7,6, a maximum age of 60 and a minimum age of 26 years.

The mean qualification is four years post matric study. The rank of the subjects gives an indication of seniority within the organisation. The mean rank at the time of appointment was research officer and at the time of the study senior research officer. Seventy-two of the subjects are on the research staff and 19 on the technical staff. One subject did not disclose his present rank. The mean age at which matric was written was 18,16 years with a standard deviation of 2,63. In this regard it should be mentioned that one of the subjects wrote matric at the age of 34. The median age for matric is 17,65 years.

3.2 Testing of the model

The predictor and criteria variables in terms of the model being tested are portrayed in Fig. 3.3.

Fig. 3.3: Testing of the model



3.2.1 Measuring instruments - predictors (person)

All subjects were assessed by means of a test battery before being appointed to the organisation. The assessment procedures form part of the employment policy of the organisation. Not all tests administered at the time of appointment are included in the present study but only those of relevance to the project.

3.2.2 Intellectual ability

(1) Mental alertness test - B/75

Intellectual ability was assessed by means of the B/75 Mental Alertness Test which forms part of the NIPR High Level Battery. This is a test of general intelligence and is defined as measuring the ability to learn and to apply previously gained knowledge to present problem situations (Visser, 1977).

The questions posed are both verbal and non-verbal, requiring a fairly high level of abstract reasoning ability. It includes reasoning tasks in the form of analogies, classification of abstract concepts, figures and number series. The test consists of 42 items and has a time limit of 45 minutes and is presented in a multiple choice format.

Reliability: 0,80 (KR₂₀ with Tucker's correction), graduate employees.

(2) Deductive reasoning

The Deductive Reasoning Test is intended as a selection instrument for scientific, entrepreneurial and other high-level professional and occupational personnel (Verster, 1973). The test consists of a booklet containing 36 items and has a time limit of 40 minutes. Each item entails two statements or premises followed by five possible conclusions, only one of which is correct.

The remaining four distractors constitute statements that either reformulate a single premise, statements that are invalid and statements that are consistent with the premise but not necessarily an inference. The concept of deduction as used in this test is derived from the Aristotelian logic.

Reliability: 0,94 (KR_{21} with Tucker's correction).

Norms - research scientists.

Both Mental Alertness and Deductive Reasoning will be used as an indication of general intellectual ability.

3.2.3 Personality measurements

(1) The South African Personality Questionnaire

The questionnaire was developed to fill a long-felt need for a personality questionnaire devised and standardised for South-African conditions (Steyn, 1977). The questionnaire is not aimed at psychopathology but at normal behaviour in the day-to-day situations encountered in industrial and vocational guidance settings.

The questionnaire consists of five dimensions: aggression; social responsiveness; dominance; rigidity; and anxiety. In the development of the questionnaire, these dimensions were defined in psychological terms. The test consists of 170 items formulated in a bipolar format and the testee supplied with four alternatives, for example:

his behaviour corresponds with that of A but not B = A

his behaviour corresponds more with A than B = a

his behaviour corresponds more with B than A = b

his behaviour corresponds with that of B but not A = B.

The following criteria regarding the scales were observed: reliabilities between 0,80 and 0,90, low statistical inter-correlations between the scales, the maximum being 0,30 (Steyn, 1977).

In behavioural terms, high scores on each of the scales can be described as follows:

- (i) Social responsiveness: seeks out and enjoys social encounters, spontaneously initiates social contact and responds to others in a warmhearted manner;
- (ii) Anxiety: reacts with disproportionate intensity to sources of threat, worries easily, feels apprehensive and finds it difficult to relax;
- (iii) Hostility: displays feelings of dislike of others, is cynical, distrustful and hypercritical in attitudes, retaliates with little provocation;
- (iv) Rigidity: displays relative inability to change action and attitudes when objective conditions demand it, preoccupied with status quo, compulsive, over-organised, shows stereotyped and highly predictable behaviour patterns;
- (v) Dominance: takes an assertive and dominant role in social relations, constantly strives to be in a position of authority, displays a considerable amount of drive.

(2) Willemse Board

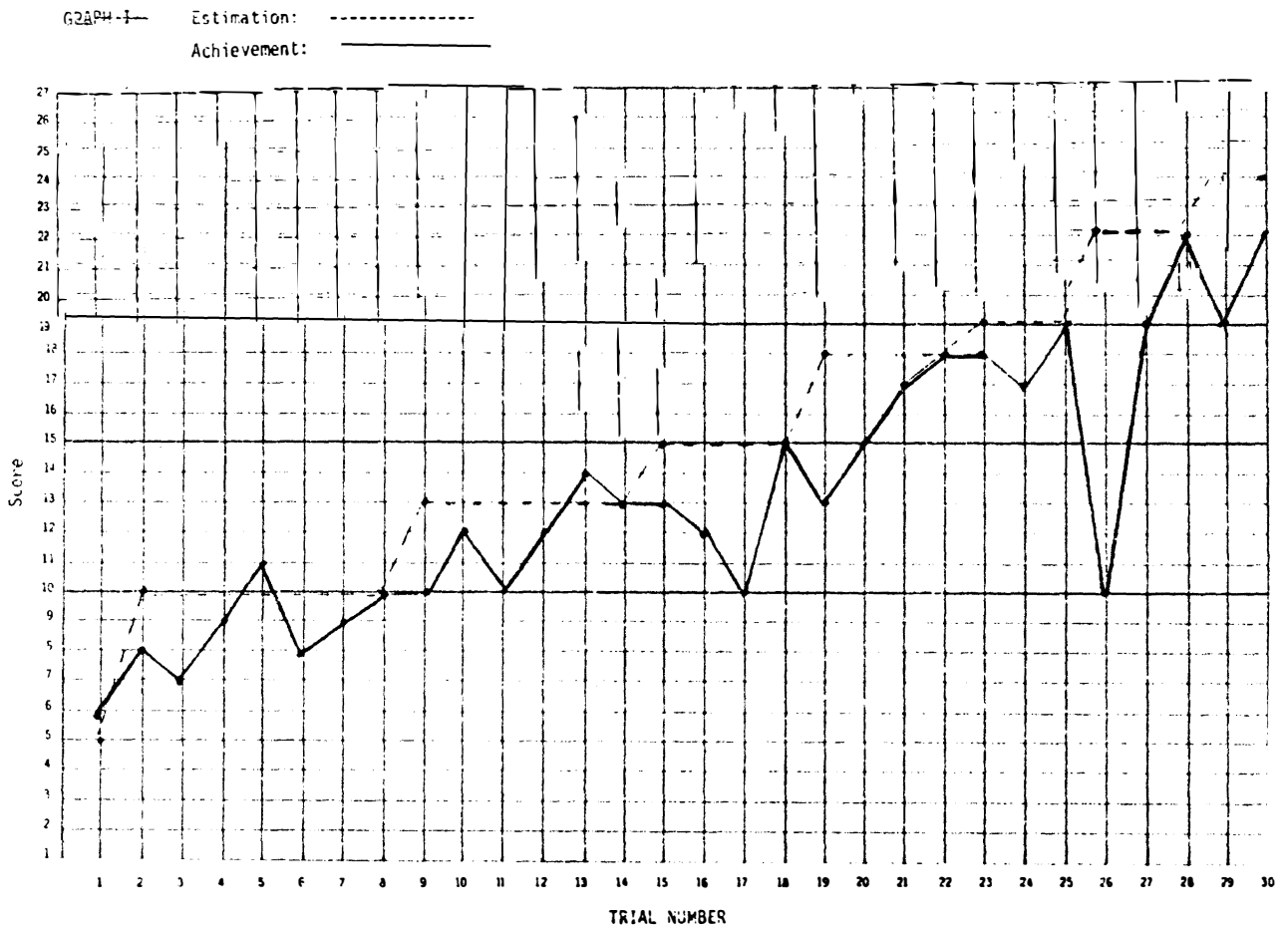
Willemse constructed the test in order to get information about the behaviour of juvenile psychopaths in conflict situations (Skawran, 1962). In designing the test, an attempt was made to elicit responses which would indicate some of Lewin's and Gottschald's concepts, for example, level of aspiration, success and failure, and relating these to the goal-directed activities of a person (Skawran, 1961). By the nature of the test, a testee is put in a conflict situation where he has to make compromises between his aspirations and his actual achievement when setting his goals.

Skawran (1961) found that conflict-disposed and conflict-free behavioural expressions have personal insecurity as a common cause. The difference between the two being that the conflict-disposed person is aware of his fears and acts in a careful and self-underestimating manner. The conflict-free person, on the other hand, over-estimates himself and tries to compensate for his fears in this manner.

Willemse was interested mainly in the clinical picture that presented itself in the test situation and although he did use some scores, for example, counting the number of successes or failures and the first motivational level, he utilised them only to substantiate some of his observed findings.

The testee's performance on the test is plotted on a graph showing his estimation and his actual performance.

GRAPH I: Example of a Willemse Score Plot



Skawran (1962) found two different types of graphs which he divided into stable and unstable groups. By means of the Willemse Board graphs he was able to assess a person's self-confidence, his way of compensating, his initiative, drive and aspiration level. By utilising this approach he was able to predict training success of air force pupil pilots.

Although the test does not easily lend itself to quantification, a few studies have demonstrated that this is nevertheless possible to a certain extent (Skawran, 1962; Heroldt, 1972; de Jager, 1972).

The scores utilised in this study include the following:

- (i) Success score is the sum of the number of times that the testee achieved his goal, i.e. that he landed the ball in the bag. The success score is, however, not a true indication of a testee's performance on the test. He may, for example, have set his goals unrealistically low and achievable and not tried to achieve on the test.
- (ii) D-Score (Discrepancy score) is a more refined success score devised by Skawran (1962, p.23) which controls under-estimation or low goal setting. This score is an indication of the testee's ability to set his goals in accordance with his previous achievement.
- $$\text{D-score} = \frac{(\text{Sum of estimations 2-30}) - (\text{Sum of scores 1-29})}{\text{Sum of scores 1-29}}$$
- A high D-score is indicative of an unrealistic approach towards the test.
- (iii) Average performance. The performance scores are averaged and divided by the number of trials. This score indicates the testee's skill, not taking into consideration his level of aspiration.
- (iv) V-Score measures achievement of the testee throughout the test and is a measure of perseverance (De Jager, 1972). The procedure for calculating this score:
- (a) Ignore trials 1-6 (it is presupposed that the ability to learn and individual differences influence these scores);
 - (b) Group trials 7-30 into eight groups representing three trials each;
 - (c) Average each of the groups, and read the standard score of each group from the norm table;

- (d) Calculate the average for all eight standard scores;
- (e) This average is then deducted from the maximum standard score and represents the extent to which the testee performed below his capacity on the test.

This score was found to correlate with university achievement (De Jager, 1972). The test-retest reliability of the V-Score (N=25), retested between 4-7 years, is 0,32 and for the D-Score 0,22.

- (v) X-Score. The tenth strip on the board is the first real obstacle encountered. The X-Score is based on performance regarding this strip - the number of times the testee fails to pass this strip after he has passed it once before. Repeated failure at this point is associated with stress and anxiety in the testee (Skawran, 1961; Van Coller, 1961). Lack of concentration or the inability to learn may also be involved.

- (vi) G.V.-Score (failure to progress). This is usually indicated by subtracting the lowest from the highest score. The main criticism of this score is that it is possible for the testee to reach his highest achievement early in the test and may fare rather badly further during the test and this is not accounted for by the score.

G.V.-Score = highest score - highest score during the
the last trial and the number of trials
since the highest score had been reached
and the last trial.

A high score indicates a lack of perseverance (Heroldt, 1972).

(vii) Sum Score. This score is indicative of the attitude of the testee towards the test as a whole regarding his own abilities, and the adjustment of goals according to the realities of the test (Heroldt, 1972).

(viii) Goal-directed behaviour. The use of goal-directed behaviour when confronted with an unfamiliar stress-provoking situation involves the handling of the tenth strip on the board (X-Score), as well as perseverance at the task (V-Score), the D-Score which is indicative of a person's ability to set his goals in accordance with his previous achievement, as well as the failure to progress (G.V.-Score). The ability to use goal-directed behaviour will be calculated by adding these scores. A high composite score is then seen as indicative of a person who is not able to handle a stressful situation in a goal-directed manner.

In addition to the separate scores 1-8, the composite score which indicates the use of goal-directed behaviours in an unfamiliar stress-provoking situation will be used.

Skawran (1961) calculated the reliability between average performance and average performance for even and uneven trials and found coefficients of 0,88 and 0,97 respectively.

3.2.4 Management Style

The Styles of Management Inventory (SMI) describes management behaviour based on the two dimensions 'concern for production' and 'concern for people' (Blake and Mouton, 1964). On the Managerial Grid, the possible interactions between the two orientations are portrayed graphically. Blake and Mouton (1964) state that aspects of the grid are more accurately regarded as describing systems of pressure acting on the individual to manage in a certain manner. These pressures reside in the individual, his external environment and the organisation system. The management behavioural styles are not seen as personality types.

Twelve typical management situations are portrayed with five alternative ways of handling each situation listed. The testee is required to select from each five statements the one which is most characteristic of him and to place the letter designate of that item at the point on the scale which reflects the degree that the behaviour is characteristic of him. The alternative which is least characteristic is then selected and treated in the same manner, while the degree of corresponding with the rest of the statements are handled in the same manner.

Five managerial styles are suggested by the grid model:

- 1/9 Production is incidental to lack of conflict and 'good fellowship';
- 9/9 Production is from integration of task and human requirements;
- 5/5 Production comes first, but morale cannot be ignored. Push enough to get the work done, but give enough too to get the morale necessary;

- 1/1 Effective production is unobtainable because people are lazy and indifferent. Sound and mature relationships are difficult to achieve because conflict is inevitable;
- 9/1 Men are a commodity just as machines. A manager's responsibility is primarily to plan, direct and control the work.

Provision is also made to describe the preferred management style in four phases or components of management: philosophy, planning, implementation, evaluation. The person's score is plotted on four graphs representing the four components.

