
INDEX

TITLE PAGE.....	i
ACKNOWLEDGEMENTS.....	ii
EXECUTIVE SUMMARY.....	iv
INDEX.....	ix
LIST OF TABLES.....	xv
LIST OF FIGURES.....	xxii

CHAPTER 1

INTRODUCTION **1**

1.1	IRRIGATION IN THE ONDERBERG AND NKOMAZI AREAS	1
1.2	MOTIVATION FOR THE STUDY	3
1.3	OBJECTIVES OF THE PROJECT	3
1.4	COMPOSITION OF THE REPORT	3

CHAPTER 2

MATERIAL AND METHODS **5**

2.1	OVERVIEW OF IRRIGATION IN THE ONDERBERG AND NKOMAZI AREAS	5
2.2	DESCRIPTION OF THE MADADENI, MBONGOZI AND WALDA IRRIGATION SCHEMES	7
2.2.1	MADADENI DRAGLINE SYSTEM	8
2.2.2	MBONGOZI CENTRE PIVOT SYSTEM	9
2.2.3	WALDA FLOPPY SYSTEM	9
2.3	IRRIGATION SITUATION OF FIVE INDEPENDENT CASE STUDY FARMERS	10
2.3.1	IRRIGATION MANAGEMENT	10
2.3.2	CROP PROFIT POTENTIAL	10
2.3.3	GENERAL MANAGEMENT	11
2.3.4	LABOUR MANAGEMENT	12

2.3.5	FARMER SUCCESS POTENTIAL	12
2.3.6	FINANCIAL ASPECTS	13
2.3.7	LAND TENURE	14
2.3.8	MARKETING	15
2.4	RESEARCH METHODS	15

CHAPTER 3

DEVELOPMENT OF COST ESTIMATING PROCEDURES FOR MICRO, DRIP AND FURROW IRRIGATION 17

3.1	INTRODUCTION	17
3.2	METHODS	17
3.2.1	COST ESTIMATING PROCEDURE	18
3.2.2	DESIGN OF TYPICAL IRRIGATION SYSTEMS	19
3.3	RESULTS	22
3.3.1	COST ESTIMATING WORKSHEETS FOR DRIP-IRRIGATION.....	23
3.3.2	COST ESTIMATING WORKSHEETS FOR MICRO-IRRIGATION.....	30
3.3.3	COST ESTIMATING PROCEDURES FOR FURROW-IRRIGATION	37
3.3.4	COST ESTIMATING WORKSHEETS FOR MAIN LINE PIPE SYSTEM.....	44
3.3.5	ESTIMATING THE ANNUAL COSTS OF A DRIP-, MICRO- AND FURROW-IRRIGATION SYSTEM IN THE ONDERBERG AREA	67
3.4	CONCLUSION	69

CHAPTER 4

A CASE STUDY ANALYSIS OF FIVE INDEPENDENT SMALL-SCALE COMMERCIAL IRRIGATION FARMERS IN NKOMAZI DISTRICT 71

4.1	INTRODUCTION	71
4.2	THE CASE STUDY RESEARCH METHOD	71
4.2.1	INTRODUCTION	71
4.2.2	CASE STUDY METHOD DEFINED	71
4.2.3	CHARACTERISTICS OF THE CASE STUDY METHOD	72
4.2.4	COMPONENTS OF CASE STUDY METHOD	73
4.2.4.1	<i>Data Collection</i>	73
4.2.4.2	<i>Data Analysis</i>	73
4.2.4.3	<i>The Case Study Report</i>	74
4.2.5	WHEN TO USE CASE STUDY DESIGN	74
4.2.6	STRENGTHS AND LIMITATIONS OF CASE STUDY DESIGN	75

4.2.7	CRITICISMS OF THE CASE STUDY METHOD	76
4.3	THE CASE STUDY METHOD	77
4.3.1	SAMPLE SELECTION AND SIZE	77
4.3.2	METHODS OF DATA COLLECTION	77
4.3.3	METHODS OF DATA ANALYSES AND PRESENTATION.....	78
4.3.3.1	<i>The FARMS model</i>	78
4.3.3.2	<i>RISKMAN</i>	79
4.3.3.3	<i>Descriptive Method</i>	80
4.3.3.4	<i>Comparative Analysis</i>	80
4.4	DESCRIPTION OF THE CASE STUDY FARM BUSINESS	80
4.4.1	INTRODUCTION	80
4.4.2	GENERAL MANAGEMENT	80
4.4.3	LAND TENURE	81
4.4.4	IRRIGATION MANAGEMENT	81
4.4.5	LABOUR MANAGEMENT	82
4.4.6	CROP ENTERPRISE ANALYSES	83
4.5	CONCLUSION	87
4.6	FINANCIAL AND RISK ANALYSES OF THE CASE STUDY FARM BUSINESS	88
4.6.1	FINANCIAL ANALYSIS	88
4.6.1.1	<i>The Balance Sheet</i>	88
4.6.1.2	<i>The Income Statement</i>	89
4.6.1.3	<i>The Cash-Flow Statement</i>	90
4.6.1.4	<i>Marketing</i>	92
4.6.2	RISK ANALYSIS	92
4.6.2.1	<i>The effect of production and price risk on net cash flow</i>	92
4.6.2.2	<i>The effect of borrowed capital on net cash flow</i>	93
4.7	CONCLUSION	94
4.7.1	INTRODUCTION	94
4.7.2	DESCRIPTION OF CASE STUDY FARMERS AND FARM BUSINESSES	95
4.7.3	CROP ENTERPRISE ANALYSIS	96
4.7.4	FINANCIAL AND RISK ANALYSIS	96
4.7.5	MARKETING STRATEGIES	98
4.7.6	GENERAL CONCLUSIONS	98
4.7.7	LIMITATIONS, POLICY IMPLICATIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH.....	99

