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## FARMER CHARACTERISTICS, RISK SOURCES AND MANAGERIAL RESPONSES TO RISK IN VEGETABLE FARMING: EVIDENCE FROM LARGE- AND SMALL-SCALE COMMERCIAL VEGETABLE FARMERS IN KWAZULU-NATAL

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Vegetable farmers in KwaZulu-Natal were surveyed on their sources and managerial responses to risk. Most respondents considered themselves more willing to take risks relative to other farmers. Respondents viewed price, climate and yield variability as the most important sources of risk in vegetable production. Results show that government policies add to the level of uncertainty faced by vegetable farmers. However, large and small vegetable farmers differed in their perceptions of risk. Small farmers perceived changes in credit availability and changes in input costs to be more important risk sources than large farmers, while the latter were more concerned with changing interest rates. Irrigation, timely access to machinery, being a low cost producer, and diversification were considered by both large and small farmers as the most significant managerial responses to risk. Factor analysis of risk sources and managerial responses to risk suggest there are more dimensions to risk than are commonly included in economic analyses.

**Eienskappe van boere, risikobronne en bestuursopptrede ten opsigte van risiko van groenteboerdery met spesifieke verwysing na groot- en kleinskaalse kommersiële groenteboere in KwaZulu-Natal**

'n Opname is gedoen onder groenteboere in KwaZulu-Natal betreffende hulle bronne van risiko en gepaardgaande bestuursopptrede. Die meeste respondente beskou hulself as meer gewillig om risiko's te trotseer as ander boere. Respondente het prys-, klimaats- en opbrengsveranderlikheid as die belangrikste bronne van risiko vir groenteproduksie beskou. Die resultate toon dat regeringsbeleid tot groenteboere se vlak van onsekerheid bydra. Groot en klein groenteboere verskil in hulle persepsies van risiko. Kleinboere beskou veranderinge in kredietbeskikbaarheid en insetkoste as belangriker risikobronne as groot boere. Laasgenoemde is weer meer bekommerd oor veranderinge in rentekoerse. Besproeiing, tydige beskikbaarheid van meganisasie, laekoste produksie en diversifisering is deur beide groepe as die belangrikste bestuursreaksies op risiko beskou. Faktoranalise van risikobronne en bestuursopptrede ten opsigte van risiko dui op meer dimensies van risiko as wat normaalweg in ag geneem word by ekonomiese ontledings.

### 1. Introduction

Farmers operate in an environment characterised by risk and uncertainty. Sources of risk can be divided into the categories of production, marketing and finance (Anderson and Ikerd, 1985). Production or yield can vary as a result of unfavourable weather conditions, diseases, timing of practices, pest infestations and genetic variations. Similarly, expected prices for produce are subject to frequent and abrupt changes due to dynamic changes in supply and demand conditions. Financial risk arises when external capital is used and interest rates increase. In addition, farmers must consider the risks associated with the ever-changing political, social, economic and ecological environment in which they operate.

Ortmann *et al* (1992) describe risk as being the variability of outcomes such as yield, prices or profit, or simply the lack of certainty. However, profit can also be viewed as a reward for managing uncertain events that create exposure to losses. Therefore, without uncertainty and risk there is no opportunity for profit (Schwab *et al*, 1989).

Many studies examining risk sources and management responses to risk have been conducted in the USA, on both commercial livestock and crop farms (Ortmann *et al*, 1992; Boggess *et al*, 1985; Boehlje and Trede, 1977; Patrick *et al*, 1985). Similar studies have been conducted in South Africa on commercial livestock and crop farms in KwaZulu-Natal (Woodburn, 1993) and on extensive beef farms in the north-western Transvaal Bushveld (Swanepoel and Ortmann, 1993). However, comparable research specific to vegetable farmers in the USA or South Africa was not found by the authors. Patrick *et al* (1985) reported that there were significant differences among categories of farmers in the importance given to

risk sources. As these sources and the degree of risks vary amongst different farming enterprises, this study will assist in identifying the most important sources of risk vegetable farmers in KwaZulu-Natal are exposed to, and farmers' attempts to manage these risks.

Research to quantify the main sources of risk amongst large- and small-scale farmers in South Africa is necessary in order to facilitate the design of educational and information packages that will satisfy farmers' requirements for more information to manage these risks (Ortmann *et al*, 1992). The aim of this paper is to identify the main sources of risk encountered by large- and small-scale vegetable farmers in KwaZulu-Natal and their managerial responses to risk. The paper also examines the possibility of classifying the risk sources and managerial responses into a fewer number of groupings using factor analysis. It supplements research already conducted in South Africa (Woodburn, 1993; Swanepoel & Ortmann, 1993) and highlights areas where additional research specific to vegetable producers needs to be directed.

### 2. Data source

A postal survey of vegetable farmers within an 80km radius of Pietermaritzburg was conducted. A questionnaire, comprising a total of 39 questions, was mailed to the farm owner or principal decision maker. The questions were based on the study conducted by Ortmann *et al* (1992) and also included additional questions thought to be relevant to vegetable farmers. A pilot survey was conducted among five vegetable farmers in order to eliminate any ambiguities in the questionnaire.

