

An insight into the livelihood of small-scale pig farmers in the Western Cape, South Africa

by

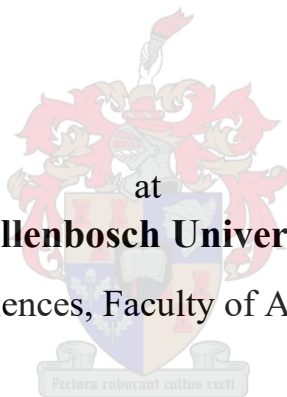
Melissa Cupido

This thesis is presented in fulfilment of the requirements for the degree of
Master of Science in Animal Sciences

at

Stellenbosch University

Animal Sciences, Faculty of AgriSciences



The financial assistance of the National Research Foundation (NRF) towards this research is hereby acknowledged. Opinions expressed and conclusions arrived at are those of the author and are not necessarily to be attributed to the NRF.

Supervisor: Prof LC Hoffman

Co-supervisor: Dr AH Molotsi

March 2020

DECLARATION

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

Date: March 2020

Copyright © 2020 Stellenbosch University

All rights reserved

ABSTRACT

The aim of this study was to gain insight into the livelihood and production characteristics of small-scale pig farmers in the Western Cape, South Africa. The objectives were to firstly compare the demographic nature of farmers across three study areas; Khayelitsha, Mamre and Malmesbury. Secondly to compare the characteristics and management practices of farmers across the three study areas. Thirdly to uncover which factors significantly impact on the production of small-scale pig farmers. The first and second objectives were obtained by means of face-to-face interviews with farmers through the use of a structured questionnaire. A focus group was organized to supplement information gathered through the questionnaire. Seventy-five farmers were interviewed of which 27 were from Khayelitsha, 26 from Mamre and 22 from Malmesbury. The third objective was obtained by means of a focus group where farmers listed, discussed and voted on factors which they believed significantly impacted their production. In order of importance these factors were; clean water, medication, proper feed, good hygiene, proper housing, knowledge, labourers (time spent with pigs), recordkeeping, research, land ownership and warmth. Data was captured by use of MS Excel and analyzed with STATISTICA version 13. When a continuous response variable was to be related to many other continuous input variables, multiple regression analysis was used. Analysis of variance (ANOVA) was used to analyze the relationships between continuous response variables and nominal input variables. The Kruskal-Wallis test was used for completely randomized designs and for repeated measures designs, the Wilcoxon- or Friedman tests was used to test for statistical differences.

Farmers were predominantly male (82.7%) and were over 40 years old (78.1%). The three main languages spoken across the three study areas were Afrikaans, English and isiXhosa. Education was relatively low with 5.6% of farmers stating that they had no formal education, 38.0% having only primary education, 52.1% having secondary education, and 4.2% stating that they had some sort of tertiary education. Farmers showed ambition for their pig farming practices as 87.8% stated that they want to expand and 42.7% stated that they farmed with pigs because they enjoyed it. Those who had been farming for over three decades sold the most pigs and most of the top producers had been farming for over a decade. Ninety-five percent of farmers stated that income was one of the reasons they farmed with pigs and 29.7% mentioned that pig farming was their main source of income; indicating that pig farming contributes financially to the livelihood of these

farmers. Farmers owned a collective average of (37.4 ± 50.5), which is more than had been reported in other countries and other South African provinces.

Farmers invested more money into the quality of feed given to their younger pigs. None of the top producing farmers (those who sold over 50 pigs per year) fed only by-products and waste to their suckling piglets or weaners. Overall, 66.7% and 61.6% of farmers fed commercial feed to their suckling piglets and weaners respectively. After the weaner production stage, the number of farmers who fed commercial feed declined as farmers increased the amount of by-products and waste in their pigs' diets. Top producing farmers who sold to the informal market could adjust their feeding strategy in this manner to produce fatter slaughter pigs, which was a more desirable carcass for this market. This allowed farmers to also save on money. It is, however, dangerous as none of the farmers cooked the waste before presenting it to their pigs.

The majority of the breeding sows and boars were obtained from the same area, increasing the risk of inbreeding. Poor record keeping was also observed as about half of farmers (51.4%) kept records of their pigs. Nearly a third of farmers (27.5%) did not mark their pigs for identification; this is not only illegal but also would make it near impossible to identify the source of a disease breakout should one occur.

Those who invested in the biosecurity and health of their pigs sold more pigs on average per year. Those who disinfected their pens (52.02 ± 138.91) and cleaned outside their pens (46.54 ± 123.47) sold more than those who did not disinfect (20.65 ± 32.79) or clean (8.70 ± 8.29).

Thirty-seven percent of farmers had never gone for training and results from this study indicated that there is an urgent need for workshops to be held for farmers. It is therefore recommended that regular and consistent training on the aspects of pig rearing. More information is also required on the small-scale farming sector in the Western Cape, particularly with regards to marketing and feeding. By generating more information on the small-scale pig farming sector, greater insight is established and thus there is better understanding on the challenges faced in this sector and how to combat them. Improved training programs for small-scale pig farmers can be developed. With improved planning, the direct needs of the farmers can be met, this could improve on their management aspects and thus safer, more sustainable meat can be produced for those living in informal settlements.

ACKNOWLEDGEMENTS

I'd like to acknowledge and praise the Lord, Father God, Who has revealed Himself faithful and good countless times on this journey.

My parents, brother and friends who have dealt with me, made me laugh and loved me endlessly through good days and bad alike, especially Soks whose support was simply unreal.

Thank you to every single farmer interviewed for this study who were so welcoming and kind throughout, as well as everyone who sacrificed their time to help with interviews.

A special thanks to Dr Jim Robinson who shared so much wisdom. Prof Nel who assisted with the statistical analysis and was always a friendly face. Mrs Adele Smith-Carstens who has gone above and beyond to roll so many stones out of my way and always treating me with so much kindness.

To my supervisors, Dr Molotsi and Prof Hoffman, for their guidance and patience from start to finish. Thank you so very much.