Teleometrics International (1973) reports on a test-retest reliability of 0,65. Nasser (1975) claims that test behaviour on the SMI for South African managers is in line with expectations of Teleometrics for American managers. The standardisation group consisted of 1 316 managers in business, industry, government and service organisations in the USA.

3.2.5 Role perception

Research leadership is a role within the science of relations and can be defined by reciprocal expectations between leader and group, and leader and his supervisor.

Role perception is defined as the difference between the job incumbent (the research leader) and his supervisor regarding the importance of work aspects as it pertains to the work of the research leader. In order to identify these work aspects, the job description for senior research personnel was used. The relevant job evaluation reads:

"Determines in consultation with group leader/ or/and Director research priorities and policies of the Group, taking into consideration research needs within and outside the institute. Anticipates needs in his field, initiates and formulates research strategies according to national and professional demands.

Works through his team by providing the necessary guidance control and structure.

Selects staff and trains them.

Presents talks and reports to appropriate bodies and stimulates progress outside the divisional context.

He is regarded as an authority in his field and consulted as such both inside and outside the division." (Skawran, Steyn and Van Rooyen, 1974, p.9.)

The following work aspects were then defined:

(1) Research

Knowledge and training in field of expertise;

Planning of research strategies, co-ordinating research, budgeting, utilising resources;

Problem solving, control over research, providing structure;

Report writing, lecturing, implementing research findings or dissemination of results.

(2) Interpersonal

Selecting and training people, motivating team or individuals;

Control over people (evaluating their work);

Negotiations with top management and outside organisations;

Dealing with peers, maintaining sound interpersonal relations in general;

Advise.

All these aspects were included in the 30-question questionnaire (Appendix B). The overall difference in role perception between the research leader and his supervisor can be calculated as well as the difference regarding certain work aspects (e.g. they may differ more regarding the way they see the importance of interpersonal relationships aspects than pure research issues or administrative tasks).

3.2.6 Biographical information

On the same day as the testing (i.e. before appointment), the following information was extracted from the Biographical Questionnaire:

- (1) Year of birth - from which the present age of the candidate could be calculated.
- (2) Test date which allowed for calculating the age of the testees at the time of testing as well as the number of years of experience in the specific research environment.
- (3) Rank at which the person was appointed.
- (4) Qualifications at the time of appointment.
- (5) Sibling status.
- (6) Father's occupational status.

The last two variables were only included to facilitate a more comprehensive description of the sample.

3.3 Development of the criteria (product)

The measuring problems in the development of criteria have received the attention of personnel selection researchers, but only a few studies have attempted to relate leadership and criteria of scientific productivity. Barnowe (1975) takes as criteria the number of published works over the past five years, self-estimation of the scientific contribution of the researcher as well as the practical application of the research. Self-assessment have numerous difficulties especially pertaining to

the theoretical foundation thereof, its measurement and behavioural focus (Heineman, 1980). Certain factors such as the obligation to publish, budget size, type of research being carried out, etc. influence the number of papers being published. Without being an expert in numerous fields, it is more or less impossible to evaluate or rate a scientific publication.

The need for criterion measurement is, however, crucial to not only establishing effectiveness but personnel selection as well.

3.3.1 Performance appraisals

Despite numerous difficulties associated with performance ratings (see p.30), they still remain the most popular and expedient way of obtaining indices of performance.

A performance rating questionnaire was developed. Special attention was paid in the development and application thereof to the most common errors and weaknesses to be expected.

The job description for senior research personnel provided information on the demands made on the research leader, especially regarding the decision-making process. Work statements covering the important areas identified in the work were generated. The supervisor of each research leader evaluated the effectiveness of the research leader on each work statement, and also indicated the importance of that statement and also indicated the importance of that statement as it pertains to the work of the job incumbent.

The supervisors received training on the most common rater errors and, in addition, had the opportunity to discuss the rating procedure with the investigator.

The raters were also assured that the ratings would not influence the standing of anyone included in the study but that their ratings may assist in the identification of valid predictors for research leadership. Confidentiality was guaranteed.

A five-point rating scale ranging from poor (1) to excellent (5) was used for evaluating effectiveness, and a four-point scale (1=statement not relevant, 4=statement representative of work of a research leader) was used (see Appendix B).

The various research disciplines were then grouped together and the average importance of each work statement for each of the disciplines calculated. By adopting this strategy it was possible to weight each ratee's efficiency in a work aspect with the average relevancy of that aspect as it pertains to his research discipline. This also made it possible to distinguish between those who have been rated as excellent regarding a less important aspect and those rated as being excellent regarding an important work aspect.

Efficiency in a work aspect is then defined as the rated efficiency in that work aspect multiplied by the average relevance of that work aspect for a certain research discipline. The general efficiency is the sum of all the weighted efficiency measures.

3.3.2 Rate of advancement in terms of salary

De Jager (1975) found salary increments a useable criterion for effectiveness in a research environment.

In addition to using performance appraisal ratings as criterion, the "rate of advancement" was also included as a measure of general research effectiveness. The "rate of advancement" gives an indication of the incumbent's worth to his research unit in terms of the salary he earns. Seeing that salary increments

may, to a certain extent, be moderated by the age, tenure, career category, qualifications as well as by the shortage of staff in certain research disciplines, a method for compensating for these was devised.

It was found that no linear relationship exists between age, tenure and salary. A transformation was done to ensure linearity. A regression analysis with the stratified salary as criterion and age, qualifications, years of service and career category as predictors was done. General efficiency was then calculated by subtracting the predicted transformed salary from the transformed salary of a person.

While this measure is not a "pure" measure of research leadership effectiveness, it is indicative of the leader's advancement salary-wise above what is expected and indicate to what extent he has met the performance criteria.

The two criteria measures, viz. the performance rating as well as the adjusted salary progress figure, were considered separately and combined as a measure for research leadership effectiveness.

CHAPTER 4

- 4. ANALYSIS OF THE DATA AND RESULTS
- 4.1 The predictor variables
- 4.2 Criterion variables
- 4.3 Correlations between independent and dependent variables
- 4.4 Regression analysis with the criteria as dependent variable
- 4.5 Regression analysis with the management style as dependent variable
- 4.6 Testing of the hypotheses
- 4.7 Conclusion

C H A P T E R 4

This chapter describes the statistical properties of the predictors and criteria as well as the results of the study. Correlations between the independent predictor variables are given. The development of the criteria, as well as the development of additional criteria by means of factor analysis of the questionnaire are presented.

Before embarking on the regression analyses, tests for linearity were done, the results of which are given as well as the way of transforming non-linear variables.

After each regression analysis on each of the effectiveness criteria, the results are discussed.

In order to understand the implications of the various management components and personality measures in terms of the questionnaire which forms the basis for the criterion for effectiveness, further regression analyses were done with each of the management styles as the dependent variable.

The hypotheses stated in Chapter 3 are discussed next.

The statistical analyses were done on a CDC computer by means of the Statistical Package for the Social Sciences (Nie, Hull, Jenkins, Steinbrenner and Bent, 1975).

4.1 The predictor variables

- (a) Mental Alertness, Deductive Reasoning, South African Personality Questionnaire (SAPQ), and Willemse Board.

Some of the subjects included in the sample did not do all the tests included in the study seeing that the test batteries had been changed and modified from time to time as new tests were developed.

The mean, standard deviation, skewness, kurtosis, maximum and minimum values for the predictor variables are given. Regarding the difference in role perception an approach which provides for assessing the difference between each research leader and his supervisor was followed and is tabled separately.

TABLE 4.1: Statistical description of the Mental Alertness, Deductive Reasoning, SAPQ, and Willemse Board

Test	N	\bar{X}	SD	SK	KT	Max.	Min
Mental Alertness	90	29,9	5,82	-0,29	-0,77	40	16
Deductive Reasoning	92	22,3	7,02	-0,33	-0,47	34	3
Sociability	37	35,2	10,9	0,09	-0,69	56	15
Anxiety	37	18,2	9,92	0,99	0,45	43	5
Hostility	37	29,7	12,6	0,30	0,15	60	9
Rigidity	37	44,6	14,8	0,11	0,17	83	12
Dominance	37	53,2	13,4	0,54	0,10	73	20
Willemse V-Score	65	2,1	1,45	1,57	2,92	5,8	0,23
Willemse D-Score	65	0,35	0,14	0,90	1,04	0,79	0,11
Willemse Sum-Score	65	400	65,2	-0,26	0,06	530	235

Intellectual Ability

In spite of pre-selectedness in terms of Mental Alertness, the distributions of this test and Deductive Reasoning were normally distributed. In comparison with a norm group graduated applicants to the organisation, this group scored in the 62nd and 56th percentile for the Mental Alertness and Deductive Reasoning tests.

South African Personality Questionnaire (SAPQ)

None of the distributions on the scales of the SAPQ deviates from normality or from the standardisation group. The fact that the test was administered for selection purposes and that the testees might have tried to manipulate the scores to appear socially acceptable should be considered.

Willemse Board

The Willemse V-score (perseverance) is extremely positively skew with a kurtosis of 2,92 narrow and highly peaked (leptokurtic) the range is adequate (0,23 - 5,80) with a standard deviation of not more than 2 (1,45). A high score indicates a lack of perseverance. Seeing that the test was administered as part of the selection procedure, the curvature was in the expected direction and indicates that most testees persevered with the test despite their failures.

(b) Styles of Management Inventory (SMI)

For the Blake and Mouton Styles of Management Inventory, the component scores as well as the total scores were investigated as predictors.

TABLE 4.2: Statistical description of the SMI

	N	\bar{X}	SD	SK	KT	Max	Min
Philosophy 99	83	25,14	3,78	-0,94	0,61	30	14
Philosophy 55	83	22,13	3,78	-0,60	1,16	30	9
Philosophy 91	83	14,61	6,17	0,46	-0,51	28	3
Philosophy 19	83	13,61	4,96	0,36	0,43	28	4
Philosophy 11	83	8,20	4,01	0,82	0,23	20	3
Planning 99	83	21,90	5,14	-0,24	-0,81	30	11
Planning 55	83	20,71	4,45	-0,56	-0,56	28	10
Planning 91	83	15,86	5,00	0,01	-0,35	27	5
Planning 19	83	17,64	4,68	0,01	-0,58	28	8
Planning 11	83	9,27	4,76	0,92	0,82	25	3
Implementation 99	83	18,71	5,85	-0,04	-0,90	30	8
Implementation 55	83	20,20	4,52	-0,55	0,28	29	7
Implementation 91	83	22,30	5,23	0,23	0,23	30	8
Implementation 19	83	16,49	4,86	0,01	-0,55	27	6
Implementation 11	83	8,24	4,57	1,24	1,19	22	3
Evaluation 99	83	18,77	4,48	-0,12	0,20	29	8
Evaluation 55	83	16,05	4,21	0,06	-0,09	27	6
Evaluation 91	83	15,19	5,23	-0,04	-0,40	27	3
Evaluation 19	83	19,04	4,88	-0,21	-0,28	27	5
Evaluation 11	83	11,17	5,40	0,63	-0,03	25	3
Management Style 99	83	84,5	12,83	0,17	-0,20	114	57
Management Style 55	83	79,1	10,09	0,19	-0,47	101	56
Management Style 91	83	67,9	14,52	-0,28	-0,59	98	28
Management Style 19	83	66,9	13,10	0,30	-0,59	97	43
Management Style 11	83	36,8	12,65	1,01	1,50	77	12

The distributions do not deviate from normality to a significant degree.

(c) Role Perception

The difference in Role Perception was calculated by subtracting the importance rating of each work aspect by the supervisor from the importance rating the research leader gave the work aspect (see Appendix A and B). These differences were squared to obtain a positive number and then added to obtain a total role difference score for each leader. The following properties regarding this score was observed: mean 27,61; standard deviation 13,41; skewness 0,87; kurtosis 0,45; minimum score 7; and maximum score 67 for 79 cases. This implies that the average difference in Role Perception is about one on a four-point scale ranging from 0,5 to 1,5.

(d) Biographical predictors

The following biographical information was also included as possible predictors of efficiency as a research leader:

	N	X	SD	Max	Min
Test age	90	31,2	8,1	58	18
Experience (years in research)	91	7,75	6,8	26	less than one year
Present age (years)	92	38,8	7,6	60	26

The sibling rank of the research leaders was also considered. A breakdown of this variable yielded the following information:

TABLE 4.3: Frequency table of sibling rank

Sibling Rank	Number of children in the family								Total	%
	1	2	3	4	5	6	7			
1	10	16	8	2	0	0	1	37	44,05	
2		16	3	1	3	0	0	23	27,38	
3			12	1	3	1	1	18	21,43	
4				4	1	1	0	6	7,14	
Total	10	32	23	8	7	2	2	84	100	
%	11,90	38,1	27,38	9,52	8,33	2,38	2,38		100	

The greatest percentage of cases in the group was the oldest child (44,05) with 11,90% the only child.