For the purposes of this study, farmers were classified as vegetable producers if their vegetable enterprises contributed more than 40 percent of farm turnover (gross

income). A total of 181 farmers were identified as growing vegetables, with the assistance of seed companies, the area Extension Officer and the University of Natal's Horticultural Science Department. Of particular interest were 30 Indian farmers who formed part of the sample as little research has been conducted on these growers. Owing to generally poor responses to postal surveys, as illustrated by response rates of 7,6 percent, 20 percent and 35 percent obtained by Swanepoel and Ortmann (1993), Van Tassell and Keller (1991) and Woodburn (1993) respectively, the whole population of farmers growing vegetables (181) was surveyed in an attempt to ensure sufficient responses for statistically significant results.

In total 67 responses were received which translates into a 37 percent response rate. Initially 53 responses were received (29 percent response rate) of which 14 were useable. A reminder letter was mailed to non-respondents with a copy of the questionnaire and personal visits were arranged. This increased the useable responses to a total of 28 (15,5 percent). Of the 28 responses, 18 were classified as large and 10 as small farmers, based on the area irrigated. Five of the 10 small farmers were Indians, four were white and one was a black farmer. Of the non-useable responses, 11 farmers had discontinued vegetable farming, two had retired from farming, one farmer had sold his farm because of the drought, and two farmers had leased out their farms. The remaining 23 responses not used consisted of farmers whose vegetable enterprises contributed less than 40 percent of farm gross income, or they had not completed their questionnaire.

### 3. Characteristics of respondents

Information on the respondents' farm business and personal characteristics included the farmers' age, education and experience, type of business arrangement, hectares owned and rented, enterprise types, gross income and the number of farm workers employed. Vegetable farmers were also asked to rate their management skills and their willingness to take risks relative to other farmers.

Respondents were classified into large- and small-scale farmers on the basis of area irrigated. As some respondents had enterprises other than vegetables, the area under irrigation was used as the grouping criterion rather than farm turnover as vegetable crops are usually irrigated. Large farmers were defined as those who irrigated an area of 15ha or more while small farmers were those who irrigated less than 15ha. Large farmers irrigated 87,1ha on average (median 47,5ha), the range being 18ha to 300ha. Small farmers irrigated 8,4ha on average (median 8ha), the range being 2,5ha to 14ha.

#### 3.1 Farmers' age, experience and education

The mean ages of large- and small-scale vegetable farmers were 45,1 and 44,8 respectively, while the mean years experience were 15,9 and 17,2 respectively. This indicates that the respondents have had considerable experience in vegetable farming. Large farmers had an average of 13,6 years of formal education compared to an average of 10,5 years for small farmers.

#### 3.2 Business arrangements and farm size

Of the 28 respondents, 23 (82 percent) operated under individual ownership, three in partnerships (11 percent), one as a Trust and one as a Close Corporation. Overall, there was a wide range of hectares owned with the largest farm being 4000ha in extent and the smallest 2,5ha. On average, large farmers owned 530,7ha (median 119ha) while small farmers owned 13,3ha (median 11ha). Three of the small farmers rented land (mean 6,7ha) and one share-leased land (5ha). Of the large farmers, five rented land (mean 33,6ha) and two share-leased land (mean 204ha).

The main method of irrigation used was overhead sprinkler followed by a combination of overhead and drip irrigation. Of the 28 respondents, 22 used overhead, four used the overhead and drip combination while two used

a combination of overhead and micro-jet. Considering the droughts in KwaZulu-Natal during 1983 and 1992/93, it may be surprising that the more water efficient methods of irrigation, such as drip and micro-jet systems, have not been adopted on a wider scale. Capital and management constraints could be an explanation for this.

#### 3.3 Enterprises and farm income

The main vegetable crops grown by the respondents include cabbage, lettuce, tomato, butternut, green beans and green mealies. Large farmers concentrated more on high volume vegetable crops such as those already mentioned, whereas small farmers also grew specialist crops such as chillies, peppers and baby marrows for 'niche markets'.

Seventy five percent of respondents generated more than 90 percent of their farm gross income from vegetables. Only one farmer generated less than 50 percent (40 percent) from vegetable production. As the survey was conducted after a drought the farmers were asked to report typical gross income (turnover) figures. Table 1 shows a frequency table for the typical gross incomes of the respondents. The highest annual gross income recorded for large vegetable farmers was R5 million and R423 000 for small farmers. The average turnover for large farmers was R1 065 500 (median R725 000) and R113 102 (median R75 000) for small farmers.

These figures translate into an average gross income of R16 303 per hectare of irrigated land for large farmers and R14 699 for small farmers. The highest gross income per hectare irrigated for large farmers was R41667 and R60 429 for small farmers.

Respondents were asked to report their present liability and asset figures from which their debt-asset ratios were calculated (Table 2). A debt-asset ratio of less than 0,50 is generally accepted as safe and a ratio of 1,0 or higher indicates that the farm is bankrupt (Standard Bank, 1988; Boggess *et al.*, 1985). Both groups of farmers had a mean debt-asset ratio of 0,31 indicating they were solvent. However, 67 percent of the small farmers had a ratio less than 0,30 compared to 39 percent of large farmers.

At the opposite extreme, 11 percent of large farmers had a debt-asset ratio greater than 0,60 compared to 22 percent of small farmers. These debt-asset ratios reflect the position of the farmers after two years of drought and may be the reason for some of the high ratios. Large farmers tended to be more highly leveraged than small farmers (50 percent of large farmers having debt-asset ratios greater than 0,30 compared to 33 percent of small farmers), which may be due to large farmers having more capital intensive farming systems.