Table of Contents

DECLARATION	i
ABSTRACT.....	ii
ACKNOWLEDGEMENTS.....	iv
Table of Contents	v
Chapter 1	1
1.1 Background.....	1
1.2 Problem statement.....	2
1.3 Justification.....	3
1.4 Objectives	3
1.5 Components of the dissertation.....	4
1.6 References.....	4
Chapter 2.....	8
2.1 Background.....	8
2.2 Demographics	8
2.3 Benefits of pig farming.....	10
2.4 Governmental support and training	12
2.5 Record keeping	13
2.6 Housing.....	14
2.7 Biosecurity and health management	16
2.8 Marketing.....	17
2.9 Breeding.....	18
2.10 Nutrition.....	20
2.11 Conclusion	21
2.12 References.....	22
Chapter 3.....	27
3.1 Abstract.....	27
3.2 Introduction.....	27
3.3 Methods and materials	29
3.3.1 Description of the study site	29
3.3.2 Surveys.....	30
3.3.3 Focus groups	31

3.3.4 Statistical analysis	31
3.4 Results and discussion	32
3.4.1 Race, gender, labourers and age	32
3.4.2 Languages and education	35
3.4.3 Financial impact of pig farming.....	37
3.4.4 Experience and future plans	39
3.4.5 Generational exposure to pig farming.....	41
3.4.6 Support and training.....	41
3.5 Conclusion	42
3.6 References.....	43
Chapter 4.....	47
4.1 Abstract	47
4.2 Introduction.....	47
4.3 Methods and Materials.....	49
4.4 Results and Discussion	51
4.4.1 Farm characteristics	51
<i>Livestock owned by small-scale pig farmers</i>	51
<i>Pigs owned, sold and consumed</i>	53
<i>Traceability and record keeping</i>	53
4.4.2 Housing and materials used	55
<i>Housing</i>	55
<i>Building materials used for housing</i>	58
<i>Flooring</i>	60
<i>Bedding</i>	61
4.4.3 Health and biosecurity	61
<i>Post-farrowing management practices</i>	61
<i>Biosecurity</i>	63
<i>Water troughs</i>	64
<i>Manure removal</i>	65
<i>Health of pigs</i>	66
<i>Handling of sick pigs</i>	66
4.4.4 Losses.....	67

4.4.5 Mortalities	69
<i>Piglet mortalities</i>	70
<i>Weaner mortalities</i>	72
<i>Post-weaning mortalities</i>	72
<i>Breeding stock mortalities</i>	73
4.4.6 Marketing	74
4.4.7 Reproduction management	78
<i>Breeds used</i>	78
<i>Obtainment of breeding stock</i>	80
<i>Gilts first service</i>	81
<i>Observed farrowings</i>	83
<i>Farrowing per year</i>	84
<i>Weaning</i>	85
<i>How soon after weaning sows are re-mated?</i>	87
<i>Litter sizes</i>	88
4.4.8 Nutrition	89
<i>Type of feed</i>	89
<i>Piglet feed</i>	91
<i>Weaner feed</i>	92
<i>Post weaning and breeding boar feed</i>	93
<i>Breeding sow feed</i>	94
4.5 Conclusion	95
4.6 References	97
Chapter 5	101
5.1 Abstract	101
5.2 Introduction	101
5.3 Methods and materials	103
5.3.1 Focus group	103
5.3.2 Statistical analysis	104
5.4 Results & discussion	106
5.4.1. Water, research, land and warmth	106
<i>Clean water</i>	106

<i>Research</i>	106
<i>Land</i>	107
<i>Warmth</i>	107
5.4.2. An overview of the number of pigs sold by small-scale pig farmers in the Western Cape	108
5.4.3 Medicine	111
5.4.4 Hygiene	113
5.4.5 Feed.....	114
5.4.6 Housing	119
5.4.7 Knowledge	120
5.4.8 Labourer	123
5.4.9 Record keeping	124
5.5 Conclusion	125
5.6 References.....	126
Chapter 6.....	130
Addendum A.....	136

Chapter 1

General introduction

1.1 Background

There is little certainty about household food security status in South Africa (Altman *et al.*, 2009). A lack of food security in South Africa is connected to high levels of poverty, particularly in rural areas (Abdu-Raheem & Worth, 2011). Agriculture is considered to be a major tool that could be used to escape poverty and food insecurity in rural households (Abdu-Raheem & Worth, 2011; Pienaar & Traub, 2015; Thamaga-Chitja & Morojele, 2017). Within agriculture, smallholder pig farming plays a significant role in South Africa as a source of revenue and a potential to reduce food insecurity (Munzhelele, 2015). Farming with pigs could provide a means to gain increased food security in the rural areas of the Western Cape.

There are many advantages to farming with pigs in rural areas. Farming with pigs has proven to have a similar impact on the livelihoods of people living in the rural areas of Western Kenya (Mutua *et al.*, 2010), Tanzania (Kimbi *et al.*, 2016) and Madagascar (Costard *et al.*, 2009). Meissner *et al.* (2013) stated that livestock forms an integral and indispensable part of social life of poor communities in South Africa and provides these communities with sustenance. Pig farming in particular has been shown to play an important role in improving the livelihoods of emerging small scale pig farmers in Limpopo (Mokoele, 2015) and Kwazulu-Natal (KZN) (Gcumisa, 2013). Previous studies found that small-scale farmers can benefit from farming with pigs be it for generating extra income or, for providing protein in the form of meat for household consumption (Kagira, Kanyari, Maingi and Githigia, 2010; Mutua *et al.*, 2010; Duniya *et al.*, 2013; Gcumisa, 2013). Small-scale farmers in Western Kenya mentioned that they kept pigs because they have a faster growth rate than ruminants and breed easily, able to farrow twice a year and produce multiple piglets each time (Mutua *et al.*, 2010). Pigs require less space to be reared on than ruminants, especially when reared intensively (Mutua *et al.*, 2010; Gcumisa, 2013), making them easier to rear in communal farming areas. Although this system has its own challenges such as providing quality feed, health control, and proper housing to the pigs. Other benefits of keeping pigs include the production of manure for fertilizer (Meissner *et al.*, 2013) and some farmers in Western Kenya and KZN claimed that pigs and/or the fat they produce could be used to ward off evil spirits (Mutua *et al.*, 2010; Gcumisa, 2013).