Father's occupational status, where available, was distributed as follows:

Status	Frequency	%
Blue-collar worker	13	18,31
White-collar worker	20	28,17
Self-employed (e.g. farmer, shop owner)	7	9,86
Professional (graduated)	31	43,66
Total	71	100

TABLE 4.4a Inter-correlations between predictor variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. Mental Alertness (N=90)																					
2. Deductive Reasoning (N=90)	0,80**																				
3. Sociability (N=37)	-0,20	-0,23																			
4. Anxiety (N=37)	-0,13	-0,05	-0,49*																		
5. Hostility (N=37)	0,29*	0,35*	-0,24	0,28*																	
6. Rigidity (N=37)	-0,04	-0,11	-0,13	-0,08	-0,01																
7. Dominance (N=37)	-0,02	0,05	0,24*	-0,18	0,14	-0,34*															
8. Willemsse V-Score (N=65)	0,07	0,14	-0,09	-0,04	0,14	0,03	0,05														
9. Willemsse D-Score (N=65)	-0,17	-0,16	-0,00	0,21	-0,00	-0,34*	0,21	0,08													
10. Willemsse Sum Score (N=65)	0,15	0,04	-0,09	0,15	-0,12	-0,26	-0,13	-0,07	-0,22*												
11. SMI 9/9 (N=83)	0,05	-0,03	0,04	-0,25	-0,38	-0,16	0,17	-0,11	0,09	0,19											
12. SMI 5/5 (N=83)	-0,03	0,05	-0,05	0,17	-0,09	-0,12	-0,15	-0,11	-0,13	0,14	0,20										
13. SMI 9/1 (N=83)	-0,19*	-0,11	0,32*	0,13	-0,09	0,04	0,14	-0,03	0,21	-0,02	-0,23*	0,11									
14. SMI 1/9 (N=83)	-0,07	-0,06	0,13	0,43*	-0,01	0,18	-0,24	-0,08	0,15	0,19	-0,04	-0,21*	-0,09								
15. SMI 1/1 (N=83)	-0,04	-0,04	-0,16	0,14	0,20	0,08	-0,15	-0,19	0,29*	-0,31*	-0,32*	-0,33*	0,07	0,24*							
16. Role Perception (N=79)	-0,01	-0,06	0,15	0,27	-0,13	-0,09	-0,30*	-0,06	0,14	-0,15	-0,10	0,09	0,09	0,15	0,30*						
17. Test Age (N=90)	-0,07	-0,06	0,06	-0,01	-0,14	-0,27*	0,32	-0,13	0,13	0,06	0,06	0,01	0,04	-0,16	0,05	0,14					
18. Experience (N=91)	0,00	-0,03	-0,30*	0,20	0,28*	-0,28*	-0,01	-0,16	-0,13	0,18	-0,04	0,02	-0,23	0,10	-0,06	-0,21*	-0,50**				
19. Age (N=92)	-0,08	-0,09	-0,01	0,08	-0,07	-0,33*	0,31	-0,25*	0,22	0,12	0,03	0,03	-0,19	-0,10	-0,00	-0,04	0,63**	0,36**			
20. Sibling Rank (N=84)	0,25*	0,23	0,09	-0,21	0,04	-0,11	0,11	-0,05	-0,00	0,07	0,11	-0,03	-0,09	0,08	-0,10	-0,09	-0,10	-0,07	-0,16		
21. Qualifications (N=92)	0,22*	0,18	0,33*	-0,13	0,25	-0,02	-0,03	0,15	-0,21	0,15	0,08	0,25*	0,02	0,24	-0,24	-0,00	0,05	-0,20*	-0,12	0,03	
22. Father's Occupation (N=74)	0,19	0,24*	0,00	0,20	0,28	-0,17	-0,08	-0,06	0,07	0,20	-0,21	0,20	0,03	-0,12	0,11	0,01	-0,09	0,20	0,11	0,03	0,10

* p < 0,05

** p < 0,01

TABLE 4.4b Correlation between SMI component scores and other independent variables

	MANAGEMENT PHILOSOPHY					MANAGEMENT PLANNING					MANAGEMENT IMPLEMENTATION					MANAGEMENT EVALUATION				
	9/9	5/5	9/1	1/9	1/1	9/9	5/5	9/1	1/9	1/1	9/9	5/5	9/1	1/9	1/1	9/9	5/5	9/1	1/9	1/1
Mental Alertness	0,09	-0,05	-0,05	0,21	-0,09	0,11	0,02	0,03	0,04	-0,13	0,10	0,12	-0,22	-0,06	-0,04	-0,09	0,04	-0,21	-0,19	0,12
Deductive Reasoning	0,04	-0,01	-0,01	-0,04	-0,05	0,12	0,06	-0,02	-0,00	-0,11	-0,11	-0,03	-0,12	-0,11	-0,03	-0,22	0,13	-0,21	-0,09	0,06
Sociability	-0,15	-0,03	0,08	-0,03	-0,08	-0,05	0,12	0,03	0,22	0,13	0,02	0,05	0,17	0,08	-0,14	0,24	0,28	0,57	0,08	-0,37
Anxiety	-0,15	0,07	-0,05	0,32*	-0,07	-0,14	-0,41*	0,08	0,24*	0,01	-0,09	0,05	0,22	0,38*	0,24	-0,28	0,05	-0,04	0,26	0,18
Hostility	-0,10	0,08	-0,14	-0,07	0,06	-0,33	0,16	0,25*	-0,02	0,13	-0,12	0,11	-0,03	0,14	0,05	-0,43	-0,31	-0,19	-0,10	0,30
Rigidity	-0,00	0,08	0,03	0,33	-0,06	-0,18	0,11	0,11	-0,00	-0,07	-0,14	-0,08	0,06	0,05	0,23*	-0,05	-0,18	-0,14	0,14	0,11
Dominance	-0,23*	-0,03	0,13	-0,10	-0,17	0,15	-0,02	0,17	-0,24	0,13	-0,05	-0,13	0,20	-0,14	-0,23*	0,18	0,27	0,02	-0,20	-0,17
Willense D-score	-0,10	-0,20	0,11	0,15	0,05	-0,14	-0,13	0,10	0,10	0,26*	0,16	-0,07	0,13	0,02	0,18	0,32*	0,11	0,24*	0,22	0,24*
Willense Sum score	0,13	-0,00	-0,02	-0,09	-0,25	0,41*	0,14	-0,20	-0,11	-0,38*	0,04	0,07	0,09	-0,13	-0,15	-0,10	0,12	0,07	-0,18	-0,07
Role perception	-0,08	0,09	0,09	0,12	0,13	-0,11	-0,01	-0,9	0,9	0,24*	-0,08	0,05	0,14	0,16	0,19	-0,01	0,08	0,05	0,04	0,18

* p ≤ 0,05

(e) Inter-correlations between predictor variables

Significant positive correlations were found between measures of Intellectual Ability and Hostility, Sibling Rank and Father's Occupational Status. The Mental Alertness test also correlated highly with Educational Qualifications. It thus seems as if the intellectually superior subjects were more hostile (this was also found by Steyn, 1974) and that they tend to come from families where the father belongs to a higher occupational group.

The subscales of the SAPQ do not differ in the direction of the correlations from the standardisation group but the negative correlations between Sociability, Anxiety and Hostility are more marked as well as the correlation between Anxiety and Hostility.

On the SMI, the correlations between the 9/9 (ideal) and 9/1 (task oriented) and 1/1 (withdrawal) are significantly negative, as was expected. A significant positive correlation between 1/1 and 1/9 style was found in addition, supporting Taylor's (1976) criticism that the test fails to differentiate sufficiently between the two main dimensions, Consideration and Structure.

4.2 Criterion variables

Since the job description indicated that research leadership is multidimensional, the criteria for effectiveness could also be multidimensional. The criteria consist of the ratings done by the supervisors on the efficiency of the research leaders as well as the relative salary progress. The ratings of the supervisors also have a rating on the importance of a specific work aspect. It follows that it is more important to be rated excellent on an important work aspect than to be rated excellent on a less important work aspect. Hence, the ratings had to be weighted.

It was firstly found that differences exist between the various research disciplines on what constitutes important work aspects in their specific field.

Table 5.5 gives the mean and standard deviations of the importance various ratings of the work aspects as rated by the supervisors. The next table gives the difference between raters from the six research disciplines.

TABLE 4.5: Statistical properties of the ratings of the importance of each work aspect by the supervisors

Work aspect	X	SD	Work aspect	X	SD
1	3,39	0,74	16	3,10	0,76
2	3,74	0,51	17	2,91	0,82
3	3,63	0,64	18	3,00	0,81
4	3,11	0,60	19	3,59	0,52
5	3,54	0,58	20	3,15	0,63
6	3,76	0,52	21	2,83	0,90
7	3,29	0,73	22	3,04	0,71
8	3,78	0,44	23	3,08	0,65
9	3,48	0,54	24	3,06	0,77
10	3,41	0,77	25	3,23	0,60
11	3,35	0,62	26	3,39	0,61
12	3,05	0,73	27	3,48	0,77
13	2,85	0,83	28	3,25	0,64
14	3,13	0,99	29	3,37	0,71
15	3,06	0,91	30	3,17	0,71

N=92

- 1: work aspect not important
- 4: work aspect very important

The possibility that the various disciplines might differ regarding the importance of the work aspects rated was investigated and significant differences were found. Table 4.6 lists significant differences between the various research disciplines regarding the importance attached to the work aspects rated.

TABLE 4.6: The difference in rating work aspects between the various research disciplines* which differ significantly at $\alpha = 0,05$

Work aspect	\bar{X} for discipline						F	Sig.
	1	2	3	4	5	6		
1. Theoretical knowledge	3,78	3,33	3,50	3,62	3,67	2,75	7,06	0,000
4. Knowledge in related fields	3,07	2,89	3,00	3,29	3,44	2,83	2,71	0,025
5. Formulate problems	3,85	3,44	3,50	3,64	3,78	3,17	3,93	0,003
7. Devise techniques	3,55	2,55	3,00	3,55	3,22	3,20	3,22	0,010
9. Report writing	3,35	3,00	3,50	3,56	3,89	3,50	2,99	0,015
10. Motivate people	3,64	3,78	2,50	3,59	3,11	3,08	3,00	0,015
11. Interpersonal relations	3,28	2,89	2,50	3,64	3,33	3,20	4,24	0,002
12. Sensitive to people	3,07	2,89	2,00	3,29	3,44	2,70	3,72	0,004
14. Evaluate others' work	3,86	3,11	2,50	3,41	3,11	2,37	6,42	0,000
15. Control of people	3,43	3,11	2,50	3,29	3,00	2,58	2,59	0,031
16. Resource handling	3,28	2,88	2,50	3,44	3,55	2,45	8,55	0,000
17. Budgeting	3,28	2,77	2,00	3,26	3,33	2,16	10,28	0,000
19. Insight into problems	3,92	3,11	4,00	3,62	3,44	3,54	3,67	0,005
20. Anticipate problems	3,21	3,55	2,50	3,32	3,22	2,75	4,39	0,001
21. Develop subordinates	3,28	2,78	2,00	3,15	3,22	2,04	8,07	0,000
22. Decision making	3,57	2,67	3,00	2,94	3,22	2,95	2,59	0,031
23. Handling frustrations	3,21	2,22	2,50	3,15	3,44	3,12	5,21	0,000
24. Self confidence	3,21	1,89	3,00	3,41	3,44	2,79	10,19	0,000
25. Admit mistakes	3,21	2,67	2,50	3,44	3,44	3,17	3,81	0,004
26. Listen to others	3,78	2,66	3,50	3,38	3,78	3,29	5,76	0,000
27. Change strategy	4,00	2,55	3,00	3,50	3,78	3,42	6,88	0,000
29. Goal directed	3,57	3,11	2,00	3,56	3,78	3,04	4,99	0,001
30. Talks and lectures	2,76	3,11	3,00	3,38	3,67	2,96	3,11	0,012

N=92

* Research disciplines:

1. Water Research
2. Physics "
3. Chemistry "
4. Building "
5. Road "
6. Mechanical Engineering Research

The differences between the six research disciplines on how important they rate certain work aspects may be a reflection of the type of research involved, e.g. contract research or basic research. With contract research, deadlines and budget implications could become of greater importance. In order to further investigate the significant differences found between the research disciplines and to identify groupings of disciplines, a discriminant analysis was done.

If the assumption is made that the job description method followed covers the work of a research leader, the questionnaire based on the job description should also be adequate for all research disciplines. This implies that the total average score over the 30 work aspects covered in the questionnaire should be more or less the same regardless of the research discipline. The importance rating average for the sample on all the work aspects was found to be 3,27 (the average of the raw ratings). For the discriminant analysis, the ratings were corrected as follows:

$$CR_{ij} = R_{ij} - 3,27 + \bar{R}_i$$

where

- CR = corrected rating of rater i on item j
- R_{ij} = rating of rater i on item j
- \bar{R}_i = mean rating of rater i on all 30 items.

The co-ordinates of the centroid of each group in the discriminant space are given.

TABLE 4.7 : Discriminant functions evaluated at group centroids for the research disciplines

GROUP (Research discipline)	Function 1	Function 2	Function 3
1	2,612	1,052	-2,309
2	-8,781	-0,616	-1,576
3	2,329	-0,107	-1,686
4	0,940	1,342	1,291
5	4,084	2,628	-0,267
6	1,677	-2,986	0,382

The distance in the discriminant space between research discipline i and j was calculated by the following formula:

$$D_{ij} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2 + (z_i - z_j)^2}$$

where x_i and x_j = co-ordinate of centroid on discriminant function 1 for disciplines i and j respectively

y_i and y_j = co-ordinate of centroid on discriminant function 2 for disciplines i and j respectively

z_i and z_j = co-ordinate of centroid on discriminant function 3 for disciplines i and j respectively

D_{ij} = Cartesian distance between centroids for disciplines i and j .

TABLE 4.8 : Distances between centroids of disciplines

Research Discipline	1	2	3	4	5	N
1						
2	11,5**					
3	1,4	11,1**				
4	5,0**	8,6**	4,6*			
5	2,9**	13,4**	3,5	5,4**		
6	5,0**	11,0**	3,6	5,1**	6,1**	

* F test for difference significant: $p \leq 0,05$

**F test for difference significant: $p \leq 0,01$

After inspection of the distances between group centroids and their significancies, it is clear that research discipline 2 differs most from the others and should be excluded from some of the analyses.

(a) General Work Efficiency as criterion

General Work Efficiency was calculated by weighting the rated efficiency of each research leader on each work aspect by the average relevance of that work aspect for his research discipline. The rating scale ranged from 1=poor to 5=excellent.

The mean Work Efficiency obtained is 3,35 with a standard deviation of 0,69, skewness of 1,10, kurtosis of -0,55, maximum score of 4,83, and minimum score of 1,51 for 92 cases.

(b) Work efficiency in various areas covered by the questionnaire as criteria

The job description of senior research staff covered various areas, e.g. doing research, anticipating future needs, managing and dealing with people, and initiating and planning strategies. In order to ascertain whether these areas are real and could be identified separately, a factor analysis on the efficiency ratings of the questionnaire was carried out.

The factor analysis yielded five factors with eigen values of more than 1.

