utilize this service (a case of "preaching to the converted") militate against any widespread improvement in the situation.

3.1.6 Previous extension programmes in the region

In view of the findings of Coetzee (1971), a programmed extension campaign was launched in the Thabazimbi extension ward (in which the present study area lies) in 1973 (du Plooy, 1975). The "open rotation multi-camp system" (essentially the controlled selective grazing system) was introduced to the target audience. The extension message was conveyed by means of a newsletter, radio and press, while farmers days, study tours, competitions, film shows and lectures were also used. Various study groups were formed, and visits to experimental farms and demonstration farms were undertaken. The campaign ended in September 1977 (du Plooy, 1977). In a dissertation entitled "Evaluation of communication techniques in programmed extension work", du Plooy (1980) set out to determine which characteristics of information sources and which communication techniques contributed to the success of such a communication programme. He found that about two-thirds of the respondents perceived the stabilizing effect of the recommended grazing management system in a favourable light (du Plooy, 1980). He concluded that about 60% of all respondents implemented the recommended system at least reasonably. (This compared with only

15% reported by Coetzee, 1971).

3.1.7 Theoretical considerations in measuring psycho-sociological factors

The adoption and implementation of an innovation, in this case CSG, is propogated by the Department of Agriculture and Water Supply. A host of factors influence practice adoption, and, clearly, a theoretical framework for the analysis of such factors is required. Of the various theories regarding human behaviour, the Field Theory of Lewin (1951) and Maslow's (1970) Hierarchy of Needs Theory of Motivation have been used in studies of farmer motivation (e.g. Duvel, 1975; du Plooy, 1980; Young, 1980; Rix, 1984; de Klerk, 1985).

Duvel (1975) is of the opinion that the model of Lewin (1951) is the most acceptable behavioural theory for both practical extension and for theoretical analysis of extension problems. In essence, field theory holds that the behaviour (B) of an individual is best described as a function of the individual's "life space" (LS) or psychological field. Life space can be regarded as the product of the interaction between the person (P) and his environment (E).

The theory may be expressed in the following form:

$B = f(LS) = f(PE)$.

P and E are the individual's own perception of reality. According to the individual's perceptions, attitude, motivation, aspirations and needs, so will behaviour be modified. Needs create a "tension", which leads to decision-making and behavioural change. Duvel (1982) has quantified the magnitude of an individual's psychological need or need tension as being the distance between his current situation and his desired situation - see Fig 3.1.

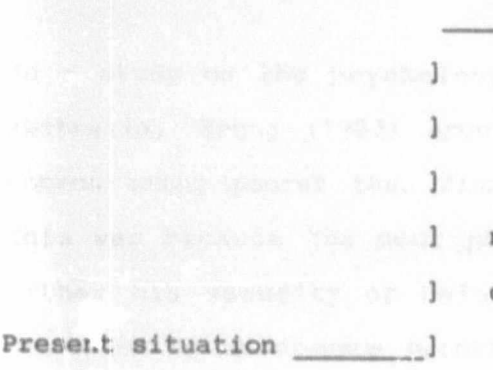

Fig. 3.1 Schematic representation of need magnitude (Duvel, 1982).

The farmer's level of aspiration is thus a function of his perceived needs. This is in turn influenced by his percep-

tion of, and satisfaction with his present situation, the distance from the present level to the desired level, and the hindrances ("negative forces") in the path.

In terms of human needs, Maslow (1970) identifies a hierarchical structure. The basic or lowest needs are physiological (such as food, water, warmth), followed by safety needs (such as shelter, security). The next level is social belongingness and love (family, close friends). The upper levels of human needs relate to community recognition and esteem, and ultimately, to creative, aesthetic and "spiritual" needs (Maslow, 1970).

In a study on the psychology of arid zone management in Australia, Young (1980) argued that overgrazing was more common among poorer than financially better off graziers. This was because the poor pastoralist had not fulfilled either his security or belonging needs - his aims were satisfied by short-term practices which avoid the disaster of bankruptcy. The financially secure rancher, on the other hand, had the opportunity to assume more complex challenges such as gaining social prestige and intellectual fulfilment (Young, 1980). Such ranchers had the appropriate motivation and economic leeway to heed the advice of the extension officer and to maintain a conservative stocking rate.