Pig farmers in the rural sector, however, also face many challenges, which include disease outbreaks. Duniya *et al.* (2013) stated that the greatest constraints faced by emerging small-scale pig farmers in Nigeria are high cost of piglets, high cost of feeds, outbreak of diseases and high piglet mortality rates. These findings are supported by a study in Western Kenya which noted that 81% of emerging small-scale pig farmers lost production due to diseases and high cost or lack of feed (Kagira, Kanyari, Maingi and Githigia, 2010). In South Africa, there was Classical Swine Fever (CSF) and Porcine Reproductive and Respiratory Disease (PRRS) between 2004 and 2008 that cost the country dear to eradicate (Visser, 2014). Amongst small-scale pig farmers in KwaZulu-Natal, vaccination and biosecurity measures did not exist and treatments of sick pigs were minimal (Gcumisa, 2013). Other challenges such as external parasites, poor housing, poor veterinary services, ineffective drugs and a general lack of knowledge on piggery management were brought up by Dione *et al.* (2014). Nutrition is a great concern for the rearing of pigs in the rural communal sector. Some farmers cannot afford to feed commercial feeds (Dione *et al.*, 2014) which leads to many farmers across developing countries to make use of swill feeding (McOrist *et al.*, 2011; Montsho & Moreki, 2012; Nath *et al.*, 2013; Phengsavanh, 2013; Gcumisa, 2013; Komba *et al.*, 2013; Dione *et al.*, 2014; Kambashi *et al.*, 2014; Munzhelele, 2015; Matabane *et al.*, 2015; Mokoetele, 2015; Ibitoye *et al.*, 2016; Strom *et al.*, 2017). Other challenges include lack of sufficient space to keep pigs (Mutua *et al.*, 2010), poor record keeping (Mutua *et al.*, 2010; Gcumisa, 2013; Madzimure *et al.*, 2013; Matabane *et al.*, 2015; Mokoetele, 2015; Munzhelele, 2015; Ibitoye *et al.*, 2016), difficulty with marketing (Mutua *et al.*, 2010; Matabane *et al.*, 2015; Kimbi *et al.*, 2016), and high inbreeding levels (Mutua *et al.*, 2010; Montsho & Moreki, 2012).

1.2 Problem statement

Little documented information exists on the farming characteristics of small-scale pig farmers in the Western Cape. Without information on these farmers and the way they manage their piggeries, it is not possible to identify problems and challenges faced by farmers or formulate solutions to these challenges. This study sought to describe the characteristics of small-scale pig farmer systems in the Western Cape, their pig rearing practices, and factors that made it possible for farmers to become successful in the environment they reared their pigs.

1.3 Justification

The small-scale pig farming sector has the potential to reduce poverty; however, unless data is gathered on the challenges and benefits faced by emerging small-scale farmers, this potential cannot be realized (Mutua *et al.*, 2010). There is a need to characterize the small-scale pig production sector of the Western Cape to aid in the development of programmes to improve this sector. It has been noted through observation that farmers supported by government have better infrastructure, facilities, and better or improved breeding stock (Mokoele, 2015). Some studies have recommended the formation of farmer groups to increase profitability amongst small-scale pig farmers (Mutua *et al.*, 2010; Mokoele, 2015). Mentoring farmers on feeding, housing and controlled breeding (Gcumisa, 2013) and financial management as well as pig production expertise (Roelofse, 2013) have also been suggested to improve on the success of pig farming in rural areas within the South African context.

Therefore, the aim of this study is to gather insight on the demographics and farming characteristics of small-scale pig farmers in the Western Cape, uncover challenges faced by farmers and discover factors which positively impact the production of small-scale pig farming. By doing this study, information on the current status of small-scale pig farmers in South Africa is gathered and will be made available to farmers, governmental officials, researchers and those who could require this information. The data could be used to improve the planning of training programs which will provide the small-scale pig farmers with the necessary insight on how to better manage and grow their farms. Future research can be built on the information gathered for the further development and benefit of these farmers.

1.4 Objectives

The specific objectives of the study were to:

1. Compare the demographic nature of small-scale pig farmers across the three study areas; Mamre, Malmesbury and Khayelitsha.
2. Compare the characteristics and management practices of small-scale pig farmers across the three study areas; Mamre, Malmesbury and Khayelitsha.
3. Determine factors that play a significant role on the production outputs of small-scale pig farmers in the Western Cape, South Africa.

1.5 Components of the dissertation

This study consists of six chapters:

Chapter 1 contains the general introduction which provides a background and motivation for this study.

Chapter 2 contains the literature review and discusses components of small-scale pig farmers previously researched.

Chapter 3 is a research chapter which compares the demographic nature of small-scale pig farmers across three areas of the Western Cape.

Chapter 4 is a research chapter which compares the farming characteristics and management practices of small-scale pig farmers across three study areas of the Western Cape.

Chapter 5 is a research chapter which investigates factors playing a significant role on the production outputs of small-scale pig farmers.

Chapter 6 concludes the thesis and reflects on the research done and presents comments and recommendations.

1.6 References

- Abdu-Raheem, K.A. & Worth, S.H. 2011. Household Food Security in South Africa: Evaluating Extension's Paradigms Relative To the Current Food Security and Development Goals. *Landbouvoorl./S. Afr. J. Agric. Ext.* 39, 91–103. Available at: <http://www.scielo.org.za/pdf/sajae/v39n2/08.pdf>.
- Altman, M., Hart, T., & Jacobs, P. 2009. Food Security in South Africa. *Hum. Sci. Res. Counc.* 1, 1–29. Available at: <http://www.tandfonline.com/doi/abs/10.1080/03031853.1992.9524684>.
- Costard, S., Porphyre, V., Messad, S., Rakotondrahanta, S., Vidon, H. 2009. Multivariate analysis of management and biosecurity practices in smallholder pig farms in Madagascar. *Prev. Vet. Med.* 92, 199–209. doi: 10.1016/j.prevetmed.2009.08.010.
- Dione, M.M., Ouma, E.A., Roesel, K., Kungu, J., Lule, P. & Pezo, D. 2014. Participatory assessment of animal health and husbandry practices in smallholder pig production systems in three high poverty districts in Uganda. *Prev. Vet. Med.* 117. 565–576. doi:

10.1016/j.prevetmed.2014.10.012.