TABLE 4.9 : Eigen values and percentage of variance yielded by factor analysis of questionnaire

Factor	Eigen value	% variance	Cum. %
1	13,62	45,4	45,4
2	2,11	7,0	52,4
3	1,96	6,5	59,0
4	1,27	4,2	63,2
5	1,15	3,8	67,0

Table 4.10 represents the oblique factor structure matrix. Each loading represents the correlation between the variable and the factor. For factors 1 and 2 minimum loadings of 0,45 and for factors 3 and 4 minimum loadings of 0,50 are underlined.

According to Childs (1973), the formula for deciding on the minimum factor loading is:

$$\sqrt{\frac{P}{(p+1-k)\left(\frac{n-2}{t^2} + 1\right)}}$$

By convention, most researchers decide on loadings around 0,30 and the formula of Childs' results even more conservative minimum loadings.

TABLE 4.10 : Oblique factor structure matrix after rotation
with Kaiser normalisation on the effectiveness ratings
(N=92)

Effectiveness		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Theoretical knowledge	1	<u>0,78</u>	<u>0,47</u>	0,30	0,01	0,21
Methods used	2	<u>0,75</u>	0,24	0,48	0,14	0,35
Meet challenges	3	<u>0,51</u>	0,02	<u>0,57</u>	0,39	<u>0,57</u>
Knowledge related fields	4	<u>0,71</u>	<u>0,48</u>	0,40	-0,03	0,37
Formulate problems and hypotheses	5	<u>0,83</u>	0,27	0,42	0,23	0,47
Plan investigations	6	<u>0,62</u>	0,13	0,41	<u>0,54</u>	0,42
Devise techniques	7	<u>0,68</u>	0,23	0,36	0,24	0,45
Draw conclusions	8	<u>0,72</u>	0,22	0,45	0,20	0,35
Report writing	9	<u>0,75</u>	<u>0,49</u>	0,45	-0,01	0,43
Motivate people	10	<u>0,69</u>	0,12	<u>0,53</u>	0,42	0,49
Interpersonal relations	11	<u>0,49</u>	0,25	<u>0,85</u>	-0,01	0,37
Sensitive to others' needs	12	<u>0,52</u>	0,25	<u>0,69</u>	-0,34	0,30
Select and train	13	<u>0,65</u>	0,17	<u>0,53</u>	0,30	<u>0,66</u>
Evaluate work	14	<u>0,73</u>	<u>0,46</u>	<u>0,62</u>	0,26	0,33
Control people	15	<u>0,52</u>	0,11	<u>0,51</u>	<u>0,50</u>	0,45
Resource handling	16	<u>0,58</u>	0,22	0,36	<u>0,52</u>	<u>0,64</u>
Budgeting	17	<u>0,45</u>	0,40	0,26	0,32	0,46
Flexibility	18	0,42	0,09	<u>0,63</u>	0,33	<u>0,60</u>
Insight into problems	19	<u>0,77</u>	0,22	<u>0,54</u>	0,13	0,31
Anticipate problems	20	<u>0,67</u>	0,17	0,39	0,11	0,38
Develop subordinates	21	<u>0,55</u>	0,30	<u>0,69</u>	0,21	0,41
Decision making	22	<u>0,64</u>	0,11	0,45	0,30	<u>0,73</u>
Handle frustrations	23	0,32	0,21	<u>0,72</u>	0,15	0,28
Self confidence	24	<u>0,64</u>	0,07	0,28	-0,16	<u>0,50</u>
Admit when wrong	25	0,35	<u>0,91</u>	0,40	0,01	0,16
Listen to others	26	<u>0,46</u>	<u>0,54</u>	<u>0,69</u>	-0,04	0,28
Change strategies	27	0,41	0,32	<u>0,64</u>	0,23	0,43
Time limits	28	0,29	0,13	0,37	0,07	<u>0,73</u>
Goal directed	29	<u>0,73</u>	0,22	0,47	0,30	<u>0,61</u>
Talks and lectures	30	<u>0,63</u>	0,30	0,45	-0,19	0,46

TABLE 4.11: Inter-correlation matrix of the factors extracted from the factor analysis of effectiveness in work aspects (N=2)

	Factor 1	Factor 2	Factor 3	Factor 4
Factor 2	0,305			
Factor 3	0,498	0,254		
Factor 4	0,153	-0,022	0,133	
Factor 5	0,476	0,100	0,399	0,207

Factor 1 loaded highly on most of the items of the questionnaire, while the items dealing with pure research aspects had the highest loadings. This factor was interpreted as general efficiency in research.

Factor 2 loadings on questionnaire items indicate functioning in a subordinate capacity, e.g. admit when in the wrong, pay attention to ideas of others, write and prepare reports as well as theoretical knowledge. This factor was interpreted as the subordinate functions of a research leader.

Factor 3 loaded highest on factors related to interpersonal interaction, e.g. questions 11, 23, 26, 12 and 21 and deals with being accepted as a person. It was interpreted as an interpersonal relations factor.

Factor 4 loaded highest on factors dealing with the task, e.g. plan and design investigations, handling of resources, controlling subordinates, and was interpreted as a task oriented factor.

Factor 5 could not be interpreted. The underlined loadings of Table 4.10 was used to identify itmes to be added for measuring four additional criteria.

TABLE 4.12: Statistical properties of the additional criteria

Criterion	N	\bar{X}	SD	sk	kt	Max	Min
1. General efficiency	92	3,36	0,72	-0,13	-0,61	4,79	1,41
2. Subordinate "	92	3,38	0,83	-0,29	-0,56	5,00	1,33
3. Interpersonal "	92	3,36	0,72	-0,31	-0,59	4,85	1,62
4. Task "	92	3,36	0,86	-0,26	-0,45	5,00	1,33

(c) Salary Progress (rate of advancement) as criterion for effectiveness

The "rate of advancement" is indicative of the incumbent's worth to his research unit in terms of the salary he earns.

Seeing that differences were found between the research disciplines regarding how important certain work aspects were rated, differences regarding salary increments had to be investigated. It was found that the relationship between salary, age, qualifications and years of service is not linear. Transformations were done to ensure linearity. A regression analysis with the salary as criterion and transformed age, qualifications and years of service as predictors was done. Rate of advancement was calculated by subtracting the predicted salary from the salary of each research leader. An analysis of variance indicated that there is no difference between the various research disciplines regarding salary ($F=0,20$, Sig. 0,959, $P>0,05$).

TABLE 4.13: Correlation matrix of the variables in the regression analysis (N=77)

	Salary	Ln(Qualifications)	Ln(Age)
Ln (Qualifications)	0,114		
Ln (Age)	0,346	-0,159	
(Service)	0,408	-0,345	0,416

where \ln (variable) = natural logarithm of the variable.

TABLE 4.14: Summary of the regression analysis with salary as criterion, transformed age, qualification and service as predictors

Predictors	B (Non standardised regression co- efficient)	Significance of B	Multiple correlation
(Service) ²	6,845	,000	0,409
ln (Qualifications)	1876,5	,007	0,491
ln (Age)	3194,5	,049	0,529
Constant	1218		

The multiple correlation, adjusted for number of cases and number of predictors, is 0,50.

Salary progress can then be calculated as follows:

$$\text{Salary} - (6,845 + \ln(\text{Service}) + 1876,5 \times \ln(\text{Qualifications}) + 3194,5 \times \ln(\text{Age}) + 1218).$$

$$\bar{X} = 0,213 ; S = 2364,97$$

(d) Unweighted efficiency as criterion

The mean effectiveness score obtained for each research leader was also considered. This score was obtained by simply adding all the effectiveness ratings a person has obtained.

This criterion variable had a mean of 69,82, standard deviation of 14,54, skewness of -0,09, kurtosis of -0,74, maximum of 101 and minimum score of 36.

(e) Correlation between criterion variables

TABLE 4.15: Inter-correlation matrix of criteria scores

1(N=92)						
2(N=92)	0,99 ^{***}					
3(N=92)	0,85 ^{***}	0,84 ^{***}				
4(N=92)	0,94 ^{***}	0,91 ^{***}	0,75 ^{***}			
5(N=92)	0,79 [*]	0,78 ^{***}	0,53 ^{***}	0,72 ^{***}		
6(N=92)	0,20 [*]	0,21 [*]	0,22 ^{***}	0,21 ^{***}	0,06	
7(N=92)	0,98 ^{***}	0,96 ^{***}	0,96 ^{***}	0,81 ^{***}	0,75 ^{***}	0,22 [*]

* p < 0,05

***p < 0,01

- 1 Weighted research leader efficiency
- 2 General research efficiency
- 3 Subordinate efficiency
- 4 Interpersonal efficiency
- 5 Task efficiency
- 6 Salary progress
- 7 Unweighted research leader efficiency

4.3 Correlations between predictor variables and criteria

The correlations between the criterion measures and the component scores of the SMI are given separately. The component scores as well as the overall management style were considered as predictors.

TABLE 4.16: Correlations between component scores of the SMI and criteria (N=83)

Predictors	Criterion variables						
	1	2	3	4	5	6	7
Philosophy 9/9	0,10	0,11	0,06	0,10	0,12	0,01	0,12
Philosophy 5/5	0,16	0,16	0,11	0,24*	0,21*	-0,10	0,21*
Philosophy 9/1	-0,02	-0,02	-0,05	-0,04	0,01	0,01	0,01
Philosophy 1/9	-0,07	-0,08	-0,04	-0,06	-0,05	0,01	-0,05
Philosophy 1/1	** -0,36	** -0,39	** -0,33	** -0,39	** -0,35	-0,09	** -0,35
Planning 9/9	0,12	0,15	0,09	0,12	0,10	-0,07	0,10
Planning 5/5	** 0,27	** 0,28	** 0,26	** 0,25	** 0,28	0,00	** 0,28
Planning 9/1	* -0,18	* -0,20	* -0,19	-0,12	-0,12	0,01	-0,12
Planning 1/9	-0,17	* -0,18	-0,13	-0,16	* -0,18	-0,12	-0,18
Planning 1/1	-0,10	-0,13	-0,07	-0,09	-0,04	0,13	-0,04
Implementation 9/9	-0,05	-0,05	0,10	-0,13	-0,05	-0,05	-0,05
Implementation 5/5	-0,09	-0,06	-0,10	-0,10	-0,15	-0,05	-0,15
Implementation 9/1	-0,03	-0,05	-0,06	0,10	0,03	0,09	0,03
Implementation 1/9	-0,02	-0,04	-0,01	0,04	0,03	0,03	0,03
Implementation 1/1	* -0,25	* -0,22	-0,18	* -0,31	** -0,27	-0,18	** -0,27
Evaluation 9/9	-0,13	-0,13	-0,15	-0,17	-0,11	-0,09	-0,11
Evaluation 5/5	0,02	0,06	-0,07	0,03	0,03	0,04	0,03
Evaluation 9/1	* -0,19	* -0,20	-0,12	-0,13	-0,10	-0,10	-0,18
Evaluation 1/9	-0,17	-0,14	-0,19	-0,11	-0,08	-0,08	-0,23*
Evaluation 1/1	-0,03	-0,04	0,11	-0,06	0,21	* 0,21	-0,06

* $p < 0,05$

** $p < 0,01$

1. Weighted research leader efficiency
2. General research efficiency
3. Subordinate efficiency
4. Interpersonal efficiency
5. Task efficiency
6. Salary progress
7. Unweighted research leader efficiency

TABLE 4.17: Correlations between predictor variables and criteria

	Criteria						
	1	2	3	4	5	6	7
Mental Alertness	0,19 [*] (N=89)	0,19 [*] (N=89)	0,27 ^{**} (N=89)	0,07 (N=89)	0,15 (N=89)	0,11 (N=75)	0,15 (N=85)
Deductive Reasoning	0,20 [*] (N=89)	0,20 [*] (N=89)	0,24 [*] (N=89)	0,12 (N=89)	0,19 (N=89)	0,07 (N=75)	0,19 [*] (N=85)
Role Perception	-0,25 [*] (N=79)	-0,24 [*] (N=79)	-0,19 [*] (N=79)	-0,17 (N=79)	-0,15 (N=79)	0,07 (N=68)	-0,24 [*] (N=78)
Sociability	-0,16 (N=37)	-0,16 (N=37)	-0,27 [*] (N=37)	-0,09 (N=37)	-0,04 (N=37)	-0,18 (N=30)	-0,17 (N=34)
Anxiety	0,01 (N=37)	0,03 (N=37)	-0,02 (N=37)	0,14 (N=37)	0,08 (N=37)	0,15 (N=30)	0,04 (N=34)
Hostility	0,25 (N=37)	0,22 (N=37)	0,16 (N=37)	0,17 (N=37)	0,27 [*] (N=37)	0,34 [*] (N=30)	0,25 (N=34)
Rigidity	0,05 (N=37)	0,03 (N=37)	0,20 (N=37)	0,07 (N=37)	0,04 (N=37)	-0,03 (N=30)	0,05 (N=34)
Dominance	0,18 (N=37)	0,19 (N=37)	-0,08 (N=37)	0,20 (N=37)	0,26 [*] (N=37)	-0,04 (N=30)	0,24 (N=34)
Willemse D-Score	-0,19 (N=65)	-0,18 (N=65)	-0,14 (N=65)	-0,18 (N=65)	-0,09 (N=65)	-0,20 (N=56)	-0,18 (N=62)
Willemse Sum-Score	0,09 (N=65)	0,03 (N=65)	-0,03 (N=65)	0,02 (N=65)	-0,05 (N=65)	0,07 (N=56)	0,07 (N=62)
Management Style 9/9	0,01 (N=83)	0,02 (N=83)	0,05 (N=83)	-0,04 (N=83)	-0,03 (N=83)	-0,07 (N=70)	0,02 (N=79)
Management Style 5/5	0,15 (N=83)	0,19 [*] (N=83)	0,08 (N=83)	0,17 (N=83)	0,08 (N=83)	-0,04 (N=70)	0,14 (N=79)
Management Style 9/1	-0,15 (N=83)	-0,17 (N=83)	-0,15 (N=83)	-0,07 (N=83)	-0,15 (N=83)	0,01 (N=70)	-0,09 (N=79)
Management Style 1/9	-0,16 (N=83)	-0,16 (N=83)	-0,13 (N=83)	-0,11 (N=83)	-0,15 (N=83)	-0,07 (N=70)	-0,15 (N=79)
Management Style 1/1	-0,26 ^{**} (N=83)	-0,27 ^{**} (N=82)	-0,15 (N=82)	-0,30 ^{**} (N=82)	-0,18 [*] (N=82)	0,04 (N=69)	-0,26 [*] (N=78)
Age	-0,06 (N=90)	-0,03 (N=90)	-0,06 (N=90)	-0,06 (N=90)	-0,07 (N=90)	-0,00 (N=77)	-0,05 (N=86)
Qualifications	0,20 [*] (N=88)	0,23 [*] (N=88)	0,12 (N=88)	0,12 (N=88)	0,32 ^{**} (N=88)	-0,01 (N=77)	0,16 (N=84)
Experience	0,14 (N=91)	0,15 (N=91)	0,12 (N=91)	0,10 (N=91)	0,04 (N=91)	0,03 (N=77)	0,14 (N=87)
Father's Occupation	0,15 (N=74)	0,15 (N=74)	0,15 (N=74)	0,10 (N=74)	0,15 (N=74)	-0,15 (N=65)	0,17 (N=70)
Sibling Rank	0,16 (N=85)	0,16 (N=85)	0,11 (N=85)	0,17 (N=85)	0,16 (N=84)	-0,14 (N=74)	0,16 (N=81)

* p < 0,05

** p < 0,01

Intellectual Ability, Role Perception, the 1/1 Management Style and Qualifications correlated to a significant degree with weighted efficiency. The 1/1 Management Style, which implies a minimum concern for both production and people, had a negative correlation. A high score on Role Perception is indicative of a big difference in the way the leader and his supervisor views his task. A negative correlation could thus be expected.