Young (1980) concluded that the identification of those ranchers who were motivated by their desire to gratify their lower needs was important, in that they were probably the hardest to influence. Possible methods of elevating such ranchers were subsidies, grants or sufficient additional land.

In a study of the human factor in land use in the Underberg region of Natal, Rix (1984) concluded that optimum land use was a function of practice adoption which, in turn, was a function of knowledge. Knowledge was influenced by motivation and aptitude. Rix (1984) concluded that motivation may have been the main constraint to the achievement of optimum land use.

3.1.8 Hypothesis

The above preamble would seem to summarise the literature relating to the rancher and his action. The hypothesis under test may be described as follows:- only those ranchers whose lower level needs have been adequately fulfilled will strive to implement what they perceive to be conservation orientated management principles. The constraints operative on those whose lower level needs have not been fulfilled are of such a strongly "negative" nature that elevation to the next level of aspiration is an unattainable goal. (H4 -

"Poor" human characteristics result in poor veld management techniques).

3.2 Methods

In order to obtain the information required for describing the attitudes, perceptions and aspirations of the ranchers in the study area, it was necessary to construct a questionnaire schedule*.

As a first attempt (and due to personal inexperience in this type of survey), a questionnaire was obtained from the extension officer of the Tzaneen region in the North Eastern Transvaal. This questionnaire (Noel, 1980) designed for a complete situation analysis of beef ranching, was then pretested on a sample of ranchers known to the writer. On the

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* At the outset it was appreciated that the questionnaire approach had limitations compared to a long-term intensive micro-study of the nature undertaken by anthropologists. As a compromise, the writer lived with a ranching family on visits to the study area. The insights thus gained contributed greatly to the writer's own perceptions of the problems, values and general way-of-life of the ranching community).

basis of this pilot study, and helpful feedback from the selected ranchers interviewed, the questionnaire schedule was discarded as being too lengthy and unwieldy. After consultation with an experienced social scientist (Orkin**, pers. comm.), a less formally structured interview approach was developed around a list of guide questions. The questions (see Appendix 1) were designed to determine "attitude", perceptions, ability, performance and problems.

The 42 ranchers forming part of the study (selected according to the criteria described previously) were visited on several occasions. This, coupled with the assistance of leading members of the community and the extension officer, resulted in the study gradually becoming known to members of the ranching community. Once a favourable attitude was expressed, the interview was conducted and individual ranchers scored according to predetermined scales. In two cases hostility resulted in exclusion from the study. The few absentee ranchers presented a problem in that the same level of personal intimacy reached with occupier ranchers, visited several times, could not be reached.

** Dr M Orkin, Department of Sociology, University of the Witwatersrand.

Scaled data obtained on the 42 ranches comprising the study sites, were statistically tested using non- parametric Kendall rank correlation. In order to determine the degree (if any) of interaction, factor analysis was used to group colinear variables which could then be further statistically tested against other variables. Multiple stepwise linear-regression was used as a further method of assessing variable interaction and colinearity (bearing in mind the possible confounding influences mentioned in section 2).

Explanation of the variables measured

Farm size : Total size in hectares (ha).

Age : Age of rancher in years.

Education : Years of school and post high school education.

Matriculation = 5 years post primary.

Bachelor degree = 8 years post primary.

Bachelor plus Honours = 9 years post primary.

Masters degree = 11 years post primary.

Experience : Number of years experience as a rancher

in savanna.

Extension contact : Rated on a scale of "best third, average third and worst third". N.B. In cases where scaling was used, various scales were tested, ranging from 7-point to "thirds". No essential differences emerged and the least arbitrary "thirds" was decided on. The temptation to conveniently place most cases in the "average third" was studiously avoided.

Improvements : Ranchers were asked to indicate the desired improvements they wished to implement in their ranching enterprises. Answers were scored into three categories, using the mediocre answers as criteria against which to rate higher or lower order desires.

Physical planning : Scaled according to degree of conformity with recommended planning. "Best" ranches had six or more camps per herd, separated according to vegetation type, each camp supplied with water. Next in the scale were multi-camp systems with other than vegetation type as basis for separation e.g. "checkerboard" layout. Lowest score was assigned to cases with three or less camps available per herd.