#### 3.3 Farm labour

Table 3 shows that vegetable farming provides substantial employment for the local population because of the labour intensive nature of vegetable production. Small farmers employed more labourers per irrigated hectare (three) than did large farmers (one), probably because large farms were more mechanised. Daily wage rates paid by both categories of farmer were similar, although large farmers paid more for truck drivers and indunas. Approximately 54 percent of the labour force on large farms was employed on a temporary basis (casuals) compared to 48 percent on small farms.

#### 3.4 Management skills

The vegetable farmers were asked to rate their management skills relative to other farmers in the areas of farm production, product marketing, farm finance and overall farm management. Table 4 shows that respondents generally rated their relative skills highly (above 3,50). Large farmers, however, rated their marketing skills the lowest (3,33) while small farmers rated themselves the highest in this category (3,70). Small farmers gave themselves the lowest ratings for farm production and overall management (both 3,50).

Table 1: Typical gross incomes of large and small commercial vegetable farmers in KwaZulu-Natal.

Large farmers (n=18)			Small farmers (n=9)		
Gross farm income (R)	Frequency	Percent	Gross farm income (R)	Frequency	Percent
100 000 - 499 999	4	22,2	less than 50 000	3	33,3
500 000 - 999 999	8	44,4	50 000 - 99 999	3	33,3
1 000 000 - 1 499 999	2	11,1	100 000 - 149 999	1	11,1
1 500 000 - 1 999 999	2	11,1	150 000 - 199 999	1	11,1
2 000 000 or above	2	11,1	200 000 or above	1	11,1

Table 2: Debt-asset ratios of large and small commercial vegetable farmers in KwaZulu-Natal.

Debt-asset ratio	Large farmers (n=18)		Small farmers (n=9)	
	Frequency	Percent	Frequency	Percent
0,00 - 0,09	3	16,7	3	33,3
0,10 - 0,19	1	0,1	1	11,1
0,20 - 0,29	4	22,2	2	22,2
0,30 - 0,39	4	22,2	0	0,0
0,40 - 0,49	3	16,7	0	0,0
0,50 - 0,59	1	0,1	1	11,1
above 0,60	2	11,1	2	22,2

### 3.5 Willingness to take risks

Survey participants were asked to rate their willingness to take risks, relative to other farmers, on a scale ranging from one (much less willing) to five (much more willing). From Table 5 it would appear that vegetable farmers are less risk averse as most (85 percent) considered themselves willing or more willing to take risks relative to other farmers.

It appears that younger, less experienced and less educated farmers are more willing to take risks. This is a different result to Woodburn's (1993) who found that younger and more educated farmers were risk preferers. He also found the relationships between the willingness to take risks and annual turnover, liabilities and debt-asset ratios to be U-shaped. That is, the means for the three variables were higher for farmers who were either much more or much less willing to take risks. This study shows a negative relationship between the willingness to take risks and gross income, total liabilities and the debt-asset ratio. An important point is that farmers with a lower debt-asset ratio are more willing to take risks. These are farmers with a greater risk-bearing capacity.

Farmers who were much more willing to take risks rated themselves on average as having the highest management skills in overall farm management. This was also true for their relative management skills in production, marketing and finance. Woodburn (1993) found just the opposite result, namely that farmers who were much less willing to take risks rated themselves on average as having the highest management skills.

### 4. Sources of Risk

Farmers in the survey were asked for their definition of risk. Of the 26 responses, 11 focused on the chance of negative outcomes, six defined risk as the chance of success or failure, four defined it as taking a chance, three perceived risk as the activity of farming and two saw risk as an opportunity to make a profit. Boggess *et al* (1985) also found that the majority of respondents focused on the potential of negative outcomes.

Farmers were asked to rate various sources of risk in terms of their importance to farm decision-making on a Likert-type scale ranging from one (not important) to five (very important).

As new information becomes available and management objectives evolve, these perceptions will no doubt change (Young *et al*, 1979, as cited by Boggess *et al*, 1985). Thus the results of this study will give an indication of

the respondents' risk perceptions at the time of the survey.

Table 6 shows the mean ratings, percentage of farmers responding with a four or five, and rankings of the 16 sources of risk according to the mean ratings in the overall sample. As expected, the vegetable farmers as a whole rated crop price variability (4,89) as the most important source of risk, followed by climate (4,46) and crop yield variability (4,07). In vegetable farming, climate not only affects yields but also the quality of crops produced; hence, variability in climate and yield were given as separate sources of risk. An example is high temperatures (above 30°C) inducing seedstalk development and hence inferior quality in mature lettuce (Smith and Holcroft, 1991). The results obtained support the studies by Patrick *et al* (1985), Knight *et al* (1985) and Ortmann *et al* (1992), which found that crop price and crop yield (weather) variability were the most important sources of risk on US crop farms.

The ranking of price variation as the most important source of uncertainty could be expected, as vegetable farmers have little control over prices received for their produce. With the recent droughts of 1983 and 1992/93 it is not surprising that climate was ranked second. Tala Valley, where a substantial number of the respondents farm, is subject to abrupt changes in weather conditions on a daily basis (Smith and Holcroft, 1991). Yield variation is ranked third probably because vegetable farmers have some degree of control over yield variations by using fertilizers, chemicals and irrigation.

Changes in input costs (3,96) and changes in labour legislation (3,82) were ranked fourth and fifth respectively, closely followed by changes in interest rates (3,79), changes in the labour force (3,71), changes in the cost of capital items (3,64) and changes in land policies (3,61).