Regarding Salary Progress and Task Efficiency as criteria, a significant positive correlation with Hostility was found. This relationship can be explained in various ways but because of the sample size (N=30) no conclusions can be made without more evidence.

The unweighted Efficiency criterion correlated with the same predictors and in the same direction, if somewhat weaker, as general Work Efficiency criterion. The weighted and unweighted criterion measures correlated highly (0,98) and it was decided not to use the unweighted criterion measurement for research leadership effectiveness.

4.4 Regression analysis

The study is aimed at predicting effective research leadership by considering a variety of possible predictor variables. Multiple regression lends itself to this kind of study because of the collective as well as separate contribution of two or more independent variables to the variance of a dependent variable.

The unstandardised regression equation is

$$y^1 = A + B_1 X_1 + B_2 X_2 + \dots + B_K X_K$$

(Kim and Kohout in Nie et al., 1975, p.9 328)

where y^1 represents the estimated value for y . A is the intercept and B_i are regression coefficients. The A and B_i coefficients are selected in such a way that the sums of the squared residuals $(y - y^1)^2$ is minimised. Selection of the optimum A and B_i coefficients using the least-squares criterion also implies that the correlation between the actual y values and the y^1 estimated values is maximised, while the correlation between the independent variables and the residual values $(y - y^1)$ is reduced to zero.

Multiple regression requires that the relationship among the variables are linear. Kim and Kohout (1975) suggest that non-linear relationships be handled through transformation of variables.

Linearity was first tested and the non-linear predictor variables transformed.

Seeing that General Research Efficiency correlated highly with the other dependent variables, it was decided to use this variable in the test for linearity.

An analysis of variance was done for each predictor variable where the levels of each predictor had been grouped into six class intervals. The Eta^2 value was computed and the significance of its difference from the product moment correlation determined. When this difference was found to be significant, the predictor was considered to be non-linearly related to the criteria. General Work Efficiency was then graphed against the variable to determine the optimum value of the predictor.

¹) Eta^2 , the proportion of variance in y explained by the different levels of a predictor.

The following predictors were found to be non-linear:

TABLE 4.18: Significant* non-linear predictors

Predictor (X)	r	Eta	P of dif. between r and Eta	Optimum value	Transformation
Management Philosophy 9/1	-0,10	0,43	0,020	18	X-18
Management Evaluation 1/9	-0,14	0,43	0,006	18	X-18
Management Style 1/9	-0,14	0,38	0,055	63	X-63
Management Style 1/1	-0,31	0,47	0,086	33	X-33

*p < 0,10

The regression analyses were firstly carried out on the sample from which research discipline 2 was excluded.

The order of including independent variables into the regression equations can be done in several ways. The method adopted for this study was a stepwise inclusion by which a variable is entered according to the amount of variance of the independent variable, in descending order of contribution.

The SPSS programme (Nie et al., 1975) automatically enters the independent variable that explains the greatest amount of variance, the second variable to enter the equation is the one that in its combination with the first variable will account for the most amount of variance in the dependent variable, etc. A variable was included only if its contribution was significant at $p=0,100$ and removed if, after some other inclusions, its contribution fell below this level.

The inclusion of the SAPQ independent variables in the regression analyses resulted in small numbers (N=37). The convention adhered to for computer analyses eliminated all cases that had missing data for a particular variable. The inclusion of missing data is thus unacceptable and the SAPQ measures were thus excluded from the regression analyses. Furthermore, only Hostility correlated significantly with Salary Progress (which was also later excluded) and Task Efficiency criteria.

4.4.1 Regression analysis with weighted Research Leadership Efficiency as criterion

This criterion is the average efficiency of the research leader in terms of the importance of the work aspect in his research discipline.

TABLE 4.19: Regression analysis Research Leader Efficiency (N=50)

Variable	B Regression weight	Individual predictor significance (p)	Beta	Significance (p)
Management Philosophy 1/1	-0,049	0,019	-0,317	0,01
Management Evaluation 9/1	-0,037	0,033	-0,288	0,004

The F-level was insufficient for further computation.

Constant = 4,39

Seeing that the predictors obtained from the regression analysis on weighted Research Leadership Efficiency were less desirable, no further analysis was done with this criterion.

4.4.2 Regression analysis with General Research Efficiency as criterion

A summary of the multiple regression analysis conducted with the additional predictor variables is presented in Table .20.

TABLE 4.20: Regression analysis General Research Efficiency

Variable	B (regression weights)	Individual predictor significance (p)	Beta	Overall significance (p)
Transformed Evaluation 1/9	-0,0702	0,008	-0,2801	0,000
Philosophy 1/1	-0,0558	0,003	-0,3162	0,000
Planning 5/5	0,0376	0,024	0,2270	0,000
Transformed Philosophy 9/1	-0,0527	0,014	-0,267	0,000
Management Style 9/1	-0,0171	0,003	-0,351	0,000
Planning 1/1	0,0270	0,100	0,184	0,000

The multiple $R = 0,653$. For 70 cases and 6 predictors the adjusted multiple $R = 0,609$, constant = 4,60.

0,37% of the variance is accounted for by the six predictors.

The manager who practices 1/9 during evaluation will, according to Teleometrics Int. (1980), focus on high morale among employees. Underlying this approach is a basic distrust of people. No significant correlation between Hostility and 1/9 Evaluation was found ($r=0,10$; $p=0,29$). The numbers, however, were small ($N=37$) and no conclusions can be made regarding Hostility and 1/9 Evaluation. Anxiety and Evaluation 1/9 showed a more significant correlation ($p=0,07$). It is suggested that anxiety rather than a basic distrust of people underlie the 1/9 Management Evaluation practices.

The manager with a 1/1 Philosophy feels that production and people concerns are in conflict, his cynicism is borne of frustration at having no impact on the organisation (Teleometrics, 1980).

The 1/1 Philosophy correlated significantly with the Willemse X-score ($r=0,27$; $p=0,05$).

The X-score is associated with stress and anxiety in the person (Van Coller, 1961). However, the X-score had no significant relationship with Anxiety as measured by the SAPQ. It is interesting to note that Philosophy 1/1 correlated significantly negatively with Qualifications ($r=0,20$; $p=0,03$) indicating that the lower the qualifications the more apt a 1/1 Management philosophy becomes.

An overall 5/5 Management Style is seen as one that represents a moderate concern for both production and people concerns. This "middle of the road" Management Style prevents big confrontations but is also not conducive to excellence and originality (Blake and Mouton, 1968). 5/5 Planning practices means a consultative approach to influencing decision making. In a research environment, this approach may be the more preferred because of the interest value of the work and the possibility that the leader may take for granted the high motivation of subordinates. Planning in a 5/5 manner leads to an avoidance of 1/9 Evaluation practices ($r=0,18$; $p=0,05$) and towards an overall 9/9 Management philosophy ($r=0,18$; $p=0,05$). Experience also correlated with 5/5 Planning ($r=0,25$; $p=0,01$) indicating that experience in doing research might force the leader to adopt 5/5 Planning practices. The leader with 5/5 Planning practices is also less sociable ($r=0,41$; $p=0,007$) and less dominant ($r=-0,33$; $p=0,2$).

9/1 Management philosophy is indicative of a strong authoritarian approach to management issues (Teleometrics, 1980). This leader is directive and tends to believe that subordinates are not responsible regarding their work. The 9/1 and 1/9 Philosophies had a negative correlation ($r=-0,44$; $p=0,001$) indicating that the two attitudes are directly in opposition. Experience and 9/1 Philosophy also correlated negatively ($r=-0,20$; $p=0,03$) indicating that the more experienced researchers do not have a

9/1 Philosophy. The 9/1 Philosophy also correlated with 1/1 Implementation practices implying withdrawal ($r=0,27$; $p=0,008$). This could be interpreted that the less experienced researchers are more inclined to favour production concerns but tends to withdraw from management evaluation practices.

The 1/1 manager tries to avoid personal risks and limits his involvement in Planning practices. Planning 1/1 had a significant negative correlation with Willemse total score ($r=0,38$; $p=0,001$) - the Willemse Sum-score which is indicative of a positive realistic approach toward unfamiliar tasks. The Willemse D-score (of which a high score is indicative of an over-estimating approach towards unfamiliar tasks) correlated ($r=0,26$; $p=0,02$) with 1/1 Planning practices. Role perception (the higher the score the greater the difference between the leader and his supervisor regarding his role) also correlated with 1/1 Planning ($r=0,24$; $p=0,01$). It thus emerges that the leader who uses 1/1 Planning practices is somewhat unrealistic when he has to assess new and unfamiliar tasks and that he experiences role conflict.

In order to get a clear idea of research leaders if General Research Efficiency is used as a criterion, a profile can be drawn:

Regarding the area of General Research Efficiency, the research leader should not have an authoritarian or withdrawal management philosophy, during the planning stages he should adopt a consultative approach tending to let his subordinates participate in the relevant decisions, particularly those who represent certain specialisation fields. He should not be anxious in his dealings with others and should have faith in people and it is required that he has a realistic view of his capabilities when faced with the unfamiliar.

4.4.3 Regression analysis with Subordinate Efficiency as criterion

TABLE 4.21: Summary of multiple regression analysis conducted with Subordinate Efficiency as criterion and all the independent variables

Variable	B (regression weights)	Individual predictor significance (p)	Beta	Overall significance (p)
Transformed Evaluation 1/9	-0,0991	0,001	12,472	0,001
Planning 5/5	-0,0336	0,071	0,184	0,000
Philosophy 1/1	-0,0519	0,010	-0,267	0,000
Implementation 9/9	0,0450	0,002	0,353	0,000
Evaluation 9/9	-0,0576	0,006	-0,315	0,000

Multiple R = 0,633. For 70 cases and five predictors the adjusted multiple R = 0,595; Constant = 2,73.

35% of the variance is accounted for by the five predictors.

The 9/9 Evaluation correlated highly ($r=-0,43$; $p=0,006$) with Hostility, indicating that the leader who adopts 9/9 Evaluation practices is amiable and trusting. Apparently, too much of this is not conducive to functioning in the leadership role. Evaluation 9/9 also correlated with Willemse D-score ($r=0,32$; $p=0,006$). A high D-score is indicative of an unrealistic approach to an unfamiliar situation. It thus seems possible that people who prefer a 9/9 Evaluation approach may be both too trusting and unrealistic. It should, however, be kept in mind that the numbers involved for Hostility are small ($N=34$).

The 9/9 Implementation approach had a positive correlation with the criterion and this implies that both people and production concerns should be considered for optimum functioning. The fact that 5/5 Planning again emerged as a predictor indicates that in the research environment the effective leader does not interfere and guide or involve himself too much in the activities of subordinates.

4.4.4 Regression analysis with Interpersonal Efficiency as criterion

TABLE 4.22: Summary of the multiple regression analysis conducted with Interpersonal Efficiency as criterion and all the independent variables

Variable	B (regression weight)	Individual predictor significance (p)	Beta	Overall significance (p)
Transformed Management Style 1/1	-0,0273	0,001	-0,358	0,001
Transformed Evaluation 1/9	-0,0685	0,011	-0,271	0,000
Planning 5/5	0,03172	0,073	0,190	0,000
Evaluation 9/9	-0,3062	0,083	-0,183	0,000

The multiple correlation is 0,575. For 70 cases and four variables the adjusted multiple $R = 0,542$, and the constant = 3,84.

29% of the variance is accounted for by the four predictors.

Regarding efficiency in interpersonal relationships, a 1/1 withdrawal style with the underlying anxiety and unrealistic ways of evaluating and approaching the unfamiliar is again contradictory of effectiveness, role perception conflict ($p=0,005$). The fact that the measured anxiety on the SAPQ scale had an insignificant relationship with 1/1 Management philosophy attributed to the possibility that scores might have been manipulated to appear acceptable (bearing in mind that the tests were administered for selection purposes).

Evaluation and Planning practices showed the same direction as with the previous efficiency factors.