Production system : Highest score was assigned to steer production systems generally regarded as being best suited to the area in that fewer breeding animals results in greater flexibility in an uncertain environment. Weaner systems were rated lower, with lowest score assigned to cases having ill-defined or haphazard production systems.

Grazing system : In line with current wisdom and hypotheses being tested, top rated cases effectively employed the recommended system of controlled selective grazing. Mid third used a less clearly defined rotational grazing system. Poor third employed continuous grazing or lengthy (+1 month) period of stay in large camps.

Planted pastures : Best third had incorporated adequately sized and suitable planted pastures (interpreted as being an innovation) into forage flow. Middle third had a limited amount of planted pastures (insufficient to be effective). "Worst" third had no planted pastures.

Motivation : Answers were again rated against the mediocre. Sub-mediocre answers included those who stated that they had always farmed (inherited), or who "shrugged shoulders". Highest were those who had studied agriculture for the express purpose of optimizing land use and income, while mediocre answers were for example, "I enjoy raising cattle", "I'm a cattle breeder by profession" etc.

Veld knowledge : Farmers were rated on their ability to indentify grasses, and comment on their grazing value.

Relative performance : Due to the difficulty in obtaining financial data, indirect estimates of income were also used (e.g. level of debt, standard of living, state of repair of gates, fences, roads, dips, vehicles and implements and living quarters). These estimates were coupled with indications of income given by the ranchers, adjusted to income per animal unit for purposes of comparison. Absolute figures were not used because of doubt as to their validity.

Number of cattle : Exact figures for cattle numbers were

surprisingly difficult to obtain. Use was made of declared number sold, staff were asked and the extension officer assisted. Number of cattle per unit area were assigned to one of three categories based on comparison with recommended number per unit area (stocking rate).

Extension rating : The extension officer was asked to rate each rancher on the basis of the rancher's level of contact with him.

Camps : Number of camps per herd, where 6+ is "best" and fewer than 3 is worst.

Mortality rate : The average annual mortality rate of cattle was obtained from each rancher.

3.3 Results

3.3.1 Human characteristics

3.3.1.1 Age structure

The average age of ranchers (in 1983) was 49 (SD ± 13,8) years with a range from 26 to 80 years. This compares with the average age of 50,9 years reported for the region by Coetzee (1971). The frequency distribution of age is shown in Table 3.4.

Table 3.4 Age frequency distribution (%) of a sample of 41 ranchers in the Thabazimbi district, 1983.

Ages	Percentage
30	8,3
31 - 40	16,7
41 - 51	33,3
51 - 60	19,4
60	22,2

Clearly age frequency is skewed towards the older end of the range. Some 75% of ranchers are over the age of 40 years, whereas less than 10% are younger than 30. Coetzee (1971) similarly found that 82% of ranchers were older than 40, and 24% older than 60 years of age. In the nearby central Transvaal, van der Riet (1974) found that 48,7% of farmers were older than 50 while only 7,3% were aged 30 or younger.

In a nationwide survey of ranchers, de Klerk (1986) found that only 7,4% were 30 years or younger. 16% were older than 60, the average being 47,5 years.

Age per se need not necessarily be indicative of attitude or ability, and in fact age and adoption of innovations, for example, were not found to be linearly correlated by Rogers and Shoemaker (1971). Coetzee (1971) nevertheless concluded that the age structure of the ranching community restricted the development of modern ranching methods and limited the application of systems suitable to the particular environment. In Table 3.5, the Kendall rank correlation coefficients of age with other variables are shown.

From the absence of any strong correlations between age and other variables, it is concluded that age per se is not a factor influencing ranchers attitudes, perceptions or

actions. Individual responses from interviewees (case studies) confirmed this finding - older ranchers in some cases retired from other occupations, exhibited a high degree of enthusiasm for the study and a willingness to learn.

Table 3.5 Kendall rank correlation coefficients of ranchers age with other variables.