Woodburn (1993) reported that commercial farmers in KwaZulu-Natal ranked changes in costs of farm inputs as the most important source of risk, followed by variability in crop yield, crop price, livestock price and livestock product prices. However, the importance of risk sources varied among different regions. X Changes in labour legislation (3,82), in the labour force (3,71), in land policy (3,50) and in tax policy (3,32) were also perceived as important risk sources by vegetable farmers in this study. The perceived threat of labour unions, the extension of the Labour Act to include the agricultural sector and talk of the imposition of minimum wages have increased uncertainty for vegetable farmers. This was expected with the advent of a new political dispensation and hence uncertainty about future government policies.

**Table 3: Number employed and wage rates per day of permanent and casual labour on commercial vegetable farms in KwaZulu-Natal.**

Labourers	Overall (n=28)		Large farmers (n=18)		Small farmers (n=10)	
	Workers employed (per farm)	Wages per day (R)	Workers employed (per farm)	Wages per day (R)	Workers employed (per farm)	Wages per day (R)
<b>Permanent:</b>						
Tractor drivers	3	14,70	4	14,50	1	15,50
Truck drivers	2	30,55	2	30,90	1	27,00
Indunas	2	18,03	2	19,12	1	14,50
Other	30	8,18	35	8,07	10	8,50
<b>Casuals</b>	32	7,30	51	6,73	12	7,85

**Table 4: Vegetable farmers' ratings of management skills relative to other farmers**

Management area	Large farmers <sup>1</sup>	Small farmers <sup>1</sup>
Farm production	3,61	3,50
Product marketing	3,33	3,70
Farm finance	3,61	3,60
Overall farm management	3,89	3,50

<sup>1</sup> where 1 = relatively low management skills and 5 = relatively high management skills

**Table 5: Vegetable farmers' characteristics for different levels of willingness to take risks in overall farm management (n=28).**

Willingness to take risks	n	Gross income (Rand)	Total liabilities (Rand)	Age (years)	Educa-tion (years)	Expe-rience (years)	Debt/Asset Ratio	Overall Management skills
Much less willing	0	0	0	0	0	0	0	0
Less willing	0	0	0	0	0	0	0	0
Willing	12	928 826	515 320	50,6	13,0	19,3	0,36	3,67
More willing	11	713 000	324 000	39,4	12,6	12,9	0,30	3,45
Much more willing	4	478 750	170 700	44,0	11,5	17,3	0,21	4,50

Livestock farmers in the north-western Transvaal Bushveld ranked livestock production variability, rainfall variability, livestock price variability, the threat of land reform and changes in input costs as the five most important sources of risk (Swanepoel and Ortmann 1993). In the studies conducted by Woodburn (1993) and Swanepoel and Ortmann (1993) farmers also gave high ratings to changes in the labour force, changes in labour legislation and changes in land policy. Although these sources of risk have high ratings, only changes in labour legislation was ranked in the top five sources of risk in this study. This is probably due to the fact that vegetable farming is labour intensive, making wages a large component of input costs.

Changes in interest rates appear to be more of a concern for large farmers. Small farmers ranked changes in interest rates seventh as opposed to a fourth place ranking by large farmers of whom 72 percent indicated a four or a five on the five-point scale. This may be attributed to small farmers making use of Agricultural Credit Board loans (rather than commercial bank loans) which have a relatively low and stable interest rate (eight percent). Large farmers probably place more emphasis on changes in interest rates as their main sources of credit are commercial banks whose interest rates are higher and subject to variations.

The most prominent differences between the responses of large and small farmers are in their rankings of changes in input costs and changes in credit availability. Changes in input costs and credit availability were ranked second and fourth respectively by small farmers compared to ninth and thirteenth by large farmers. Other sources of risk that were identified, particularly by small farmers, were theft and security.

In 1990 a survey was conducted to assess the financial position of vegetable farmers in the Tala Valley (Depart-

ment of Agriculture, 1991). Respondents ascribed their financial problems to marketing, over-production, high input costs and high interest rates. This study shows that vegetable farmers still perceived input costs and interest rates to be important sources of risk.

Sources of risk that received low ratings included changes in the control board system (1,93), land rental changes (1,93) and changes in environmental regulations (2,43). This differs from the results of Patrick *et al* (1985) and Ortmann *et al* (1992) who reported that changes in government commodity programmes and changes in government environmental regulations were rated highly as sources of risk by mid-western farmers in the USA. The results of this study can be ascribed to the fact that marketing of vegetables is not controlled, there are few cases of land rentals and environmental regulations are not effective.

These results confirm the concept that sources of risk vary according to farm type and farm size. Overall, vegetable farmers perceived price, climate and yield variability as the three most important sources of uncertainty they face. Livestock farmers in the north-western Transvaal Bushveld ranked livestock production variability, rainfall and livestock price variability as their main sources of risk (Swanepoel and Ortmann, 1993). Commercial farmers in KwaZulu-Natal rated input cost, crop price and livestock price variability as their most important risk sources. However, the perceived importance of various risk sources varied between regions, and thus enterprises, in KwaZulu-Natal (Woodburn, 1993).

#### 4.1 Factor analysis of risk sources

A factor analysis was conducted to group the various sources of risk into a smaller number of categories (factors). Thirteen of the original 16 sources of risk were included in the factor analysis.