- Duniya, K.P., Akpoko, J.G., Oyakhilomen, O. & Nandi, J.A. 2013. Measurement of Pig Production Profitability in Zangon Kataf and Jema'a Local Government Areas of Kaduna State, Nigeria. *Curr. J. Appl. Sci. Technol.* 3, 1455–1463. doi: <https://doi.org/10.9734/BJAST/2014/4137>
- Gcumisa, S.T. 2013. The untold story of the pig farming sector of rural Kwazulu-Natal: A case study of Uthukela District. MSc thesis. Available at: http://uir.unisa.ac.za/bitstream/handle/10500/14146/dissertation_gcumisa_st.pdf?sequence=1.
- Ibitoye, S.J., Shaibu, U.M., Sanda, M.E. & Oshadare, D. 2016. Economic Analysis of Local Swine Production Among Small Scale Farmers in Kabba/Bunu Local Government Area of Kogi State, Nigeria. *Gashua J. Irrig. Desertif. Stud.* 2, 1–11.
- Kagira, J.M., Kanyari, P.W.N., Maingi, N. & Githigia, S.M. 2010. Characteristics of the smallholder free-range pig production system in western Kenya. *Trop. Anim. Health Prod.* 42, 865–873. doi: 10.1007/s11250-009-9500-y.
- Kambashi, B., Picron, P., Boudry, C., Thewis, A., Kiatoko, H. & Bindelle, J. 2014. Smallholder pig production systems along a periurban-rural gradient in the Western provinces of the Democratic Republic of the Congo. *J. Agric. Rural Dev. Trop. Subtrop.* 115, 9–22.
- Kimbi, E.C., Mlangwa, J., Thamsborg, S. M., Mejer, H., Lekule, F.P. 2016. Smallholder Pig Marketing Systems in the Southern Highlands of Tanzania. *J. Nat. Sci. Res.* 6, 87–98.
- Komba, E.V.G., Kimbi, E.C., Ngowi, H.A., Kimera, S.I., Mlangwa, J.E., Lekule, F.P., Sikasunge, C.S., Willingham, A.L., Johansen, M.V., Thamsborg, S.M. 2013. Prevalence of porcine cysticercosis and associated risk factors in smallholder pig production systems in Mbeya region, southern highlands of Tanzania. *Vet. Parasitol.* 198, 284–291. doi: 10.1016/j.vetpar.2013.09.020.
- Madzimure, J., Chimonyo, M., Zander, K.K. & Dzama, K. 2012. Potential for using indigenous pigs in subsistence-oriented and market-oriented small-scale farming systems of Southern Africa. *Trop. Anim. Health Prod.* 45, 135–142. doi: 10.1007/s11250-012-0184-3.
- Matabane, M.B., Nethenzheni, P., Thomas, R., Netshirovha, T.R., Norris, D., Nephawe, K.A. &

- Nedambale, T.L. 2015. Status of the smallholder pig farming sector in Gauteng Province of South Africa. *Appl. Anim. Husbandry Rural Develop.* 8, 19–25. Available at: www.sasas.co.za/aahrd/.
- McOrist, S., Khampee, K. & Guo, A. 2011. Modern pig farming in the Peoples’s Republic of China: growth and veterinary challenges. *Rev. Sci. Tech. l’OIE.* 30, 961–968. doi: 10.20506/rst.30.3.2091.
- Meissner, H.H., Scholtz, M.M. & Palmer, A.R. 2013. Sustainability of the South African livestock sector towards 2050 Part 1: Worth and impact of the sector. *S. Afr. J. Anim. Sci.* 43, 282–297. doi: 10.4314/sajas.v43i3.5.
- Mokoele, J.M. 2016. Reasons for poor production among the emerging small-scale pig farmers of the Limpopo province of the Republic of South Africa. MMed Vet., University of Pretoria.
- Montsho, T. & Moreki, J.C. 2012. Challenges in commercial pig production in Botswana. *J. Agric. Technol.* 8, 1161–1170.
- Munzhelele, P. 2015. Evaluation of the production systems and constraints of smallholder pig farming in three agro-ecological zones of Mpumalanga province, South Africa. MSc (Agric) thesis, University of South Africa.
- Mutua, F.K., Arimi, S., Oraga, W., Dewey, C., Schelling, E. 2010. Farmer Perceptions on Indigenous Pig Farming in Kakamega District, Western Kenya. *Nord. J. African Stud.* 23, 43-57. Available at: <http://www.lrrd.org/lrrd23/7/mutu23144.htm%5Cnhttp://hdl.handle.net/10568/5369>.
- Nath, B.G., Pathak., P.K., Ngachan, S.V., Tripathi, A.K., Mohanty, A.K. 2013. Characterization of smallholder pig production system : productive and reproductive performances of local and crossbred pigs in Sikkim Himalayan region. *Trop. Anim. Health Prod.* 45, 1513–1518. doi: 10.1007/s11250-013-0391-6.
- Phengsavanh, P. 2013. Forage Legumes as Feed for Pigs in Smallholder Production Systems in the North of Lao PDR Production Systems, Forage Biomass Yield and Protein. PhD diss, Swedish University of Agricultural Sciences.
- Pienaar, L. & Traub, L.N. 2015. Understanding the smallholder farmer in South Africa : Towards

a sustainable livelihoods classification. No. 1008-2016-79955.

- Roelofse, J.J. 2013. Economic feasibility study of the establishment of smallholder pig farmers for the commercial market: Empolweni case study. MSc (Engineering management) thesis, University of Stellenbosch, South Africa. Available at: <http://hdl.handle.net/10019.1/85703>.
- Strom G, Djurfeldt, A. A., Boqvist S., Albiñ A, Sokerya S, San S, Davun H, Magnusson, U. 2017. Urban and peri-urban family-based pig- keeping in Cambodia: Characteristics, management and perceived benefits and constraints. PLoS ONE. 12, 1–13. Available at: <https://doi.org/10.1371/journal.pone.0182247>.
- Thamaga-Chitja, J.M. & Morojele, P. 2017. The Context of Smallholder Farming in South Africa: Towards a Livelihood Asset Building Framework. J. Hum. Ecol. 45, 147–155. doi: 10.1080/09709274.2014.11906688.
- Visser, D. 2014. Modern Pig Production. Available at: <https://books.google.co.za/books?id=mpXorQEACAAJ>.

Chapter 2

Literature Review

2.1 Background

The South African pig industry contributes less than 0.5% to the world's pig production (Visser, 2014) and only 2.05% to South Africa's primary agricultural sector (DAFF, 2015). Pork is produced throughout South Africa, in all nine provinces (Visser, 2014; DAFF, 2015). The highest pork producing province is Limpopo, followed by the North West (DAFF, 2015). The Western Cape is home to the third highest number of pork producers, making up 11% of the pork producers (DAFF, 2015) and has the third highest number of sows in South Africa (15.5%) (Visser, 2014). DAFF (2015) estimates that there are roughly 4000 commercial producers in South Africa, 19 stud breeders, and 100 small-scale pig farmers. They further estimate that South Africa owns 125 000 sows of which 100 000 are owned by commercial farmers and 25 000 are owned by small-scale producers. Visser (2014) estimated that there are 120 000 total sows in South Africa, where 103 400 are owned by commercial producers and fewer than 16 000 by communal producers.

The contribution of the pork industry has increased steadily from 2005/6 to 2013/14, mainly due to an increase in pork consumption which resulted in an increase in prices (DAFF, 2015). Except for the years 2013/14, South Africa has been a net importer of meat. The increase in pork consumption and demand in South Africa resulted in more pigs being slaughtered (DAFF, 2015); hence pork production increased over the past decade from just over 150 000 tons of pork in 2004/2005 to nearly 250 000 tons in 2013/2014.

2.2 Demographics

The demographic information on small-scale pig farmers gives an overview of how the social aspect of farmers and the circumstances they live in impact the way they rear and market their pigs. Demographic information encompasses the composition of a population, such as gender, age, income, and race. It also provides insight into how their history and background impacts their farming practices.