Variable	Correlation co-efficient
Education	-0,160
Experience	0,450
Extension contact	0,122
Improvements	-0,180
Physical planning	0,288
Production system	0,121
Grazing system	-0,019
Planted Pastures	0,084
Veld knowledge	-0,003
Number of cattle	0,530
Number of camps/herd	0,309
Mortality rate	0,047
Rating by extension officer	0,121
Relative performance	0,043
Veld composition score	0,124

3.3.1.2 Level of education

Of the ranchers sampled, 22% had received less than five years of post-primary schooling (equivalent to matriculation). On the other hand, 29% had post matriculation qualifications. Of these, two- thirds were university graduates (although not necessarily possessing degrees in agriculture) while the remainder possessed diplomas. Van der Riet (1974) reported that only 8,7% of ranchers in the nearby Central Transvaal had post matriculation qualifications. Coetzee (1971) found that less than one-third of farmers in the north-western Transvaal had received more than ten years of schooling (where 12 years of schooling is equivalent to matriculation).

As reported by Serfontein (1979) nearly 80% of farmers in South Africa had received less than 10 years schooling (equivalent to Standard Eight). In a survey of then Rhodesian farmers, Bembridge (1978) found that 75% had less than matriculation. Rix (1984) in a survey of 38 farmers in the Underberg region of Natal, found that 37% had received some form of post-school formal education. He described the farmers as a well-educated group. In a national survey of ranchers, de Klerk (1986) found that 13,3% were graduates, whilst 26,5% had not attained matriculation level.

The findings of this study indicate that the ranchers sampled also comprise a relatively well educated group. Examination of individual qualifications, however, revealed that "other" than agricultural qualifications actually predominated. This is ascribed to the relatively high proportion of ranchers who had retired (or semi-retired) from other professions. The group is still nevertheless relatively well-educated and as such may be expected to be more amenable to receiving information and implementing innovations.

In the following table, the Kendall rank correlation coefficients of level of education with other variables are shown.

Highest coefficient of correlation was obtained in the case of level of education vs grazing system implemented. Rogers and Shoemaker (1971) concluded that in the majority of studies reviewed, farmers with a higher level of formal education were inclined to adopt innovative practices at an earlier stage than those less educated. Bembridge (1975) reported a similar finding in a study on the adoption of beef production practices in the former Rhodesia. Individual cases confirmed that the more highly educated ranchers in the present study were in fact more inclined to implement the recommended grazing system. It should be noted however, that several of these ranchers were not financially dependant on income derived from the ranching

Table 3.6 Kendall rank correlation coefficients of rancher's level of education with other variables.

Variable	Correlation co-efficient
Age	-0,160
Years of experience	0,390
Contact with extension officer	0,325
Improvements	0,222
Physical planning	0,267
Production system	0,283
Grazing system	0,590
Planted pastures	0,223
Motivation	0,413
Veld knowledge	0,283
Number of cattle	-0,252
Rating by extension officer	0,227
Number of camps	0,151
Mortality	0,263
Veld composition score	0,356
Relative performance	0,219

enterprise. Alternate incomes provided the financial security, or satisfied Maslow's (1970) lower order (physiological) needs. This would accord with the hypothesis stated earlier, that only those ranchers whose lower order needs had been fulfilled would strive to implement what they perceived to be conservation-orientated grazing management systems. It is concluded therefore that although a higher level of education would seem to be associated with a favourable attitude towards conservation - oriented management, other factors such as financial security (Maslow's lower order needs) are influential in the managers decision-making process. (This point is elaborated below.)

3.3.1.3 Contact with extension officer

The Thabazimbi extension ward has been characterized, in the past, by active extension programmes (Coetzee, 1971; du Plooy, 1980). In order to assess the effectiveness of such programmes, the ranchers' level of contact with the extension officer was correlated with other variables. The results are shown in Table 3.7.

Table 3.7 Kendall rank correlation coefficients of rancher's level of extension contact, with other variables.

Variable	Correlation co-efficient
Age	0,122
Education	0,325
Experience	0,041
Improvements	0,177
Physical planning	0,602
Production system	0,404
Grazing system	0,623
Planted pastures	0,330
Motivation	0,437
Veld knowledge	0,569
Rating by extension officer	0,657
Number of camps	0,546
Veld composition score	0,153
Relative performance	0,574

Each rancher was rated according to his own assessment of the degree of his contact with the extension officer. As a cross check, the extension officer was asked to provide his personal rating of each rancher's level of contact with him. The fairly high correlation coefficient (0,657) substan-

tiates the ranchers perception of their level of contact with the officer.