Table 6: Mean ratings, percentage of 4 and 5's and rankings of sources of risk faced by commercial vegetable farmers in KwaZulu-Natal.

Sources of risk <sup>1</sup>	Overall (n=28)			Large farmers (n=18)			Small farmers (n=10)		
	Mean rating <sup>2</sup>	Percent 4 & 5's	Rankings	Mean rating	Percent 4 & 5's	Rankings	Mean rating	Percent 4 & 5's	Rankings
Crop price variation	4,89	96,4	1	4,83	94,4	1	5,00	100,0	1
Climate	4,46	85,7	2	4,50	88,9	2	4,40	80,0	3
Crop yield variation	4,07	71,4	3	4,17	72,2	3	3,90	70,0	4
Changes in input costs	3,96	71,4	4	3,67	61,1	9	4,50	90,0	2
Changes in labour legislation	3,82	64,3	5	3,89	61,1	6	3,70	70,0	6
Interest rate changes	3,79	67,9	6	3,94	72,2	4	3,50	60,0	7
Labour force changes	3,71	67,9	7	3,89	72,2	5	3,40	60,0	9
Changes in capital costs	3,64	57,1	8	3,72	55,6	8	3,50	60,0	7
Changes in land policy	3,61	57,1	9	3,78	61,1	7	3,30	50,0	11
Changes in health	3,50	50,0	10	3,56	50,0	10	3,40	50,0	10
Changes in tax policy	3,32	46,4	11	3,44	50,0	11	3,10	40,0	13
Changes in credit availability	3,14	46,4	12	2,72	33,3	13	3,90	70,0	4
Technology changes	3,04	39,3	13	2,89	33,3	12	3,30	50,0	11
Changes in environmental regulations	2,43	32,1	14	2,67	38,9	14	2,00	20,0	15
Land rent	1,93	21,4	15	1,89	16,7	16	2,00	30,0	14
Changes in control board system	1,93	17,9	16	2,28	22,2	15	1,30	10,0	16

<sup>1</sup> The sources of risk are listed in order of their importance in the overall ratings.  
<sup>2</sup> Where 1 = not important and 5 = very important.

Changes in the control board system, changes in environmental regulations and changes in land rents were omitted as they had overall mean ratings below 2.5. Principal component analysis was used initially to determine how many factors should be included in the analysis. Four components had eigenvalues greater than one and explained 72.2 percent of the variance in the 13 sources of risk (Manly, 1986). The fifth component was included as it had an eigenvalue close to one (0.834) and its inclusion increased the percentage variation accounted for to 78.6 percent. Use was then made of a varimax rotation to provide simpler factors (Manly, 1986).

Results of the factor analysis are presented in Table 7. The communalities for the risk sources after rotation were all greater than 0.6. This means that most of the variance in the variables (sources of risk) is accounted for by the five common factors (Manly, 1986). Most of the sources of risk that had loadings greater than 0.6 in one factor did not exceed 0.4 in any of the other factors. Changes in labour legislation and changes in capital costs were the only sources of risk whose loadings exceeded 0.5 in more than one factor.

One of the disadvantages of factor analysis arises when trying to attach labels to the factors. It is fair to say that assigning labels to the factors is difficult and requires a degree of inventiveness (Manly, 1986).

Factor 1 was labelled "government policy". Although changes in health of the farmer has the highest individual loading in this factor, the combined loadings of the three policy-related variables (changes in tax policy, land policy and labour legislation) are much greater. Factor 2 has loadings greater than 0.7 for yield variability and climate while crop price variability has a loading greater than 0.5; hence the factor was labelled "gross income".

Changes in input costs and credit availability have their highest loadings in factor 3 (both greater than 0.7). It was therefore labelled "input costs and credit". Factor 4 was called the "labour" factor, because of the high loadings for changes in labour legislation and changes in the labour force. The three major responses in Factor 5 are all related to capital and hence this factor is named "capital costs".

The factor scores for large and small farmers are also presented in Table 7. Factor 1 illustrates the emphasis large farmers place on changes in government policy and their own health as indicated by the positive factor score for large farmers. Variability in gross income and labour issues are also considered important sources of risk by large farmers. On the other hand, small farmers place more emphasis on changes in input costs, credit availability and capital costs (Factors 3 and 5 appear to be closely related). This supports the higher rankings given to changes in input costs, credit availability and in capital costs by small farmers relative to large farmers.

These results support the findings of Patrick et al (1993) and Woodburn (1993), who suggest that farmers view risk in various dimensions but not as many as the individual questions.

For example, vegetable farmers may be more concerned with changes in gross income than with crop price and crop yield variability separately, or they may be more concerned with changes in capital costs in general which include changes in interest rates, capital costs and technology.

## 5. Managerial responses to risk

Vegetable farmers were also asked to rate production, marketing and financial responses to risk, again using a Likert-type scale ranging from one (not important) to five (very important). The mean ratings for these responses are presented in Table 8.

### 5.1 Production responses

Of the 12 production responses provided, vegetable farmers as a whole rated irrigation (4.64), having timely

access to machinery (3.75), being a low cost producer (3.54), enterprise diversification (3.11) and increasing the use of capital (2.89) as the five most important production responses to risk.

It is not surprising that irrigation is considered as the most important production response, as it is a standard practice for vegetable farmers. Timely access to machinery and low cost production were also ranked highly in the Ortmann et al (1992) and Woodburn (1993) studies.