The dominance of men amongst small-scale pig farmers has been noticed in the Democratic Republic of Congo (Kambashi *et al.*, 2014) and Nigeria (Adetunji & Adeyemo, 2012; Umeh *et al.*, 2015; Aminu *et al.*, 2017). Umeh *et al.* (2015) reasoned that men are relatively stronger and have

a higher technical efficiency. The dominance of female pig farmers was, however, more widely noted internationally. This was seen in Cambodia *et al.*, 2017), Nigeria (Duniya *et al.*, 2013), North of Lao (Phengsavanh, 2013), and Kenya (Kagira *et al.*, 2010; Mutua *et al.*, 2010). It was also reported in the Eastern Cape, South Africa (Madzimure *et al.*, 2013). In South Africa, the majority of small-scale pig farmers were found to be male in Mpumalanga (Munzhelele, 2015), KwaZulu-Natal (Gcumisa, 2013), Limpopo (Mokoele, 2015) and Gauteng (Matabane *et al.*, 2015). Madzimure *et al.* (2013) however reported that female farmers dominate pig production in the Eastern Cape.

Madec *et al.* (2010) stated that women often manage small-scale livestock production and because of this, gender issues should be understood when proposing changes in small-scale pig production. Due to the high prevalence of women in agriculture, an increase in focus on them as well as their gender determined constraints is demanded (Altman *et al.*, 2009). The participation of women in pig production needs to be encouraged as it may be a developmental tool in small-scale farming systems (Madzimure *et al.*, 2013) and means by which they could improve their standard of living (Aminu *et al.*, 2017). In addition, the majority of the unemployed in South Africa are black African women, often living in rural areas, and often earn less money than their male counterparts when they are employed, making it more difficult for them to bridge the poverty gap (Altman *et al.*, 2009). Pig farming could serve as a critical contributor to uplift these women as they don't require great labour inputs and their feeding and keeping can be combined with domestic work (Strom *et al.* 2017).

Low education levels were observed amongst small-scale pig farmers in Kenya (Kagira *et al.*, 2010), Tanzania (Komba *et al.*, 2013), Nigeria (Duniya *et al.*, 2013) and India (Haldar *et al.*, 2017). Low education levels amongst small-scale pig farmers also existed in the Mpumalanga (Munzhelele, 2015) and Eastern Cape Provinces (Madzimure *et al.*, 2013), Seventy-eight percent of farmers from Nigeria (Duniya *et al.*, 2013) Fifty-nine percent of farmers from Limpopo (Mokoele, 2015) and had high school experience. Kimbi *et al.*, (2016) noted that farmers who had secondary education purchased more pigs. Kagira *et al.*, (2010) reasoned that the low education level amongst the pig farmers could limit their knowledge on pig management practices. An increase in education status also improved the likelihood of farmers to improve their production, adapt to new technology and farming methods, and become more economically efficient (Saka *et*

al., 2010; Adetunji & Adeyemo, 2012; Mokoelé, 2015). Matabane *et al.*, (2015) stated that formal education is of utmost importance for small-scale pig farmers in order for them to be able to access modern farming practices and agricultural information. Ibitoye *et al.* (2016) suggested that adult education be provided to small-scale pig farmers by the government.

Small-scale pig farmers in rural areas were generally found to be more mature in their age. Majority of farmers were over 40 years old in Nigeria (Duniya *et al.*, 2013; Umeh *et al.*, 2015; Ibitoye *et al.*, 2016). In Nigeria, where the average age of the farmers was found to be 48 years, it was argued that at this age most respondents still had the required energy for pig management and optimum output thereof (Ibitoye *et al.*, 2016). This was also observed in Limpopo (Mokoelé, 2015), Gauteng (Matabane *et al.*, 2015), Mpumalanga (Munzhelele, 2015) and KwaZulu-Natal (Gcumisa, 2013). This is an indication that younger people prefer not to get involved in agriculture, and more specifically, pig farming (Duniya *et al.*, 2013). Opportunities for the youth in agriculture should be provided and encouraged to reduce emigration to cities and boost agricultural productivity in rural areas (Matabane *et al.*, 2015; Mokoelé, 2015).

In many cases, small-scale farmers have been farming with pigs for decades, where the majority of farmers from Nigeria had between 3 and 20 years experience with pig farming (Duniya *et al.*, 2013). Other studies in Nigeria reported that farmers had on average 10 years of experience (Umeh *et al.*, 2015; Ibitoye *et al.*, 2016). Experience in pig rearing might increase technical efficiency and improve the ability of the farmers to adapt to technology (Umeh *et al.*, 2015).

2.3 Benefits of pig farming

Meissner *et al.* (2013) stated that livestock forms an integral and indispensable part of social life and sustenance of poor communities in South Africa. Emerging small-scale farmers in Limpopo view pig production and management as an alternative investment option for the future (Mokoelé, 2015).

Pig farming in particular plays an important role in improving the livelihoods of emerging small-scale pig farmers in Tanzania (Kimbi *et al.*, 2016), Nigeria (Duniya *et al.*, 2013), Cambodia (Strom *et al.*, 2017), Western Kenya (Mutua *et al.*, 2010), and Madagascar (Costard *et al.*, 2009). Farming with pigs has proven to have a similar positive impact on the livelihood of people living in the

rural areas of South Africa, particularly Limpopo (Mokoele, 2015), Gauteng (Matabane *et al.*, 2015), Mpumalanga (Munzhelele, 2015) and KZN (Gcumisa, 2013).

Pig production provides small-scale farmers with an extra source of revenue and animal protein (Lekule & Kyvsgaard, 2003; Kagira *et al.*, 2010; Mutua *et al.*, 2010; Duniya *et al.*, 2013; Gcumisa, 2013; Meissner *et al.*, 2013; Ibitoye *et al.*, 2016; Kimbi *et al.*, 2016), allowing them to use the returns from pig farming to support their families. In Cambodia, many farmers reported that pigs were their main income source or, one of their main income sources (Strom *et al.*, 2017). Pigs were also kept as an economic reserve and investment (Meissner *et al.*, 2013; Mokoele, 2015; Strom *et al.*, 2017).