In contrast to age and level of education, several variables are relatively highly correlated with the amount of extension contact. The physical planning of the ranch, the grazing management system applied, the rancher's knowledge of his veld, the number of camps per herd and ultimately the relative performance of the enterprize were all fairly highly (>0,5) correlated with the level of contact with the officer. It is however noteworthy that in contrast, veld composition score was very poorly (0,153) correlated with extension contact. This observation lends further support to the contention that driving forces other than managerial input are primarily responsible for veld composition in this savanna region:- although ranchers appeared to be receptive to the extension message, the prime objective of the extension campaign, namely "good veld" was not achieved. (The possibility further exists that the management system propagated does not per se achieve the desired results, that the assumptions as to what constitutes "good management are wrong - see below).

The fact that the above management related variables were relatively highly correlated with the amount of extension contact is important, when viewed in the context of the Department's Extension strategy. As stated, the study area

had been subject to previous extension campaigns. The average number of camps per herd in the study area was 5,5. This compares with the average of 2,9 found in a nationwide survey by de Klerk (1986), indicating that previous campaigns in the study area had created an awareness amongst ranchers of the need for multi-camp management systems.

3.3.1.4 Motivation

Motivation of the individual is important for the acquisition of knowledge, adoption of innovative practices and ultimately the achievement of "optimum land use" (Rix,1984). In order to assess the relative degree of motivation, a series of questions relating to the ranchers aspirations in life, satisfaction or dissatisfaction with current standard of living and general approach to ranching were included during the interview sessions. Those farmers who ranched primarily for lifestyle consideration were scored lower than those whose motivation was based on sound business or profit-oriented principles (this is in line with the Departemental policy of "optimal resource utilization). The rank correlation coefficients of ranchers level of motivation with other variables, are shown in Table 3.8.

Table 3.8 Kendall rank correlation co-efficients of ranchers level of motivation with other variables.

Variable	Correlation co-efficient
Age	-0,25
Education	0,41
Experience	-0,16
Extension contact	0,44
Improvement	0,42
Physical Planning	0,38
Production system	0,16
Grazing system	0,51
Planted pastures	0,50
Veld knowledge	0,47
Rating by extension officer	0,43
Number of camps	0,29
Veld composition score	0,20
Relative performance	0,41
Farm size	0,20

Motivation appeared to be most highly correlated with the type of grazing system practised, the incorporation of planted pastures into the management programme ($r > 0,50$), followed by veld knowledge and contact with extension staff.

As with other human traits, the level of motivation was very weakly (0,20) correlated with veld composition score. The ranchers' needs for, or desire to bring about, improvements in their management systems were also assessed during the interviews. This factor was weakly correlated with all other variables, the highest correlation (0,42) being obtained against motivation. Bearing in mind the notion that human behaviour is the result of a complex interaction of factors, the indications are, nevertheless, that motivation as measured in this study, does not necessarily result in innovation or, ultimately, "good veld". In other words, certain constraints override any desire to achieve "optimum resource use".

3.3.2 Physical factors

3.3.2.1 Farm size

As stated in a previous section, farm size was not found to be strongly correlated with veld composition score (0,199). This finding is counter intuitive, in that sub-economic units have been widely cited as contributing to the deterioration of the veld. In table 3.9 the frequency distribution of farm sizes in the study area is shown.

Table 3.9 Frequency distribution (%) of farm sizes in the study area.

Size class (ha)	Percentage of farms
< 1000	14,3
1000 - 1500	17,8
1501 - 2000	25,0
2001 - 2500	17,8
2501 - 3000	7,2
> 3000	17,8

From these data, it can be seen that some 57% of farms in the study were 2000 ha or smaller. Farm size was found to be most strongly correlated with total number of cattle (r = 0,674), as might be expected. Number of camps was next strongly correlated with farm size (r = 0,412), followed by physical planning (r = 0,311). Relative financial peformance was poorly correlated with farm size (r = 0,070)- bigger is certainly not better in this case.