Geographic dispersion (1.86), decreasing the use of capital (1.86), having back-up management (2.00), and decreasing farm size (1.57) were perceived to be unimportant production responses. Geographic dispersion was also rated relatively lowly by respondents in the studies of Woodburn (1993), Ortmann et al (1992) and Patrick et al (1985). Woodburn (1993) also found that farmers rated farm size reduction as unimportant. It is worth noting that decreasing farm size was ranked lowest by both small and large farmers. Increasing farm size was ranked relatively highly, namely sixth by large farmers and seventh by small producers.

### 5.2 Marketing and financial responses

Of the six marketing responses considered, all the farmers rated use of the free market (4.50) as the most important response, followed by use of market information (3.54) and selling to hawkers (3.46). The latter result illustrates the growing importance of the informal market in the distribution of fresh produce. There is little difference between large and small producers in their marketing responses. Co-operatives (1.25), forward contracts (1.79) and own marketing groups (2.46) were considered unimportant marketing responses to risk.

Vegetable farmers as a whole rated keeping financial records (4.25), debt management (3.61) and asset insurance (3.36) as the three most important responses used to manage financial risk. Both groups of farmers ranked the same strategies highly, but it is perhaps surprising that small farmers rated keeping financial records (3.60), debt management (2.40) and maintaining financial and credit reserves (2.10) much lower. This may be because credit availability is more limiting for smaller farmers and their business transactions are generally conducted on a cash basis. Large farmers gave a wider range of financial responses high ratings compared to small producers, which may be a result of large farmers having more complex financial arrangements. Further investigation into the reasons for the relatively low ratings given by small farmers is warranted and perhaps more extension efforts in this area may be useful.

Hail and crop insurance (2.07) was rated lowly by both groups of farmers and it is probably not used widely despite the fact that climate was rated as an important source of risk (4.46). Flooding and hail are not uncommon in the areas surveyed and it was expected that crop insurance would be considered as an important risk management strategy. A possible reason for the low rating of crop insurance is that this type of insurance is perceived to be very costly and the respondents prefer to carry the risk themselves. As was indicated earlier, the respondents considered themselves more willing to take risks than other farmers.

### 5.3 Factor analysis of risk responses

A factor analysis of the responses to risk was also conducted. To simplify the analysis, only 16 of the original 27 responses were included in the factor analysis. Responses that had overall mean ratings lower than 2.2 were omitted as they were considered to be relatively unimportant. As with the risk sources, a factor analysis using a varimax rotation was conducted (Manly, 1986). This gave the best groupings, which are shown in Table 9. Six components had eigenvalues greater than one and explained 77.1 percent of the variance. All of the risk responses had communalities greater than 0.6. This means that most of the variance in the responses to risk is accounted for by the six common factors (Manly, 1986).

Table 7: Factor analysis of risk sources of commercial vegetable farmers in KwaZulu-Natal.

Principal components		1	2	3	4	5
Eigenvalues		4,394	2,256	1,600	1,134	0,834
Percentage variance explained		33,80	17,35	12,31	8,72	6,42
Sources of risk	Communalities	Factors				
		Government policy	Gross income	Input costs and credit	Labour	Capital costs
Changes in health	0,7824	0,8496	0,0902	-0,0777	0,1674	-0,1352
Changes in tax policy	0,7226	0,7394	0,1807	-0,1144	0,1750	-0,3218
Changes in land policy	0,7337	0,7255	0,0747	-0,2604	0,3652	0,0240
Changes in labour legislation	0,8324	0,5220	0,1265	0,0159	0,7142	-0,1833
Crop yield variability	0,7225	0,1434	0,8268	-0,0929	-0,0870	0,0461
Climate	0,7930	0,1733	0,7176	-0,0060	0,3460	0,3581
Crop price variability	0,6140	-0,0652	0,5854	0,4771	-0,1885	0,0628
Changes in input costs	0,8473	0,3248	0,0577	0,7984	0,2779	-0,1541
Changes in credit availability	0,7839	-0,4334	-0,1055	0,7374	-0,2017	-0,0209
Labour force changes	0,8478	-0,2402	-0,0653	0,0034	0,8741	-0,1476
Changes in capital costs	0,8825	-0,1363	-0,1564	-0,0507	0,5232	-0,7504
Technology changes	0,8995	0,1474	-0,1457	0,1974	-0,0225	-0,9039
Interest rate changes	0,7522	0,4787	0,1313	-0,0985	0,3924	-0,5849
<b>Factor scores:</b>						
Large farmers		0,0748	0,0276	-0,3793	0,1017	0,0279
Small farmers		-0,1346	-0,0496	0,6827	-0,1830	-0,0503

Selling direct to hawkers, diversification, debt management and asset insurance were the only risk responses to have loadings greater than 0,4 in more than one factor. Debt management had factor loadings exceeding 0,5 in factors 1 and 4.

The first factor is the "timeliness and insurance" factor as timely access to machinery, irrigation, asset insurance and debt management have relatively high loadings in this factor. Factor 2 is labelled the "free market" factor as use of the free market has its highest loading in this factor. Factor 3, the "increasing operations" factor, has high loadings for increasing farm size and increasing the use of capital items. The fourth factor is referred to as "reducing financial risk", as the five responses with loadings greater than 0,5 impact on financial risk. Debt management, keeping financial records and liability insurance all assist in financial risk management. Diversification and decreasing the labour force are methods used to reduce business risks. Although a distinction is made between business and financial risks, the former is one of the main contributors to financial risk (Calkins and Di Pietre, 1983). All five responses are therefore related to managing financial risks.