4.4.5 Multiple regression analysis with Task Efficiency as criterion

TABLE 4.23: Summary of the multiple regression analysis conducted with Task Efficiency as criterion and all the independent predictor variables

Variable	B (regression weight)	Individual predictor significance (p)	Beta	Overall significance (p)
Transformed Evaluation 1/9	-0,130	0,000	-0,433	0,000
Evaluation 9/1	-0,037	0,031	-0,223	0,000
Planning 5/5	0,0371	0,070	0,187	0,000
Transformed Management Style 1/1	-0,0154	0,103	-0,170	0,000

Multiple R = 0,592. For 70 cases and 4 predictors the adjusted multiple R = 0,558, and constant = 3,88.

31% of the variance is accounted for by the 4 predictors.

Evaluation 9/1 production orientated evaluation practices showed a negative correlation with Sociability ($r=0,57$; $p=0,001$) indicating that these people are more socially unresponsive and that a 9/1 evaluation approach is not conducive to task efficiency, the 1/9 evaluation approach is also contra-indicative of effectiveness.

The 5/5 approach for Planning again emerged as the most desirable with 1/1 Management Style the least desirable.

4.4.6 Multiple regression analysis with Salary Progress as criterion

Salary Progress was calculated (see 5.2(c)) to imply a person's annual earnings above what is expected by virtue of his age, qualifications and years of service and is indicative of his worth to his research unit in terms of the salary he earns.

TABLE 4.24: Summary of the multiple regression analysis conducted with Salary Progress as criterion and the independent predictor variables

Variable	B (regression weight)	Individual predictor significance (p)	Beta	Overall significance (p)
Evaluation 1/1	147,507	0,018	0,301	0,000
Implementation 1/1	-135,583	0,038	0,264	0,022

The multiple $R = 0,34$. For 65 cases and 2 predictors. Adjusted multiple $R = 0,57$, and the constant = -583,76.

8% of the variance is accounted for by the two predictors.

This criterion cannot be adequately predicted by the independent variables and was not further considered as a criterion measurement.

4.5 Regression analyses with Management Style as dependent variable

Regression analyses with the various Management Styles as dependent variables; the effectiveness ratings and personality questionnaire as predictors were carried out in order to find possible predictors for a specific Management Style and in order to describe the Management Style in terms of the effectiveness ratings and personality measures.

TABLE 4.25: Correlation of the variables in the regression analysis

Effectiveness	MANAGEMENT STYLE					SAPQ				
	9/9	5/5	9/1	1/9	1/1	Sociality	Anxiety	Hostility	Rigidity	Dominance
1	-0,036	-0,141	-0,337	-0,248	-0,066	-0,441	0,109	0,290	-0,165	0,048
2	-0,279	0,136	-0,281	-0,059	-0,026	-0,118	0,005	-0,012	-0,186	0,251
3	-0,265	-0,036	-0,235	0,150	-0,203	0,263	-0,043	0,130	-0,166	0,275
4	0,148	-0,015	-0,367	-0,050	-0,166	-0,158	0,038	-0,013	-0,238	0,201
5	0,133	-0,102	-0,490	-0,055	0,035	-0,148	-0,053	0,258	-0,336	0,318
6	-0,282	-0,049	-0,320	0,145	-0,136	0,080	0,041	0,287	-0,159	0,240
7	-0,125	0,224	-0,386	0,015	-0,050	-0,217	0,156	0,320	-0,097	-0,118
8	-0,137	-0,007	-0,152	-0,070	-0,028	-0,041	0,012	0,132	-0,265	0,270
9	-0,053	-0,102	-0,435	-0,250	-0,044	-0,411	-0,100	0,300	-0,259	0,144
10	-0,101	0,182	-0,346	0,071	-0,126	0,104	0,055	-0,105	-0,135	0,276
11	-0,412	0,099	-0,184	0,136	-0,237	-0,008	0,128	0,084	-0,056	0,006
12	-0,152	0,255	-0,064	0,025	-0,069	-0,110	-0,052	0,066	-0,142	0,242
13	-0,210	0,220	-0,288	-0,180	0,001	-0,001	-0,012	0,118	-0,234	0,467
14	-0,156	-0,065	-0,211	-0,030	0,079	-0,239	0,084	-0,179	-0,015	0,142
15	-0,221	-0,060	-0,045	0,223	-0,054	0,125	0,079	0,004	0,124	0,325
16	-0,175	0,110	-0,361	0,009	-0,064	0,073	-0,020	0,320	-0,314	0,388
17	-0,054	-0,300	-0,402	-0,196	0,037	-0,087	-0,201	0,194	-0,184	0,326
18	-0,179	-0,076	-0,168	-0,161	-0,168	0,168	-0,186	0,182	-0,323	0,471
19	-0,235	0,153	-0,360	0,006	-0,106	-0,117	0,031	0,106	-0,129	0,137
20	0,053	0,190	-0,333	-0,115	-0,223	0,073	-0,186	0,023	-0,360	0,234
21	-0,225	0,127	-0,085	0,069	-0,208	-0,211	0,079	0,097	0,004	0,114
22	-0,129	0,059	-0,430	-0,060	0,041	0,110	-0,228	0,148	-0,368	0,192
23	-0,378	0,065	-0,019	0,152	-0,171	0,077	0,055	0,124	0,133	0,149
24	0,173	0,185	-0,297	-0,450	0,044	0,065	-0,323	0,047	-0,411	0,369
25	-0,084	-0,161	-0,033	0,023	0,030	-0,376	0,469	0,167	-0,048	-0,332
26	-0,283	-0,134	-0,064	-0,033	-0,100	0,046	0,236	0,146	-0,253	-0,030
27	-0,297	-0,070	0,081	-0,056	-0,118	0,089	-0,030	-0,068	-0,254	-0,033
28	-0,268	-0,096	-0,278	-0,330	0,124	-0,030	-0,342	0,460	-0,323	0,309
29	-0,222	0,266	-0,423	-0,031	-0,030	0,057	-0,073	0,171	-0,260	0,133
30	0,052	-0,083	-0,249	-0,309	-0,163	-0,053	-0,193	0,093	-0,357	0,270

- (a) The 9/9 (ideal) Management Style as dependent variable, the effectiveness ratings, and personality questionnaire as independent variables

TABLE 4.26: Regression analysis on 9/9 Management Style

Variable	B (regression weight)	Beta	Individual predictor significance (p)	Overall significance (p)
Hostility	-0,451	-0,463	0,001	0,009
Effectiveness 5	10,646	0,912	0,000	0,003
Effectiveness 2	-7,305	-0,492	0,003	0,001
Effectiveness 19	-4,625	-0,324	0,076	0,001
Effectiveness 20	5,788	0,476	0,005	0,000
Effectiveness 26	-5,613	-0,375	0,008	0,000
Effectiveness 29	-4,507	-0,390	0,061	0,000

The adjusted multiple R = 0,80 for 30 cases and 64% of the variance is explained by the seven predictors. Constant = 122,26.

Multiple R = 0,85.

The leader with a 9/9 Management Style is amiable (low on Hostility), received a high rating on motivating people (Effectiveness 5), was evaluated low on his effectiveness (2) regarding the methods used in his field as well as his insight into problems in his field (Effectiveness 19). He is evaluated as being effective (20) in anticipating new problems which may lead to research, but low on paying attention to the ideas of others (Effectiveness 26). He was rated low on displaying goal-directed behaviour when faced with unfamiliar situations.

The results obtained thus portrays the 9/9 manager as an amiable, trusting, well-disposed person who is able to anticipate new problems which may lead to research, and, while he is able to motivate people, little attention is paid to their ideas. He is not seen as being goal-directed, and not well-versed in the methods used in his field and his insight into problems in his field is seen as being poor.

According to the results obtained, the leader with a 9/9 management approach cannot be seen as a person with equal concern for people and production seeing that he is not goal-directed and has little insight into problems in his field.

(b) The 5/5 Management Style

TABLE 4.27 : Regression analysis on 5/5 Management Style

Predictor	Regression weight	Beta	Individual predictor significance (p)	Overall significance (p)
Effectiveness 17	-5,227	-0,225	0,004	0,108
Effectiveness 29	6,191	0,703	0,002	0,021
Effectiveness 3	-3,60	-0,432	0,036	0,007

The adjusted multiple $r=0,60$ for 30 cases and 29% of the variance is explained by the three predictors. Constant = 89,15.

Multiple R = 0,29.

The results indicate that the leader with the 5/5 Management Style was rated low on budgeting ability (Effectiveness 17), high on display of goal-directed behaviour when faced with unfamiliar situations (Effectiveness 29). This profile would account for the 5/5 Management Style manager being described as being lax to take a firm stand and not to involve himself too much in decision making. As part of a team such a person should be able to function adequately, but as the leader he is envisaged as being less dynamic.

The Effectiveness 3 (ability to meet and overcome challenges) negative correlation further supports the theory that the 5/5 manager is more concerned with security rather than innovative behaviour.

(c) The 9/1 Management StyleTABLE 4.28 : Regression analysis on 9/1 Management Style

Predictor	Regression weight	Beta	Individual predictor significance (p)	Overall significance (p)
Effectiveness 5	-7,049	-0,479	0,008	0,006
Dominance	0,454	0,347	0,017	0,003
Effectiveness 17	-5,195	-0,253	0,062	0,002

Adjusted multiple R = 0,60 for 30 cases and 36% of the variance is explained by the three predictors. Constant = 85,54. Multiple R = 0,65.

This leader is rated low on formulating problems and hypotheses, high on dominance and low on seeing the budget implications of his research programme.

(d) The 1/9 Management Style

The 1/9 Management Style yielded no predictors in the regression and only a negative correlation of more than $r=0,30$ was reported with Effectiveness 24 and 26 (feeling competent and paying attention to the ideas of others).

(e) The 1/1 Management StyleTABLE 4.29 : Regression analysis on 1/1 Management Style

Predictor	Regression weight	Beta	Individual predictor significance (p)	Overall significance (p)
Effectiveness 12	-3,569	-0,265	0,039	0,003
Effectiveness 23	-2,052	-0,189	0,152	0,005

The adjusted multiple R=0,35 for 30 cases and 12% of the variance is explained by the two predictors. Constant = 56,11. Multiple R = 0,38.

From this table it is gained that the leader with a 1/1 Management approach is evaluated as being unable to handle his frustrations and is not sensitive to the needs of others.

4.6 Testing of hypotheses

Our hypotheses stated that the research leader's intelligence, his ability to handle stress, his role perception, technical competence, and his interpersonal relationships will have an influence on his effectiveness.

A relationship between predictor variables and the criterion for effective research leadership should thus exist.

It was found that intellectual ability ($p < 0,05$), role perception ($p < 0,05$), a withdrawal from management issues (1/1 Management Style) ($p < 0,01$), and qualifications ($p < 0,05$), affect the effectiveness of the research leader.

Hypothesis 1

The relationship between leader intelligence and leader effectiveness is moderated by the level of anxiety of the research leader. To test this hypothesis, it was necessary to create multiplicative combinations of intelligence and anxiety (i.e. anxiety \times intelligence, intelligence \div anxiety, anxiety \div intelligence). If any of these combinations contribute significant to the variance of worker efficiency in a regression analysis, the hypothesis is confirmed, and the nature of the interaction between intelligence and anxiety can be determined by applying the resulting regression equation to various hypothetical cases.

However, a regression analysis accepted intelligence as a predictor of general effectiveness only. The conclusion is that the effect of intelligence on research leader effectiveness remains the same regardless of the level of anxiety.

Hypothesis 2

This hypothesis stated that research leader effectiveness is influenced by the leader's ability to use goal-directed behaviour when confronted with an unfamiliar situation.

The Willemse composite score (page 94) had no significant correlation with the various measures of effectiveness ($p > 0,10$). It should, however, be taken into consideration that reliability and validity of the goal-directedness score has not been calculated.

Hypothesis 3

It was hypothesised that the research leader's role perception affects his effectiveness. This hypothesis could be confirmed. The relationship between research leader effectiveness and role perception is significant ($p < 0,05$). It was found that the bigger the role conflict, the lower the effectiveness of the leader was rated by his supervisor. Role conflict is seen as the degree to which the research leader and his supervisor differ regarding what is considered important work aspects.

Hypothesis 4

The hypothesis stated that research leader effectiveness is related to technical skills and experience could only be partly supported. Experience showed no significant relationship with effectiveness criteria, ($p > 0,05$), but academic qualifications was significant ($p < 0,05$). The conclusion is that to be rated

effective the research leader needs the necessary academic qualifications, which is seen as more important as the number of years of experience in doing research.

Hypothesis 5

The hypothesis stated that the appropriate use of person and production oriented behaviour in management results in more effective research leadership.

The regression analysis in which the management styles which measure people and production orientation are included, yielded only two significant predictors.

Both the 1/1 Management Philosophy and 9/1 Management Evaluation had significant regression weights. This implies that these two management orientations are not conducive to functioning in the leadership role and hence a leader leaning towards these management orientations will be rated less effective.

The 1/1 Management Style is a defeatist style, while the 9/1 Management stresses a 'shape up or ship out' (Blake and Mouton, 1968) approach. While the regression analysis did not pinpoint the most appropriate management style, it showed that certain management orientations are less acceptable in the research leadership position.

4.7 Conclusion

From the hypotheses tested, it is clear that intellectual ability, qualifications (which may, to some extent, be linked to intellectual ability), whether role conflict is experienced or not, and management orientation have an influence on the effectiveness of the research leader.

Due to small numbers, the effect of personality measures could not fully be investigated.

It became clear, however, during the analysis of the data, that no clear leadership dimension could be identified as such. Certain leadership properties, however, did emerge.

The senior researchers used in this study, although they are senior enough to head research projects, were not involved in sufficiently high level decision making or planning of research strategies.

Senior research leadership can be predicted, but the factor analysis uncovered special areas of functioning which need to be further explored. It was thus considered necessary to describe effective senior research functioning in terms of the factors obtained.

The prediction models are discussed in Chapter 5.

CHAPTER 5.