3.3.2.2 Physical planning

One of the major extension messages to farmers in the study area, has been that farms need to be physically planned (du Plooy 1980). In order to qualify for any of the various subsidy incentives, farms must comply with the following criteria: vegetation types must be fenced off separately,

with water provided for each camp, and a minimum of six camps per herd. In other words, "checkerboard" or "wagon wheel" systems are neither propagated nor approved of by the Department. The relative success of this campaign can be gauged from the finding that the majority of ranches (+65%) surveyed complied with the recommended physical layout criteria of the department. The level of correlation of this variable with others is shown in Table 3.10.

Table 3.10 Kendall rank correlation co-efficients of farm physical planning with other variables

Variable	Kendall correlation co-efficient
Extension contact	0,660
Grazing management system	0,653
Planted pastures	0,420
Motivation	0,401
Veld knowledge	0,475
Relative performance	0,554
Rating by extension offier	0,759
Veld composition score	0,350

Physical layout of the farm was highly correlated with extension contact ($r = 0,660$), grazing management system ($r = 0,653$) and the rating by the extension officer ($r = 0,759$).

Veld composition score (r = 0,350) was relatively weakly correlated with physical planning, supporting the contention that other driving forces largely out of the control of the resource user, are primarily responsible for this parameter.

3.3.2.3 Grazing management system

The system of controlled selective grazing, as propagated by the extension service, would appear to have gained acceptance by the majority (+ 65%) of ranchers surveyed.

Table 3.11 Kendall rank correlation co - efficients of grazing management system with other variables.

Variable	Correlation co-efficient
Education	0,665
Extension contact	0,670
Physical planning	0,653
Motivation	0,550
Veld knowledge	0,516
Relative performance	0,407
Number of camps	0,417
Veld composition score	0,204

Education, extension contact, physical planning and motivation were most highly correlated ($r > 0,5$) with the type of grazing management system applied. However, once again, veld composition score was only weakly correlated ($r = 0,204$) with management system. This finding together with the series of findings that few if any of the management options markedly influence veld composition, is of profound importance to the extension effort. Why should the manager adopt innovative practices, when such practice adoption does not achieve the desired result of "good veld"? The feedback to the innovative farmer, who heeds advice and implements new practices must surely be negative in the extreme. More so, when the "laggard" next door, derided by the innovater, has veld in similar condition.

3.3.2.4 Incorporation of planted pastures

Altough not formally or widely propagated, the incorporation of planted pastures into animal production systems of the bushveld is felt to have potential (Reid, 1985; Hayward 1986), and is certainly an innovation. Spontaneous periodic attempts to incorporate pastures have been observed in the study area. Discussion with ranchers involved has revealed that they perceive this practice to be a means of lessening the risk associated with ranching under a variable rainfall regime. This practice may also reflect the desire of the

manager to observe a tangible end result of his toils and managerial input - often all he sees as a result of his inputs is drought ravaged "poor veld". Psychologically at least, in the case of the planted pasture it would seem to be that "finis coronat opus".

In Table 3.12, the correlation co-efficients of incorporation of planted pastures with other variables are shown.

Highest correlation (0,530) was with degree of motivation although the more experienced ranchers did not seem to adopt this practice (r = -0,074). The incorporation of pastures did not per se, appear to result in improved veld composition (r = 0,174). This finding runs contrary to the view that the incorporation of a planted pasture into the production system will lessen the pressure on veld, and result in "better" veld (Reid, 1985). Case studies, however, revealed that in most instances, the planting of pastures was characterised by a rather opportunistic hit or miss type approach, rather than a calculated planned operation. Anthephora pubescens, Cenchrus ciliaris were most popular choices, followed by Sorghum sp and babala (Pennisetum sp). In only one instance was veld reinforcement attempted (with limited success). Radical veld improvement is not currently advocated by the extension service and although "success stories" appear in the popular media, this practice does not seem to have developed spontaneously (other than in isolated

cases) in the study area.

Table 3.12 Kendall rank correlation co-efficients of incorporation of planted pastures into production system with other variables.