Factor 5 is different to the other factors in that it is bipolar. Being a low cost producer has its highest loading (-0,7334) in this factor, with the negative sign indicating a contrast to the positively loaded variables of market information and selling to hawkers. This indicates that some farmers will find marketing more important than cost minimisation and *vice versa*. In this case it is small vegetable farmers who consider cost minimisation to be a more important risk management response, while large vegetable farmers consider marketing (use of market information and selling direct to hawkers) to be more important. This is indicated by the overall negative factor score for small farmers and the overall positive factor score for large farmers. The sixth factor is named "labour intensification" as increasing the labour force has its highest loading in this factor.

The factor scores presented in Table 9 for large and small vegetable farmers indicate which factors are relatively important to each group. Factor 1 emphasises the importance of timeliness and insurance to large vegetable farmers as indicated by the positive factor score. Similarly, Factors 2, 3 and 4 highlight the importance large farmers place on the free market, increasing farm operations and reducing financial risk as management responses to risk. Factor 5, the contrast factor, illustrates that small farmers are more concerned with cost minimisation, while large farmers concentrate on marke-

ting responses to risk. Factor 6 indicates the importance of increasing use of labour to small farmers. This supports the higher rankings given to increasing the labour force by small farmers relative to large farmers. It appears that small farmers have adopted labour-intensive technology compared to a relatively capital-intensive technology adopted by large farmers.

As with the risk sources, these results support the suggestion of Patrick *et al* (1993) that farmers view managerial responses to risk in different dimensions but not as many as the individual questions. These results also highlight the importance placed on management responses by small and large farmers.

## 6. Conclusions

As reported in other studies, most vegetable farmers in this survey defined risk as the probability of negative outcomes, with only a few perceiving it as an opportunity to make a profit. The farmer's age, experience and level of education appear to be negatively related to his willingness to take risks. This differs from Woodburn's (1993) results who found that farmer's age and level of education were negatively and positively related to his willingness to take risks respectively. Farmers with lower debt-asset ratios seemed more willing to take risks, probably because they had higher financial and/or credit reserves which increase their risk-bearing capacity. Most respondents considered themselves more willing to take risks relative to other farmers.

The overall results show that the respondents view price, climate and yield variability as the most important sources of risk in vegetable production. Although changes in government policies with respect to labour, land and taxation were ranked fifth, ninth and eleventh respectively, their relatively high ratings (3,82, 3,61 and 3,32 respectively) indicate that they add to the level of uncertainty faced by vegetable farmers. This supports the results reported by Woodburn (1993) and Swanepoel and Ortmann (1993). The five most important managerial responses to risk in terms of mean ratings include irrigation, use of the free market, keeping financial records, having timely access to machinery and debt management.

Small and large vegetable farmers differed in their perceptions of risk. Large farmers rated changing interest rates highly relative to small farmers, while small farmers were more concerned with changing input costs and changes in credit availability. Both categories of farmers gave similar rankings to production and marketing responses.



Table 8: Relative importance attached to production, marketing and financial responses to risk by commercial vegetable farmers in KwaZulu-Natal.

Risk management responses <sup>1</sup>	Overall (n=28)			Large farmers (n=18)			Small farmers (n=10)		
	Mean ratings <sup>2</sup>	Percent 4 & 5's	Rankings	Mean ratings <sup>2</sup>	Percent 4 & 5's	Rankings	Mean ratings <sup>2</sup>	Percent 4 & 5's	Rankings
<b>Production responses</b>									
Irrigation	4,64	96,4	1	4,83	100,0	1	4,30	90,0	1
Timely access to machinery	3,75	71,4	2	4,06	77,8	2	3,20	60,0	3
Low cost producer	3,54	53,6	3	3,50	50,0	3	3,60	60,0	2
Diversification	3,11	46,4	4	3,22	44,4	4	2,90	50,0	4
Increasing capital	2,89	42,9	5	3,06	44,4	5	2,60	40,0	5
Increasing farm size	2,57	42,9	6	2,83	50,0	6	2,10	30,0	7
Decreasing labour	2,36	28,6	7	2,83	33,3	7	1,50	30,0	8
Increasing labour	2,32	28,6	8	2,28	22,2	8	2,40	40,0	6
Back up management	2,00	17,9	9	2,28	22,2	8	1,50	10,0	9
Geographic dispersion	1,86	17,9	10	2,22	22,2	11	1,20	10,0	10
Decreasing capital	1,86	35,7	11	2,28	16,7	10	1,15	10,0	11
Decreasing farm size	1,57	10,7	12	2,00	16,7	12	0,80	0	12
<b>Marketing responses</b>									
Use of the free market	4,50	92,9	1	4,56	94,4	1	4,40	90,0	1
Marketing information	3,54	79,2	2	3,78	72,2	2	3,10	60,0	3
Selling to hawkers	3,46	57,7	3	3,56	61,1	3	3,30	40,0	2
Own marketing group	2,46	57,9	4	2,67	44,4	4	2,10	30,0	4
Forward contracts	1,79	41,2	5	2,44	38,9	5	0,60	0	5
Co-operatives	1,25	11,8	6	1,44	11,1	6	0,90	0	6
<b>Financial responses</b>									
Keeping financial records	4,25	82,1	1	4,61	94,4	1	3,60	60,0	1
Debt management	3,61	64,3	2	4,28	83,3	2	2,40	30,0	3
Asset insurance	3,36	53,6	3	3,83	66,7	3	2,50	30,0	2
Maintaining financial/credit reserves	3,11	53,6	4	3,67	66,7	4	2,10	30,0	4
Liability insurance	2,32	25,0	5	3,00	66,7	5	1,10	10,0	9
Life insurance	2,18	39,3	6	2,44	44,4	6	1,70	30,0	5
Crop and hail insurance	2,07	21,4	7	2,33	27,8	7	1,60	10,0	6
Off-farm investments	1,75	25,0	8	1,94	33,3	8	1,40	10,0	8
Off-farm employment	1,29	10,7	9	1,22	5,6	9	1,40	20,0	7