Farmers all over the world, but especially in African and Asian countries, have given many reasons why pigs are advantageous to farm with in rural areas. Mutua *et al.* (2010) mentioned fast growth rates as one of the key reasons for keeping pigs. Farmers have reported that pigs are less labour intensive, requiring less labour than ruminants which freed up time for the farmers to attend to other chores (Madec *et al.*, 2010; Mutua *et al.*, 2010; Gcumisa, 2013; DAFF, 2015; Strom *et al.*, 2017). Some farmers prefer pigs due to their hardiness and ability to adapt (Mutua *et al.*, 2010). Pigs can be produced under a variety of production systems, giving people of various backgrounds the opportunity to become pig farmers. Genetically, pigs are able to convert feed to meat more efficiently than ruminants (DAFF, 2015). They also have a faster growth rate and breed easily, able to farrow twice a year and produce multiple piglets each time (Lekule & Kyvsgaard, 2003; Mutua *et al.*, 2010). Pigs require less space to be reared on than ruminants, especially when reared intensively (Lekule & Kyvsgaard, 2003; Mutua *et al.*, 2010; Gcumisa, 2013; DAFF, 2015). This is beneficial to farmers who have little land to farm on.

Small-scale pig farmers in Cambodia have mentioned that they started farming with pigs as a means to get rid of kitchen and farm waste (Strom *et al.*, 2017). This has been noticed in Austria as well, where a farmer who farmed with potatoes began farming with pigs so that the blemished potatoes would not be wasted (Darnhofer, 2005).

Other benefits of keeping pigs include the production of manure (Meissner *et al.*, 2013) and some farmers in Western Kenya and KZN claimed that pigs and/or the fat they produce could be used to ward off evil spirits (Mutua *et al.*, 2010; Gcumisa, 2013).

Pigs have also shown to have a social function. They can be offered as gifts or food (Madec *et al.*, 2010), can enhance social status in South Africa since many rural societies place value on livestock as an indicator of social importance, and can be exchanged as dowry (Meissner *et al.*, 2013).

2.4 Governmental support and training

Formal training on pig husbandry is often recommended as a means to increase the productivity of small-scale farmers and alleviate poverty (Mutua *et al.*, 2010; Roelofse, 2013; Chah *et al.*, 2014; Dione *et al.*, 2014; Matabane *et al.*, 2015; Mokoele, 2015). This is likely because it has been noted that training and support from government positively impacted the production of pig farmers (Costard *et al.*, 2009; Mokoele, 2015; Aminu *et al.*, 2017). A study in Limpopo province showed that pig farmers who were supported by the government had better infrastructure, facilities, and better or improved breeding stock when compared to those who received no support (Mokoele, 2015). Gcumisa (2013) noted that small-scale pig farmers need mentoring in different aspects of production, nutrition, health, housing and management to increase chances of successful pig rearing. However, even in countries where government officials and veterinarians have attempted to train small-scale pig farmers effectively, many studies have shown that even more training and government involvement is necessary to improve the management practices and production of these emerging small-scale pig farmers (Mutua *et al.*, 2010; Dione *et al.*, 2014; Kambashi *et al.*, 2014; Matabane *et al.*, 2015; Mokoele, 2015; Umeh, 2015; Ibitoye *et al.*, 2016). Farmers need to be continuously monitored, evaluated and trained to improve their situation (Matabane *et al.*, 2015).

Extension services should increase their efforts to provide farmers with the appropriate training for improved productivity and effective disease control (Chah *et al.*, 2014). In Kenya and Nigeria, farmers lacked sufficient access to extension officers, increasing the risk of health hazards (Chah *et al.*, 2014), and resulting in the farmers getting advice on pig husbandry from fellow neighbouring farmers (Kagira *et al.*, 2010). This could potentially be dangerous, as most farmers might not have had training on pig rearing and could relay incorrect information that may be harmful to the pigs or farmers themselves. This limited access to extension services may have been linked to poor funding and could lead to farmers lacking proper husbandry skills (Chema & Gathuma, 2004). Access to extension services is important as it could increase the efficiency of pig farmers (Umeh *et al.*, 2015). However, for training of the farmers to be effective, extension

officers must also be properly trained in pig husbandry before they are allowed to advise farmers (Madec *et al.*, 2010; Montsho & Moreki, 2012).

Besides training, offering financial assistance to small-scale pig farmers has also been suggested in some studies (Mutua *et al.*, 2010; Duniya *et al.*, 2013; Roelofse, 2013; Mokoele, 2015; Umeh *et al.*, 2015) as well as the formation of farmer groups (Umeh *et al.*, 2015; Aminu *et al.*, 2017). A study in Nigeria revealed that small-scale pig farmers who were in an association with one another through farmer groups derived great benefits from it (Umeh *et al.*, 2015). In Uganda, farmers claimed that farmer groups could make it easier to gain access to training and funding (Dione *et al.*, 2014).

Although it can be seen that governmental support is a key component in ensuring the success of these farmers, support should focus on sustainable production practices, so that farmers may grow to be independent in future (Mokoele, 2015).

2.5 Record keeping

Madec *et al.* (2010) described animal identification as the inclusion and linking of components such as identification of establishments/owners, the person/people responsible for the animal(s), movements and other records with animal identification. Equally important, Madec *et al.* (2010) describes animal traceability as the ability to follow an animal or group of animals throughout the stages of its life or their lives. It is mandatory that all pigs used for production in South Africa be branded with an ear tattoo number and the registration number (Visser, 2014). Pigs need to be branded in order to keep proper records and allow farmers to evaluate their pigs' performances (Visser, 2014). It also makes it easier to trace back to the origin of disease breakouts should they occur (Madec *et al.*, 2010). Pigs can be marked with tattoos, ear tags, ear notches, slap marks or a combination of these (SAPPO, 2012; Visser, 2014). The persons administering these markings should be trained as to avoid harming pigs (SAPPO, 2012). Ear notching is allowed up to the age of 7 days after birth while there is no age limit on tattooing a pig, but it is normally done within the first two weeks after birth (SAPPO, 2012; Visser, 2014).

Visser (2014) divided record keeping into five categories; financial records, feed records, reproduction records of the sow, physical records, and ear and registration numbers for the stud farmer; the book also advises record keeping of the sow's progeny. Record keeping is not only

important for the farmers themselves, but for consumers and scholars who could make use of the information for future studies. Mokoete, (2015) mentioned that ‘it becomes a difficult task to collect critical production parameters where no records exist to validate the collected information and the farmers’ perception and recall were the only forms of validation’. If better records were kept, farmers could also gain greater trust in the market.

Previous studies have shown that majority of pig farmers farming in rural areas do not keep records (Madzimure *et al.*, 2013; Matabane *et al.*, 2015). Roelofse, (2013) showed concern for diseases and inbreeding due to poor record keeping in areas where boars were shared between farmers for mating. Gcumisa, (2013) felt that farmers should be trained on how to keep financial and production records. This was recommended because of general management practices such as observing sows during farrowing, providing bedding for sows close to farrowing, establishing the age of gilts for breeding, were neglected.