Variable	Correlation co-efficient
Farm size	-0,107
Age	0,109
Education	0,254
Experience	-0,074
Extension contact	0,373
Improvements	0,260
Physical planning	0,420
Production system	0,288
Grazing system	0,435
Motivation	0,530
Cattle numbers	-0,276
Number of camps/herd	0,283
Rating by extension officer	0,486
Relative performance	0,365
Veld composition score	0,174

3.3.2.5 Animal production system

Extensive beef production off rangeland, under a variable rainfall (and hence primary production) regime, is obviously a fairly high risk venture. In order to minimise the risk associated with episodic dry periods, an ox or steer production system is advocated (du Plooy, 1980). The underlying rationale is that breeding animals are kept to a minimum, as compared with a weaner production system, and steers can be more easily bought and sold as conditions demand. The more flexible, better adapted steer production system was thus scored higher than a weaner production system, in turn rated higher than ill-defined production systems. Highest rating was accorded to those innovators who further tried to "optimise" income by incorporating game (abundant in the area) into the overall ranching enterprise.

Production system was most highly correlated with level of contact with extension officer ($r = 0,404$) followed by education ($r = 0,280$). Perhaps surprisingly, the production system was only weakly correlated with motivation ($r = 0,161$). This may indicate that other messages propagated by the extension service, such as grazing management system ($r = 0,507$, grazing management system versus motivation) are perceived by the more progressive farmers as being more important innovations than is the animal production system. This could be due to the fact that past extension efforts laid emphasis on practices such as fencing off of different

veld types, minimum number of camps and the all important controlled selective grazing (Coetzee, 1971 du Plooy, 1980). This raises questions as to the relative merits of a "total package" message, including all aspects of importance versus a "one at a time" approach to adoption of innovations.

3.3.2.6 Production figures

In order to ascertain the relative success of the ranches sampled, farmers were asked to divulge, on a confidential basis, financial achievements over the past five years. Almost universally, they were most reluctant to disclose such information. Built into the questionnaire schedule were questions relating to mortality figures, number of animals of different ages marketed, and short medium and long term debt commitments. Ranchers readily discussed mortality, and often spoke at length on this subject, obviously an important factor in savanna ranching. Toxic plants, predators and snake bite were most widely cited causes of death among livestock, while diseases were apparently largely under control. From this information, as well as indirect sources, such as the extension officer and local representatives of organized agriculture, a "relative performance" figure was calculated for each ranch. (It must be emphasized that absolute figures were not obtained!).

Mortality rate, although important to the ranchers, was found to be generally fairly low, averaging 3% with a minimum of 1% and a maximum of 8%. Mortality rate was very poorly correlated with all other variables, highest Kendall rank correlation coefficient being r = 0,270 in the case of mortality vs level of education of rancher, a seemingly non causal relationship.

The Kendall rank correlation coefficients of relative financial performance with other variables are shown in Table 3.13.

The number of camps per herd, (r = 0,625), amount of contact with the extension officer (r = 0,572) and the physical planning of the farm (r = 0,516) were most highly correlated with financial performance. Although the interpretation of cause and effect is not a clear cut issue, it would appear that contact with the extension officer leads to sound physical planning and numerous camps per herd, which in turn results in better financial performance. However, and most noteworthy, financial performance is poorly correlated with farm size (r = 0,043) ("bigger is not necessarily better"). The correlation between relative performance and veld composition score (r = 0,140) is likewise very poor, contrary to the extension message of "goeie veld, meer geld".

Table 3.13 Kendall rank correlation co-efficients of relative financial performance with other variables.

Variable	Correlation co-efficient
Farm size	0,043
Age	0,242
Education	0,219
Experience	0,138
Extension contact	0,572
Improvements desired	-0,023
Physical planning	0,516
Animal production system	0,198
Grazing management system	0,360
Planted pastures	0,340
Mortality	-0,012
Number of cattle	-0,044
Rating by extension officer	0,465
Number of camps per herd	0,625
Veld composition score	0,140

Net farming income is the difference between the gross margin and the overhead or fixed costs. The current norm (as compared with previously cited estimates) for an economically viable unit is a ranch capable of generating a net in

come of R42 000 per annum (Armer, 1988, pers comm*). Working on a net income of R120 per Large Stock Unit, a minimum of 350 LSU's is needed. The recommended stocking rate for the study area is 1 LSU per 8 ha (Coetzee, 1971). A minimum ranch size of 2800 ha is thus indicated. More than 75% of ranches in the study area were smaller than this.

Income derived from game (largely undeclared due to tax implications) probably made the difference between solvency and total bankruptcy.