- 5 . DISCUSSION OF RESULTS, CONCLUSION AND RECOMMENDATIONS
- 5.1 Discussion of results
 - 5.1.1 Criterion for research leadership effectiveness
 - 5.1.2 General profile of an effective research leader
 - 5.1.3 General profile of an effective senior researcher
 - 5.1.4 Discussion of the differences
 - 5.1.5 Implications
- 5.2 Conclusion
- 5.3 Recommendations

5. DISCUSSION OF THE RESULTS AND CONCLUSION

5.1 Discussion of the results

This study aimed at predicting effective research leadership potential. Information on 92 subjects who were considered to be research leaders because of their responsibility for research projects and technical or research staff, was obtained. Whereas a sample of 92 could be accepted as adequate, discussion of the final results are hampered because of missing information on the South African Personality Questionnaire and Willemse Board (both measures of personality). This resulted in analysis for these two measures being based on 37 and 53 cases respectively.

A model for research leadership which accounted for specific consideration of the job demands pertaining to a research leader's position, was developed. The structure for this model was based on the Person-Process-Product Model of Campbell et al. (1970). The Fiedler and Leister Multiple Screen Model (1977), in which the influence of intervening variables on intelligence was investigated, provided conceptualisation of the leadership process. The present model thus takes into consideration the interaction between the leader and his environment. This model guided in the development of:

- (i) a suitably adapted leader profile for prediction purposes, and
- (ii) of a useful basis for assessment of leadership performance.

The research job demands pertaining to the decision making process can be grouped for the purposes of this study into three broad areas:

- (i) those pertaining to research requirements;
- (ii) aspects involving management functions;
- (iii) interpersonal requirements.

The following measures pertaining to the person aspect of the proposed model were used as predictors:

- (i) measures of intellectual potential;
- (ii) management orientation;
- (iii) personality assessment regarding sociability, anxiety, hostility, rigidity, dominance;
- (iv) practical test observing behaviour in an unfamiliar task setting;
- (v) biographical information;
- (vi) role perception.

Job performance was assessed by means of a questionnaire rating scale in which effectiveness as well as the importance of the work aspects involved were included.

5.1.1 Criterion for research leadership effectiveness

Research leadership effectiveness was defined as how well the person meets the organisational objectives appropriate to his assigned level of functioning. Organisational goals were accepted as being the transformation of ideas and visions into operational results or useable products. It was accepted that during the transformation process, certain salient work aspects, e.g. the way in which the job is perceived, could be identified which could affect worker efficiency. Recognition

of environmental influences is also implied.

The results of this study indicate that no clear leadership dimension could be established for the research leader subjects. Such issues as planning strategies, handling of resources, decision making, which are normally accepted as leadership functions, received low loadings when responses for the study were factor analysed. This poses a question relating to the type and level of leadership involved for this sample in meeting research objectives.

The factors comprising senior research functioning stressed personality qualities such as efficiency in doing research, the researcher as subordinate, efficiency in interpersonal relations, as well as a task efficiency factor.

It is accepted policy that general research efficiency is a prerequisite for being promoted to a senior supervisory position, and that interpersonal relationships are of necessity important to obtain co-operation. However, the true essence of research leadership involving planning, manpower utilisation and decision making did not crystallise for the sample group.

It furthermore became evident that the criteria for research leadership effectiveness was influenced to a large extent by the research institute involved. Research leaders as assessed by this study cannot be seen as a homogeneous group. Differences relate to both personality traits and environmental expectations.

5.1.2 General profile of an effective research leader

The profile for research leadership effectiveness which developed for the sample according to the proposed criteria, can be summarised as follows:

- (i) above average intellectual ability and deductive reasoning ability;
- (ii) no role conflict should exist;
- (iii) should not have a 1/1 Management Style, and
- (iv) should have the necessary academic qualifications.

In terms of the stated performance criteria, the effective research leaders will be rated as follows by their supervisor:

- (i) high on the ability to see the budget implications of their own research programmes;
- (ii) high on theoretical knowledge in field of expertise;
- (iii) as displaying goal-directed behaviour when doing research;
- (iv) high on the ability to meet and overcome research challenges.

The formula for predicting effective research leadership, deduced from the regression analysis is as follows:

$$\text{Effective Research Leadership} = (\text{Philosophy 1/1} - 0,0496 + \text{Evaluation 9/1} - 0,0376 + 4,39).$$

This formula, however, explains only 19,4% of the variance which is unacceptable for prediction purposes.

5.1.3 Profile of an effective senior researcher

Factor analysis failed to identify a pure leadership dimension and the factors identified related more to the role of a research worker: his general efficiency in doing research, functioning in a subordinate role; interpersonal relationships; and task orientation. It was therefore deemed necessary to draw profiles describing the effective researcher in each of the areas identified.

In terms of the available data, the following profiles were obtained:

A. General research efficiency

The effective senior research worker will be rated by his supervisor as:

- (i) someone who has the ability to formulate problems and hypotheses;
- (ii) someone who can anticipate problems which may lead to new research;
- (iii) someone who does not pay attention to the ideas of others.

To be effective as a research worker, a person should in terms of the predictors used have:

- (i) above average intellectual potential in comparison with graduates;
- (ii) a preference for the 5/5 Style of Management planning approach;
- (iii) the 9/1 Management Style (production orientation) as his least preferred one.

In terms therefore of the abovementioned results, the effective researcher would be consultative in his planning of research projects and try to find a balance between exercising major control and abdicating decision making. Although tending to compromise, he will take on responsibility. Although his supervisor sees him as someone who does not pay attention to the ideas of others, the researcher prefers to consult when planning his work but in executing his work (perhaps by virtue of his specialised knowledge) he may display different sets of behaviour.

The formula for predicting research efficiency, deduced from the regression analysis done explains 37% of the variance.

Research efficiency = (Transformed Evaluation 1/9 - 0,0702
 + Philosophy 1/1 - 0,0558 + Planning 5/5 + 0,0376
 + Transformed Philosophy 9/1 - 0,0527 + 9/1 Management
 Style - 0,0171 + Planning 1/1 + 0,0270 + 4,60).

B. Subordinate efficiency

This dimension deals mainly with the researcher as a subordinate and was identified as "efficiency in the subordinate role".

Effectiveness as a subordinate deals with issues such as paying attention to the ideas of others, admitting when at fault, writing and preparing reports, being theoretically competent, although not necessarily self-confident.

A rating of effectiveness in this area also includes that the person would be rated high by his supervisor on:

- (i) his ability to formulate problems and hypotheses;
- (ii) knowledge of methods used in his field of expertise;
- (iii) insight into problems;
- (iv) display of goal-directed behaviour.

The researchers in the sample who were rated as being effective on this dimension preferred a 9/9 Management Implementation style which indicates a preference to develop a team from which he functions as a member.

During the planning stages, a 5/5 approach is advocated indicating that majority opinion and compromise dominate when he has to plan strategies.

When this worker has to evaluate subordinates he favours the 1/9 approach indicating that he prefers the role of confidant and avoids discussion of mistakes made by people.

The formula for predicting effectiveness in this area is as follows:

$$\text{Effectiveness} = (\text{Transformed Evaluation } 1/9 - 0,0991 + \text{Planning } 5/5 - 0,0336 + \text{Philosophy } 1/1 - 0,0519 + \text{Implementation } 9/1 + 0,045 + \text{Evaluation } 9/1 - 0,0576 + 2,737).$$

This formula explains 35% of the variance.

C. Interpersonal efficiency in research

A factor implying interpersonal relationships was also identified.

Efficiency in this area is linked to being rated by the supervisor as:

- (i) sensitive to the needs of others;
- (ii) having the ability to handle frustrations in an acceptable manner;
- (iii) being flexible in functioning;
- (iv) paying attention to the ideas of others;
- (v) maintaining sound interpersonal relations.

The profile includes:

- (i) a consultative 5/5 Management approach towards influencing decisions during planning stages;
- (ii) not leaning towards extremes regarding concern for people and concern for production when evaluations are carried out.

However, he does not abdicate or withdraw from decision making. This is indicated by the 1/1 Management Style being his least preferred style.

Interpersonal efficiency = (Transformed 1/1 Management Style
 $-0,0273 + \text{Transformed Evaluation } 1/9 - 0,0685$
 $- \text{Management Planning } 5/5 + 0,03172 + \text{Management Evaluation } 9/9 - 0,0062 + 3,84$).

This prediction model explains 29% of the variance.

D. Task efficiency

The task efficiency factor deals with issues such as confidence in ability to do research, effectiveness in handling of resources, goal-directed behaviour. These issues received higher importance ratings by the Supervisors of the research leaders.

The task orientated efficiency profile yielded similar predictors as the general research efficiency factor, namely a consultative management approach, accepting decision responsibilities and not stressing extremes in concern for either production or people.

Task efficiency = (Transformed Evaluation 1/9 - 0,130 + Evaluation 9/1 - 0,037 + Planning 5/5 + 0,0371 + Transformed 1/1 Management Style - 0,0154 + 3,88).

This formula explains 31% of the variance.

5.1.4 Differences found between the ideal management style and what is considered ideal for a research environment

The Styles of Management Inventory is based on the theory that no conflict is necessary between concern for production and concern for people, but that excellence can only be obtained through an integration of the two concerns (Blake and Mouton, 1968). Through this integration, communication becomes more effective, conflicts are resolved, commitment is established, and a contribution is made towards worker creativity.

As far as the research environment investigated in this study is concerned, we find that although a balance between the two concerns is advocated, there is a strong tendency to compromise. This results in yielding to majority opinion and "splitting the difference" being seen as the most desirable approach.

5.1.5 Implications

According to Blake and Mouton (1968) the implications of a management style based on compromise are far-reaching. This kind of management does not result in dynamic progress because worker commitment remains restricted since independent functioning is seen as risky.

When the majority point of view is accepted as the norm, and staying within the system is the most important issue at stake, then innovative management is difficult to achieve.

The question of whether the Styles of Management Inventory, based on the theory that excellence can only be obtained through an integration of concern for people and concern for production, is also applicable for a research environment needs discussion. The most important issue at stake is whether research can be equated with production. From the definition of research, viz. "the transformation of ideas and visions into operational results or useable products", it can, however, be deduced that research is, in fact, also production. Research involves the generating of ideas which then needs to be transformed into concepts which have an application value or lead to the generation of further knowledge. It thus follows that the same principles which apply in any production orientated organisation should also apply to a research organisation, the main difference being that ideas are the principal commodity to be managed.

The so-called "ideal" management style provides for the promotion of conditions that encourage creativity, high productivity and a high morale through concerted team effort.

Under the management style which was identified in this study as being the most effective in a research environment, dynamic leadership and true commitment are lacking. These are exactly the qualities needed to contribute to dynamic research progress. Anshen (1974) has found that commitment can be strengthened by defining a core idea around which a company can design its total effort. One of the options he mentions seems to be particularly applicable: "To mobilize the company's resources around the concept of becoming a creative technological leader (be) the first to discover, develop (and) at the edge of moving technology" (Anshen, 1974, p.376).

In order to achieve the above-mentioned objectives, a management orientation based on maintaining the status quo is less than desirable.

5.2 Conclusion

The proposed model could only be tested partially, the main reason being the relative small size of the sample. In order to fully investigate the proposed possible interactions, a bigger sample would be necessary.

However, the present study uncovered important facts and contributed towards a better understanding of the dynamics involved in research leadership.

5.2.1 An important fact that emerged is that even though both basic and applied research are involved in all the research disciplines investigated, differences do exist as far as the performance criteria in these research functions are concerned. This may be as a result of differences in organisational climate in the various institute or may be a function of the discipline involved.

5.2.2 It became evident that the research environment investigated accepted a management approach quite different from what is considered ideal in industry and commerce. A management approach in which positive, directive involvement in both concern for people and concern for production is deemed necessary for optimal utilisation of potential is not seen as ideal in the research environment. The implications of this management expectation involves that personal issues, receiving and giving structure where necessary or needed, goal attainment through maximising employee involvement and integration of human potential and organisational demands are not the issues at stake.

It is accepted that the environment plays a role in prescribing certain modes of behaviour and the research environment might, in certain ways, differ from an industrial one. However, one would expect in research, even more so than in industry, a 9/9 Management Philosophy - depending on the level of the workers involved. The possibility that the SMI should be adapted when used in a research environment also needs further investigation.

Investigation into the management orientation of research leaders at a higher level in the hierarchy of the organisation could answer the question of whether the preferred management orientation for the leaders involved in this study might only be a function of the level of the positions they occupy.

5.2.3 Research leadership as identified in this study concerns four broad areas of functioning which could be identified as pertaining to research itself, functioning in a subordinate role, maintaining sound interpersonal relationships and a task orientation. Effectiveness in the identified areas to some extent can be predicted by means of the Styles of Management Inventory. Specific combinations of management orientation regarding philosophy of management, planning, implementation and evaluation of employees can predict effectiveness in each of the areas identified, explaining between 29 and 35% of the variance.

The study confirmed our initial premise that research leadership is a complex and multidimensional phenomenon and that the criteria for effectiveness would also be multidimensional.

It became clear that the environment does play an important role and influences the effectiveness criteria.

5.3 Recommendations

The study resulted in identifying some of the complexities involved in researching research leadership and the inadequacy of the present techniques to clearly identify effective research leaders. It transpired that models based on traditional assessment techniques have restricted value, and need to be adapted to incorporate environmental demand implications.

In order to fully test the proposed model, the study should be extended to include higher levels of research leadership.

- 1) It is recommended that all the institutes of the organisation partake in a follow-up study. This will ensure an adequate sample size representing various research disciplines as well as different organisational climates. An adequate sample would also ensure that the personality attributes of the model could be adequately investigated.
- 2) In order to validate selection procedures it is of the utmost importance that performance appraisals should be done on a routine basis and such information be made available to the NIPR. In this regard, the most appropriate time would be after one year's service and before the incumbent is appointed permanently. Performance appraisal methods should follow a standardised approach.

- 3) Further investigation should also aim at identifying training requirements for leadership specifically directed toward the management of ideas.
- 4) The significant correlations found between management style and personality measures should be investigated to ascertain the extent to which management style might be an indication of certain personality attributes.