2.6 Housing

Lekule & Kyvsgaard, (2003) noted that a suitable piggery should have ample protection against environmental stress, good sanitation, should be hygienic, have sufficient space, minimal feed wastage and be as affordable as possible. Pig rearing systems are usually categorized into three systems; intensive, semi-extensive, and extensive. Matabane *et al.* (2015) described intensive production systems as systems consisting of pig houses constructed to protect the pigs from harsh weather conditions, semi-extensive production systems as having pig enclosures consisting of fences with roofing and with climate not completely controlled by the farmer, and extensive production systems as systems with no housing and free movement of pigs. Confined pig production, a form of intensive production, is frequently found across the world (Madec *et al.*, 2010) and is considered to be the most recommended management practice by Dione *et al.*, (2014) due to its high bio-security and its protection against diseases. Madec *et al.* (2010) described the intensive farming system as a system where animals are confined in shelters and pens are made with anything from local materials to more modern housing. In this system, pigs are completely dependent on the farmer for their feed.

Lekule & Kyvsgaard (2003) claimed that housing in most developing countries are, however, characterized by lack of wind protection, lack of bedding materials, poor sanitation, poor spacing and wet floors which lead to food wastage, physical damage to the pigs, disease transmission,

worm infestations and high mortalities. They stated that experience from Africa, especially in the tropic region, show that the traditional sector (extensive production systems) is a more sustainable pig rearing system than that of intensive pig farming.

However, research on pig farming in some African countries has shown that there are more benefits to farming intensively with pigs. In Congo, the majority of pigs were reared in pens made from either concrete, burnt-brick, mud-brick and/or wood (Kambashi *et al.*, 2014). A study in Western Kenya by Mutua *et al.*, (2010) found that confining pigs protects the public from diseases and increase production. In Uganda, total confinement of pigs helps maximize weight gain and profit (Dione *et al.*, 2014). In Gauteng, South Africa, it was found that the majority of smallholder pig farmers practise intensive farming (Matabane *et al.*, 2015).

Confining pigs was found to be an essential way of preventing diseases such as cysticercosis (Lekule & Kyvsgaard, 2003) and preventing pre-weaning mortality in Mpumalanga (Madzimure *et al.*, 2013). Manchidi (2009) noted further that pigs should not be exposed to direct sunlight and winds as this could cause stress. When pigs are exposed to high temperatures, it could result in a decrease in their fertility, libido and conception rates (Matabane *et al.*, 2015).

It was found that housing in rural areas became a problem during rainy seasons when pigs escape due to the lack of necessary resources to construct houses for pigs. The free-range pigs could cause conflicts within villages (Mutua *et al.*, 2010). Scavenging also exposes pigs to disease, especially African Swine Fever, which is mainly transferred through physical contact between pigs, uncontrolled mating and feeding on potentially contaminated materials (Dione *et al.*, 2014).

The type of housing constructed for pigs is strongly dependent on the financial capacity of the farmer (Dione *et al.*, 2014). Pigs kept in intensive systems by small-scale farmers can be reared in houses made of different materials and floor types. In KZN, pig houses were mostly built of corrugated iron (Gcumisa, 2013). In Gauteng, pigs were reared on anything from earthen floors with low cost building material to modern facilities with concrete floors and running water (Matabane *et al.*, 2015).

Majority of small-scale pig farmers in Kenya made use of soil flooring and very few had concrete (Kagira *et al.*, 2010). Similar results were observed in KZN (Gcumisa, 2013). Intensive pig housing in developing countries generally have poor waste disposal, wet floors without beddings,

and no wind protection (Lekule & Kyvsgaard, 2003). A study in Mamre, in the Western Cape of South Africa, found that none of the pig rearing systems had concrete floors (Roelofse, 2013). Some of these farmers used soil for flooring, which made it impossible to disinfect.

The type of flooring used by small-scale pig farmers ranged within communities from full earth floors and low cost building materials to concrete flooring (Matabane *et al.*, 2015). Madec *et al.* (2010) stated that the pen floor of pigs should be sloped and concrete to facilitate the movement of water and elimination of waste water. The use of wood flooring was observed amongst small-scale farmers in the Himalayas (Nath *et al.*, 2013). The benefit of this flooring, if the wood is slatted, is that dung can pass directly through the planks into the ground or water below (Nath *et al.*, 2013). The use of soil flooring was commonly used by small-scale pig farmers in South Africa, particularly Gauteng (Matabane *et al.*, 2015) and KZN (Gcumisa, 2013).. This type of flooring can however not be properly disinfected (Madec *et al.*, 2010). The use of concrete flooring was reported amongst small-scale farmers in Nigeria (Chah *et al.*, 2014) and Western Kenya (Kagira *et al.*, 2010). Similar results were seen in South Africa's KwaZulu-Natal (Gcumisa, 2013). The use of concrete flooring has been advocated for its economic and health benefits; the flooring is durable and easy to disinfect (Nath *et al.*, 2013; Chah *et al.*, 2014).

2.7 Biosecurity and health management

Small-scale farmers have been reported to have little knowledge on the aspects of biosecurity. Farmers in Madagascar (Costard *et al.*, 2009) had no sanitary measures. Madec *et al.* (2010) noted that the three main elements of biosecurity are segregation, cleaning and disinfecting. Few farmers in Mpumalanga (South Africa) (Munzhelele, 2015) made an effort to wash their hands when handling their pigs, fewer had disinfectant footbaths. Due to the informal nature of most pen structures built by small-scale pig farmers, access control and segregation is often difficult and insufficient. Fences are often not built for the purpose of biosecurity but are rather an extension of the farm (Mokoele, 2015). This creates opportunities for not only wild animals but also roaming pigs from other farms to come into contact with the confined pigs, increasing the risk of disease transfer (Costard *et al.*, 2009; Strom *et al.*, 2017). Since farmers often have limited space for their piggery, pigs of different production stages often share the same air, leaving younger piglets vulnerable to contract illnesses which older, more immune pigs may carry (Roelofse, 2013).

Disease outbreaks are also common amongst small-scale farmers (Mokoele, 2015). In Cambodia, more than 82% of farmers had experienced disease outbreaks (Strom *et al.* 2017). Diseases such as foot and mouth disease, Pasteurellosis, PRRS, Aujeszky's disease and Classical Swine Fever have been observed in Cambodia (Strom *et al.*, 2017). African swine fever (ASF) was the deadliest virus amongst pigs of small-scale farmers in Uganda (Dione *et al.*, 2014) and the Congo (Kambashi *et al.*, 2014). External parasites are also common amongst pigs of small-scale farmers in Western Kenya (Kagira *et al.*, 2010; Mutua *et al.*, 2010). These health issues and disease outbreaks are often the result of poor management practices due to lack of knowledge, poor feeding and poor relationships between farmers and health services (Dione *et al.*, 2014). In Western Kenya, small-scale farmers have little knowledge on pig illnesses and are unable to identify them (Kagira *et al.*, 2010; Mutua *et al.*, 2010). Farmers were also not aware that pigs can be treated when they become ill (Mutua *et al.*, 2010). In Mpumalanga, South Africa, 47% of farmers complained about skin diseases such as mange on their pigs

Problems with disease are also escalated due to insufficient animal health support for farmers. In areas such as Western Kenya, not many veterinarians are available to assist farmers and their assistance is also frequently limited due to the poor infrastructure in some of the villages where pigs are kept (Mutua *et al.*, 2010). There have also been reports of poor relationship between small-scale farmers and animal health technicians in Congo (Kambashi *et al.*, 2014), Western Kenya (Mutua *et al.*, 2010) and China (McOrist *et al.*, 2011).