3.4 Factor analysis

Use was made of factor analyses (BMDP4M, modified for use on Burroughs Large Systems computers by Coveney, Liddell and Halstead, Computer Unit, Unversity of Warwick Coventry, CV4 7AL, England) in order to determine any separation of farms (or groups of farms) along meaningful axes caused by grouping of variables measured in the study. This was done in order to determine whether groups of variables exhibiting colinearity would account for variance in, for example, veld

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composition. Such variance was not accounted for by simple single - variable correlation as described above.

The results of the factor analysis on all variables are tabulated below.

Table 3.14 Sorted rotated factor loadings obtained from eighteen variables.

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6
Eigen values	5,717	2,326	2,209	1,384	1,266	1,094
Extension contact	0,835					
Veld Knowledge	0,823					
Relative Performance	0,791					
Physical Planning	0,758					
Extension Rating	0,727					
Grazing System	0,680					
Number of camps	0,664					
Farm Size		0,924				
Number of cattle		0,902				
Years Experience			0,905			
Age			0,676			
Desired Improvements				0,831		
Planted Pastures				0,645		
Motivation				0,621		
Veld Composition					0,860	
Mortality						0,932

Variables clearly fall into groups as a result of the factor analysis. Those in factor 1, namely contact with extension officer, veld knowledge, relative performance, physical planning, rating by extension officer, grazing management system and number of camps per herd, are relatively highly colinear and together are interpreted as contributing to an overall index of "managerial ability".

Those in factor 2, farm size and number of cattle, relate to the magnitude, or scale of the operation. Factor 3 contains variables (experience and age) which describe the "maturity" of the manager. The variables with high loadings in factor 4, desired improvements, motivation and incorporation of planted pastures, may as a group reflect the aspirations or "innovativeness" of the ranchers. Factor 5 contains veld composition and factor 6, percentage mortality, variables poorly correlated with others. Factor scores and Mahalonobis distances (Chi - square S) from each case (farm) to the centroid of all cases for the original farm data factor scores were calculated and used to plot various factor combinations. (This entailed combining all colinear variables in, for example, Factor 1 and plotting the resultant score (index of "ability") against that similarly obtained for those variables grouped together in Factor 2 (scale of operation). The resultant plots were best described as "currant bun scatters" (Appendix 2). More specifically veld condition of farms (Factor 5) was not found to be

meaningfully interpretable in relation to other factors. This finding supports those reported on in the previous section (for correlation between individual variables). The use of multiple stepwise linear regression further corroborated the above findings. Irrespective of the variables included or excluded from the model, the variance in veld composition accounted for was never greater than 25% (Appendix 3).

Examination of individual case (farm) scores for factor 1, reveals a spread ranging from -2,221 (case 5) to 1,538 (case 14). Scores were grouped into the following categories: less than -1,0; between -1,0 and +1,0; greater than +1,0. The resultant frequency distribution of scores is shown in Table 3.15.

Table 3.15 Distribution of factor 1 ("Management ability") scores of farms in the study area.

Factor 1 scores	Percentage of farms
< -1,0	15,5
-1,0 to +1,0	76,0
> +1,0	8,5

Case studies of the individual farmers reveal the following scenario: Three main, generalized categories of ranchers may

be identified.

The first, comprising less than ten percent, is characterised by high management ability, generally larger farms (average size for the group = 2893 ha compared with average size of 2049 hectare for the whole survey) and, perhaps most significantly, considerable alternative income derived from "other sources". These are capitally powerful "land barons", with few if any long - term debt committments. Members of this group are most receptive to any advice or extension. They have a competitive approach to improving veld condition. "Good veld" (though not always achieved) becomes a source of pride, and apparently fulfills higher order or spiritual needs (sensu Maslow), much like donating to charity!

The group at the other extreme, some 15%, could best be described as "strugglers / laggards" in terms of practice adoption or aspiration (in classical terms). However, case studies indicate that the majority are completely satisfied with their current lot, their present life style. Aspirations are fulfilled, and there is no inherent need, desire or incentive to achieve externally set goals. (Can best be described as subsistence farmers). Case studies reveal that members of this group do not necessarily have "poor" veld, the distribution of veld composition scores among this group is similar to that of the total sample.