7. REFERENCES

- Allport, G.W. Personality: a psychological interpretation.
New York: Holt, Rinehart & Winston, 1937.
- Anderson, C.R. Coping behaviors as Intervening Mechanisms
in the Inverted-U Stress Relationship. Journal of Applied
Psychology, 1976, 61(1), 30-34.
- Andrews, F. & G. Farris. Supervisory practices and innovation
in scientific teams. Personnel Psychology, 1967, 20,
497-515.
- Anshen, M. The management of ideas. In Jun, J.S. & W.B. Storm (Eds.)
Tomorrow's Organizations: Challenges and strategies.
Brighton, England: Scott Foresman Co., 1973.
- Argyris, C. Integrating the individual and the Organization.
New York: John Wiley & Sons, 1964.
- Baldwin, A.L. Theories of Child Development. New York:
John Wiley & Sons, 1976.
- Bales, R.F. Role and Role conflict. In Newcomb, T.M. & E.L. Hartley,
(Eds.) Readings in Social Psychology. New York: Henry Holt
& Co., 1958.
- Barnowe, J.T. Leadership and Performance outcome in research
organizations: The supervisor of scientists as a source
of assistance. Organizational Behavior and Human Performance,
1975, 14, 264-280.

- Barrow, J.C. The variables of leadership: a Review and Conceptual Framework. Academy of Management Review, April 1977, 231-251.
- Bass, B.M., R. Cooper & J.A. Haas. Managing for accomplishment. Lexington Massachusetts: DC Heath & Co., 1970.
- Bass, B.M. Assessment of Managers. New York: Free Press, 1979.
- Bayton, J.A. & R.L. Chapman. Transformation of scientists and engineers into managers. Washington DC: US Government Printing Office, 1972.
- Behling, O. & C. Schriesheim. Organizational behavior: Theory, research and application. Boston: Allyn and Bacon, 1976.
- Blake, R.R. & J.S. Mouton. The Managerial Grid. Houston, Texas: Gulf Publication Co., 1964.
- Blake, R.R. & J.S. Mouton. Corporate excellence through Grid Organization Development. Houston, Texas: Gulf Publishing Co., 1968.
- Bonner, H. The Proactive Personality. In Jun, J.S. & W.B. Storm (Eds.) Tomorrow's Organizations. Brighton, England: Scott Foresman Co., 1973.
- Borman, W.C. Exploring upper limits of reliability and validity in job performance ratings. Journal of Applied Psychology, 1978, 63(2), 135-144.
- Bowers, D.G. & S.E. Seashore. Predicting organizational effectiveness with a four factor theory of leadership. Administrative Science Quarterly, 1966, 11, 238-263.

- Calder, B.J. An attribution theory. In Shaw, B.M. & G.R. Salancik (Eds.) New Directions in organizational behavior. Chicago: Clair Press, 1977.
- Campbell, J.P., M.D. Dunnette, E.E. Lawler & K.E. Weick. Managerial Behavior, Performance and Effectiveness. New York: McGraw-Hill, 1970.
- Carroll, J.B. & S.E. Maxwell. Individual Differences in Abilities. In Rosenweig, M.R. & L.W. Porter (Eds.) Annual Review of Psychology, Palo Alto, California: Annual Reviews Inc., 1979.
- Cartwright, D. & A. Zander. Group Dynamics: Research and Theory. Evanston: Row, 1960.
- Cattell, R.B. Personality and Motivation its structure and measurement. Yonkers-on-Hudson, New York: World Book Co., 1957.
- Childs, D. The Essentials of Factor Analysis. New York: Holt Rinehart & Winston, 1973.
- Coleman, J.C. & W.E. Broen. Abnormal Psychology and Modern Life. Glenview Ill: Scott Foresman Co., 1972.
- Cotgrove, S. & S. Box. Science, Industry and Society: Studies in the sociology of sciences. London: Allen Urwin, 1970.
- Cribbin, J.J. Effective Managerial Leadership. American Management Association, 1972.
- Dawson, J.E., L.A. Messe & J.L. Phillips. Effects of Instructor-Leader behavior on student performance. Journal of Applied Psychology, 1972, 56, 369-376

- De Jager, J. Merit increments as criterion of job effectiveness.
Unpublished NIPR report, 1975.
- Eysenck, H.J. The measurement of emotion: psychological parameters and methods. In Levi, L. (Ed.) Emotions their parameters and measurement. New York: Raven Press, 1975.
- Fiedler, F.E. A Theory of leadership effectiveness. New York: McGraw-Hill, 1967.
- Fiedler, F.E. & A.F. Leister. Leader intelligence and task performance: a test of a Multiple Screen Model. Organizational Behavior and Human Performance, 1977, 19, 368-377.
- Fleishman, E.A. The description of supervisory behavior. Journal of Applied Psychology, 1953, 37, 1-6.
- Green, S.G. & D.M. Nebeker. The effects of situational factors on leadership style and behavior. Organizational Behavior and Human Performance, 1977, 19, 368-377.
- Gilmer, B von H. Industrial and Organizational Psychology. New York: McGraw-Hill, 1971.
- Hall, R.M. Organizations: Structure and Process. Englewood Cliff, New York: Prentice Hall, 1972.
- Hall, J., J.B. Harvey & M. Williams. Styles of Management Inventory. Conroe Texas: Teleometrics Intl., 1973.
- Heineman, H.G. Self Assessment: a critical analysis. Personnel psychology, 1980, 33, 297-300.
- Herold, W. vd M. 'n Keuringsprogram vir Argitekstudente.
Unpublished D.Phil thesis, University of Pretoria, 1972.

- Hersey, P. & K.H. Blanchard, Lyfe Cycle Theory of Leadership. Training and Development Journal, June 1979, 94-100.
- Hill, W.A. & D. Huges. Variations in leader behavior as a function of Task Type. Organizational Behavior and Human Performance, 1974, 11, 83-86.
- Hollander, E.P. Leadership Dynamics: a Practical Guide to Effective Relationships. New York: Free Press, 1978.
- House, R.J. A Path-Goal Theory of Leader Effectiveness. Administrative Science Quarterly, 1974, 16, 321.
- Jermier, J.M. & S. Kerr. Substitutes for leadership: Their meaning and measurement. Organizational Behavior and Human Performance, 1978, 22, 375-403.
- Jun, J.S. & W.B. Storm. Tomorrow's Organizations: challenges and strategies. Brighton, England: Scott Foresman Co., 1973.
- Karmel, B. Leadership: a Challenge to traditional research methods and assumptions. Academy of Management Review, July 1978, 3(3), 475-482.
- Kiev, A. A Strategy for handling executive stress. Chicago: Nelson-Hall, 1974.
- Kinloch, G.C. The sociological study of South-Africa. Johannesburg: MacMillan, 1972.
- Knowles, E.S., H.S. Cutter, D.H. Walsh & N.A. Casey. Risk-taking as a personality trait. Social Behavior and Personality, 1973, 1(2), 123-136.

- Kogan, N. & M.A. Wallack. Risk-taking as a function of the situation, the person and the group. In F. Barron (Ed.) New Directions in Psychology, New York: Holt, Rinehart & Winston, 1967.
- Korman, A.K. Industrial and Organizational Psychology. New Jersey: Englewood Cliffs, 1971.
- Latham, G.P., K.N. Wexley & E.D. Pursell. Training Managers to minimize rating errors in the observation of behavior. Journal of Applied Psychology, 1975, 60, 550-555.
- Lawless, D.J. Organizational Behavior: The Psychology of Effective Management. Englewood Cliffs, New York: Prentice Hall, 1972.
- Leboyer, L. & C.B. Voisin-Vedrenne. Managerial and Organizational Determinants of Efficiency in Research Teams. Paris: ARI Technical Report, Institute de Psychologie, 1978.
- Lombardo, M.M. Looking at Leadership; some neglected issues. Virginia: Technical Report, Office of Naval Research, 1977.
- Lowin, A. & J.R. Craig. The influence of level of performance on Managerial style: an Experimental Object-lesson in the ambiguity of correlation data. Organizational Behavior and Human Performance, 1968, 3, 440-458.
- Maddi, S.R. Personality Theories. A Comparative analysis. Homewood: The Dorsey Press, 1972.
- Magnusson, D. & S. Endler. Personality at the crossroads. New York: John Wiley & Sons, 1977.

- McCall, M.W. Leadership as a design Problem. Office of Naval Research, Arlington: Technical Report, Centre for creative Leadership, 1977.
- McCall, M.W. Leadership Research: Choosing Gods and Devils on the Run. Journal of Occupational Psychology, 1976, 49, 139-153.
- McClelland, D.C. The achieving society. Princeton, New York: Nostrand Co., 1961.
- McGreggor, D. The Professional Manager. New York: McGraw-Hill, 1966.
- Megginson, L.C. Human Resources; cases and concepts. Harcourt: Brace World Inc., 1968.
- Meuwese, W.A.T. Leadership and Group Creativity under varying conditions of stress. Urbana Ill: Group Effectiveness Research, University of Illinois, 1965.
- Miner, J.B. Twenty Years of Research on Role Motivation Therapy of Managerial Effectiveness. Personnel Psychology, 1978, 31(4), 739-759.
- Mintzberg, H. The Nature of Managerial Work. New York: Harper-Rowe, 1973.
- Mitchell, T.R. Cognitive Complexity and Group Performance. Journal of Social Psychology, 1972, 86(1), 35-43.
- Nasser, M.E. Organizational Climate - a new dimension for managerial selection. Unpublished D.Lit et Phil thesis, UNISA, 1975.

- Nie, N.H., C.H. Hull, J.G. Jenkins, K. Steinbrenner & D.H. Brent. Statistical Package for the Social Sciences. New York: McGraw-Hill Co., 1975.
- Ostle, B. Statistics in Research. Iowa: Iowa State University Press, 1969.
- Pelz, D.C. & F.M. Andrews. Scientists in Organizations: Productive Climates of Research and Development. New York: John Wiley & Sons Inc., 1966.
- Petrullo, L. & B.M. Bass. Leadership and Interpersonal Behavior. New York: Holt, Rinehart & Winston, 1961.
- Piaget, J. The Origins of Intelligence. New York: International University Press, 1952.
- Porter, L.W. & E.E. Lawler. Managerial Attitudes and Performance. Homewood, Illinois: Irwin, 1968.
- Pursell, E.D., D.L. Dosset & G.P. Latham. Obtaining valid Predictors by minimising rating errors in the criterion. Personnel Psychology, 1980, 33, 91-96.
- Ronan, W.W. & A.P. Schwartz. Rating as Performance criteria. International Review of Applied Psychology, Oct. 1974, (23), 71-82.
- Rosenzweig, M.R. & L.W. Porter. (Eds.) Annual Review of Psychology. Palo Alto, California: Annual Reviews Inc., 1979.
- Schriesheim, C.A., J.M. Toliver & O.C. Behling. Leadership Theory: Some implications for managers. MSU Business Topics, 1978, 26(3), 34-40.
- Schroder, H.M., M.J. Driver & S. Streufert. Human Information Processing. New York: Holt, Rinehart & Winston, 1967.

- Skawran, R.F. The Willemse Board as Personality Test.
MA thesis, UNISA, 1961.
- Skawran, R.F. The Willemse Board as a Personality Test.
Psychologia Africana, 1962, 9, 72-85.
- Skawran, R.F., D.W. Steyn & J. van Rooyen. Performance criteria for research staff. Johannesburg: Confidential NIPR Report, 1974.
- Spielberger, C.D. Theory and Research on Anxiety. In Spielberger, C.D. (Ed.) Anxiety and Behavior. New York: Academic Press, 1966.
- Spool, M.D. Training programmes for observers of behavior: a Review. Personnel Psychology, 1978, 31(4), 853-888.
- Steyn, D.W. Die konstruksie van 'n S.A. Persoonlikheidsvraelys.
MA thesis, University of Pretoria, 1977.
- Stinson, J.S.E. & L. Tracey. Some disturbing characteristics of the LPC score. Personnel Psychology, 1974, 27(4), 477-485.
- Stogdill, R.M. & A.E. Coons. Leader Behavior: Its Description and measurement. Ohio: Columbus, 1957.
- Stogdill, R.M. Handbook of leadership. New York: Free Press, 1974.
- Suedfeld, P. & A.D. Rank. Revolutionary Leaders: long-term success as a function of change in conceptual complexity. Journal of Personality and Social Psychology, 1976, 34(2), 169-178.
- Süssenguth, C.D.E. Problem solving styles of research scientists. Johannesburg: NIPR Special Report PERS 184, 1970.

- Taylor, T.R. The construction of two scales of managerial style. Johannesburg: NIPR Report PERS 235, 1972.
- Van Coller, A.J. Die Reaksie van Akademies-suksesvolle studente in konfliktsituasie. Unpublished MA thesis, University of Pretoria, 1961.
- Van Rooyen, J. Job Evaluation Manual NIPR Q-Method. Johannesburg: NIPR, 1977.
- Vechio, R.P. Leadership Effectiveness: An Empirical Examination and Theoretical Integration. Dissertations Abstracts International, 1977, 37(10-B), 5419.
- Verster, J.M. Test Administrators Manual for the Deductive Reasoning Test. Johannesburg: NIPR, 1973.
- Visser, B.L. Vocational Counselling at the NIPR. Johannesburg: NIPR Special Report PERS 270, 1977.
- Vroom, V.H. & P.W. Yetton. Leadership and decision-making. Pittsburg: University of Pittsburg Press, 1973.
- Weber, S.K. Effects of Leadership Style, Personality, Subordinates Perception and Work Situations on Motivation to Work in Public Welfare Agencies. Dissertations Abstracts International, 1976, 37(6-A), 3195.
- Weeks, J.L. & C.J. Mullens. Criterion Development for Job Performance Evaluation. Proceedings from a symposium, 23-24 June, 1977, Air Force Command, Brooks Air Force Base Texas.

Welte, C.E. Management and Leadership: Concepts with an important difference. Personnel Journal, Nov. 1978, 57(11), 630-642.

Wofford, J.C. Factor Analysis of Management Behavior Variables. Journal of Applied Psychology, 1970, 54, 169-173.

Yukl, G. Toward a Behavioral Theory of Leadership. Organizational Behavior and Human Performance, 1971, 6, 414-440.

RCN BIBLIOTEEK	HSRC LIBRARY
-------------------	-----------------