CHAPTER 5

ECONOMIC AND FINANCIAL EVALUATION OF SMALL-SCALE FARMER IRRIGATION PROJECTS 101

5.1	INTRODUCTION _____	101
5.2	METHODOLOGY _____	101
5.2.1	DETERMINISTIC MODEL	101
5.2.1.1	<i>Inputs</i>	101
5.2.1.2	<i>Profitability module</i>	104
5.2.1.3	<i>Feasibility module</i>	105
5.2.1.4	<i>Living expenses</i>	106
5.2.2	INCORPORATING YIELD RISK	106
5.2.2.1	<i>Quantifying yield risk</i>	107
5.2.2.2	<i>Monte Carlo Simulation</i>	108
5.2.3	MODEL OUTPUT	109
5.3	RESULTS AND DISCUSSION OF RESULTS _____	109
5.3.1	PROFITABILITY	109
5.3.2	FINANCIAL FEASIBILITY OF IRRIGATION SYSTEMS	111
5.3.2.1	<i>Financial feasibility of dragline systems (Madadeni)</i>	111
5.3.2.2	<i>Incorporating living expenses (Madadeni)</i>	115
5.3.2.3	<i>Financial feasibility of centre pivots (Mbongozi)</i>	116
5.3.2.4	<i>Incorporating living expenses (Mbongozi)</i>	118
5.3.2.5	<i>Financial feasibility of floppies (Walda)</i>	119
5.3.2.6	<i>Incorporating living expenses (Walda)</i>	122
5.4	CONCLUSIONS _____	123

CHAPTER 6

WHOLE FARM ECONOMIC AND FINANCIAL ANALYSES OF LARGE-SCALE IRRIGATION FARMING IN THE ONDERBERG REGION TAKING RISK INTO CONSIDERATION 125

6.1	INTRODUCTION _____	125
6.2	METHODOLOGY _____	125
6.2.1	TYPICAL CASE STUDY FARMS	125
6.2.2	DESIGN OF TYPICAL IRRIGATION SYSTEMS	129
6.2.3	IRRIGATION SYSTEM COST ESTIMATION	129
6.2.4	CROP ENTERPRISE COSTS	129
6.2.5	FARM MECHANISATION SYSTEMS	130

6.2.6	ECONOMIC AND FINANCIAL ANALYSIS	130
6.2.7	YIELD AND PRICE DISTRIBUTIONS	130
6.2.8	RISK ANALYSIS	131
6.2.9	SPREADSHEETS	132
6.3	RESULTS	132
6.3.1	ECONOMIC PROFITABILITY	132
6.3.2	FINANCIAL FEASIBILITY	138
6.4	CONCLUSION	153

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS 154

7.1	COST ESTIMATING PROCEDURES FOR MICRO-, DRIP- AND FURROW-IRRIGATION, AS WELL AS A COMBINATION OF IRRIGATION SYSTEMS_	154
7.2	ECONOMIC EVALUATION OF INDEPENDENT SMALL-SCALE COMMERCIAL FARMING IN NKOMAZI AREA	154
7.3	ECONOMIC AND FINANCIAL EVALUATION OF SMALL-SCALE FARMER IRRIGATION PROJECTS	156
7.4	WHOLE FARM ECONOMIC AND FINANCIAL ANALYSES OF LARGE-SCALE IRRIGATION FARMING IN THE ONDERBERG REGION TAKING RISK INTO CONSIDERATION	156
7.5	RECOMMENDATIONS	157
7.5.1	ADVISORS AND FARMERS	157
7.5.2	POLICY-MAKERS	158

REFERENCES 160

APPENDIX 1.A:	LIST OF ABBREVIATIONS	164
APPENDIX 3.A:	COST ESTIMATING PROCEDURES FOR CENTRE PIVOT-IRRIGATION SYSTEMS	165
APPENDIX 3.B:	COST ESTIMATING PROCEDURES FOR DRAGLINE-IRRIGATION SYSTEMS	173
APPENDIX 4.A:	QUESTIONNAIRE CHECKLIST BASED ON THE SAPFACT FRAMEWORK	181

APPENDIX 4.B: DESCRIPTION OF THE OTHER FOUR CASE STUDY FARM BUSINESSES	186
APPENDIX 4.C: BALANCE SHEET, INCOME STATEMENT AND CASH FLOW STATEMENT FOR THE OTHER FOUR CASE STUDY FARM BUSINESSES	214
APPENDIX 4.D: RISK ANALYSIS FOR THE OTHER FOUR CASE STUDY FARM BUSINESSES	231
APPENDIX 5.A: ENTERPRISE BUDGETS FOR SUGARCANE UNDER DRAGLINE-, CENTRE PIVOT-, AND FLOPPY-IRRIGATION	245
APPENDIX 5.B: FINANCIAL FEASIBILITY AND LIVING EXPENSES FOR DRAGLINE-IRRIGATION SYSTEMS (MADADENI)	252
APPENDIX 5.C: FINANCIAL FEASIBILITY AND LIVING EXPENSES FOR CENTRE PIVOT-IRRIGATION SYSTEMS (MBONGOZI)	265
APPENDIX 5.D: FINANCIAL FEASIBILITY AND LIVING EXPENSES FOR FLOPPY-IRRIGATION SYSTEMS (WALDA)	278
APPENDIX 6.A: PROBABILITY OF FAILING TO MEET INSTALMENTS ON ONDERBERG CASE STUDY FARMS FOR TWO DIFFERENT INTEREST RATE LEVELS: 16,5% AND 13,5% (INTERMEDIATE LOANS) AND 13,5% AND 10,5% (LONG TERM LOANS)	291