1 The sources of risk are listed in order of their importance in the overall ratings.  
 2 Where 1 = not important and 5 = very important.

Table 9: Factor analysis of risk responses of commercial vegetable farmers in KwaZulu-Natal.

Principal components		1	2	3	4	5	6
Eigenvalues		4,224	2,337	1,886	1,527	1,359	1,011
Percentage variance explained		26,40	14,60	11,78	9,55	8,49	6,32
Risk management responses	Communalities	Factors					
		Timeliness and insurance	Free market	Increasing operations	Reducing financial risk	Low costs vs Marketing	Labour Intensification
Having timely access to machinery	0,6799	<b>0,8161</b>	-0,0742	0,0435	-0,0517	0,0326	-0,0530
Irrigation	0,8747	<b>0,7999</b>	0,0018	0,0796	0,1430	0,3529	0,2890
Asset insurance	0,7081	<b>0,7119</b>	0,0974	-0,1342	0,4018	-0,1110	0,0080
Debt management	0,8869	<b>0,5496</b>	0,1269	-0,1992	<b>0,6616</b>	0,2155	-0,2117
Use of the free market	0,7938	-0,1104	<b>0,8488</b>	-0,2054	0,0064	-0,0110	0,1367
Maintaining financial/credit reserves	0,8196	0,3630	<b>0,6939</b>	0,1215	0,0710	0,3548	-0,2463
Increasing capital item use	0,7772	-0,3072	0,0163	<b>0,8030</b>	-0,0001	0,1846	0,0600
Increasing farm size	0,8572	0,2581	-0,2369	<b>0,7965</b>	0,1611	-0,1472	0,2289
Keeping financial records	0,8318	-0,0970	0,2822	0,0828	<b>0,7597</b>	-0,2713	-0,2916
Decreasing the labour force	0,6192	0,0807	-0,1084	0,0994	<b>0,7021</b>	0,0318	0,3115
Liability insurance	0,6256	0,2255	-0,0535	0,3286	<b>0,6017</b>	0,3188	-0,0179
Diversification	0,7537	-0,2095	-0,3872	-0,1792	<b>0,5386</b>	0,4643	-0,1487
Use of market information	0,8370	0,0995	-0,0794	-0,1252	0,2460	<b>0,8572</b>	0,0990
Selling direct to hawkers	0,7175	0,3240	0,1911	0,4480	0,0852	<b>0,6025</b>	-0,0710
Being a low cost producer	0,6870	0,0780	-0,2130	-0,1618	0,2132	<b>-0,7334</b>	-0,1614
Increasing the labour force	0,8749	0,0458	0,0500	0,1635	-0,0322	0,1340	<b>0,9081</b>
<b>Factor scores:</b>							
Large farmers		0,2067	0,2029	0,1372	0,4031	0,0095	-0,0553
Small farmers		-0,3721	-0,3653	-0,2469	-0,7256	-0,0172	0,0996

It is surprising that small farmers did not rate financial responses as highly as large farmers. This could be due to small farmers using less capital-intensive production methods, having simpler financial arrangements and conducting more of their transactions on a cash basis. Large farmers gave relatively high ratings to a wider range of financial responses which could be due to them having more complex financial arrangements.

It is important to note that these findings are a reflection of the respondents' perceptions at the time of the survey, based on the information available to them. New information and changes in management objectives may change their risk perceptions.

As with the findings of Patrick *et al* (1993) and Woodburn (1993), factor analysis of risk sources and managerial responses to risk suggest there are more dimensions to risk than are commonly included in economic analyses. Factor analysis of risk sources also supported the emphasis small farmers placed on input costs and credit availability while large farmers appear to place more emphasis on changes in government policy, crop gross income and labour as risk sources. Timeliness, insurance, use of the free market and increasing farm operations were considered important managerial responses to risk by large farmers, while small farmers placed emphasis on cost minimisation and employing more labour as management responses to risk.

This study has assisted in establishing the main sources of risk both large and small vegetable farmers perceive to be important. These findings can be used to assist in the design of educational aids and computer software packages that will improve farmers' risk management strategies (Anderson and Ikerd, 1985; Rhodus and Precheur, 1988; Eidman, 1990). The results also suggest that extension services and private consultants should concentrate on improving and upgrading record-keeping systems as vegetable farmers consider them to be important risk management tools. They should also be aware of the different problems large and small vegetable farmers face so that appropriate assistance can be supplied. As government policies contribute to the level of risk faced by vegetable producers, policy-makers should provide clarity regarding their future policies particularly with respect to land and labour issues.

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