2.8 Marketing

Matabane *et al.*, (2015) noted that most small-scale pig farmers do not have a sustainable market to sell to. These farmers often find it difficult to sell to the formal market and have limited resources for production (Mokoele, 2015). Thus, the majority of small-scale pig farmers are often obligated to sell to local, informal markets within the community; this has been observed in China (McOrist *et al.*, 2011). . The advantage of selling to the local informal market is the lower transport costs and there is no risk of having their pigs condemned as they might be at an abattoir (Mutua *et al.*, 2010; Munzhelele, 2015). Other markets observed in previous literature are auctions and abattoirs, but often very few small-scale farmers sell to these markets. In South Africa, majority of small-scale pig farmers in Limpopo (Mokoele, 2015) and Mpumalanga (Munzhelele, 2015) sold to informal markets. The selling of pigs at auctions has been seen amongst small-scale pig farmers

in Gauteng (Matabane *et al.*, 2015), Limpopo (Mokoele, 2015), and Mpumalanga (Munzhelele, 2015). Matabane *et al.* (2015) reasoned that these farmers resort to selling to auctions because they do not have access to a sustainable market. With easier market access, farmers have a more realistic chance of emerging (Munzhelele, 2015). In Limpopo (Mokoele, 2015) and Mpumalanga (Munzhelele, 2015), a few small-scale pig farmers have been reported to sell to abattoirs. Pigs owned by small-scale pig farmers often have high bone to meat ratio when compared to that of commercial pigs (Mokoele, 2015) and few farmers market their pigs before the age of six months (Munzhelele, 2015) - all factors influencing the price paid.

Mokoele (2015) noted that there is lack in price coordination amongst these farmers and no template exists to standardize sales. Poor prices and inadequate market information amongst small-scale farmers have been observed in Western Kenya (Kagira *et al.*, 2010). In the Congo, the average selling price depended on the site (Kambashi *et al.*, 2014). Matabane *et al.* (2015) noted that small-scale pig farmers were at a disadvantage due to their lack of knowledge and skills on price determination. In addition, many farmers considered their pigs to be an alternative to their savings (Meissner *et al.*, 2013) or as an emergency fund (Madec *et al.*, 2010; Kambashi *et al.*, 2014), and sold during festive times to pay for festivities, but also because there was a greater demand for their pigs around that time (Kambashi *et al.*, 2014).

2.9 Breeding

In certain areas of Africa, such as Western Kenya, most of the pigs farmed with were crossbreeds that are likely of exotic breeds and/or indigenous origin (Kagira *et al.*, 2010). In Tanzania, Kimbi *et al.*, (2016) found that exotic breeds and their crosses were preferred to indigenous breeds even though they are more costly. Although crossbreeding has shown its advantages in the progeny, improvement of pigs is recommended to be conducted in commercial, large-scale farms which have the capacity to provide continuous intensive inputs (Madec *et al.*, 2010). Over the years, there has been a decline in the use of indigenous breeds such as the Windsnyer and Kolbroek in South Africa, especially in the commercial pig farming sector. Pig farmers are turning towards what they consider more improved, exotic breeds. This is partially due to their commercial appeal as abattoirs and auctions prefer them to indigenous breeds, making them more profitable (Munzhelele, 2015). However, indigenous pigs in African countries, including South Africa, remain a source of food and income for people farming in rural areas (Madzimure *et al.*, 2013; Kimbi *et al.*, 2016).

While indigenous South African pigs such as the Kolbroek is a hardy and versatile breed, able to survive on very little and has been shown to have greater immunity than improved breeds, exotic breeds like the Duroc, Landrace and Large White, outperform them in size, prolificacy, litter sizes and carcass confirmation (Visser, 2014; Munzhelele, 2015). In comparison to exotic breeds, local breeds usually have a high piglet mortality and a slower growth rate (Madec *et al.*, 2010; Munzhelele, 2015).

For South African pig farmers, the exotic breeds used are mostly the Landrace, Large White and Duroc breeds, or a crosses thereof. Farmers have also crossed indigenous breeds with exotic breeds to combine the hardiness of the former and production benefits of the latter, taking advantage of the hybrid vigor found in the progeny (Visser, 2014). Crosses between the Kolbroek and exotic breeds such as the Duroc and Large White breeds have resulted in progeny with better grading, growth rates, feed conversion efficiency, and carcass quality (Visser, 2014). Madzimure *et al.*, (2012) noted that there is high potential for using indigenous pig in subsistence-orientated production systems, and crosses between indigenous pigs and imported breeds has potential in market orientated systems.

Amongst small-scale farmers in South Africa, the shift from indigenous breeds to exotic/commercial breeds has been noted in Mpumalanga (Munzhelele, 2015), KZN (Gcumisa, 2013), and Limpopo (Mokoele, 2015). Similarly, Madec *et al.* (2010) stated that small-scale farmers usually farm with improved breeds such as the Large White or Landrace and crossbreeds. This statement is supported by studies in Mpumalanga (Munzhelele, 2015). However, many small-scale rural farmers in South Africa still keep indigenous pigs as has been recorded in Limpopo (Mokoele, 2015), the Eastern Cape (Madzimure *et al.*, 2012) and KZN (Gcumisa, 2013). This might be due to the ability of local breeds to remain productive when living in poor sanitary conditions. Local breeds can also be fed low quality feed, these low input requirement, they could be helpful in low-income rural communities (Madec *et al.*, 2010). In the rural areas of KZN, most respondents reported that they kept indigenous pigs because of their small size (Gcumisa, 2013). The Large White, Landrace, Duroc, Large Black and Pietrain were the exotic breeds kept by a few respondents in the study by Gcumisa (2013).

Due to the financial situation of most small-scale farmers in rural areas, acquiring good genetic material can be difficult, if farmers do in fact practice controlled mating. When controlled mating

is practiced, some small-scale pig farmers make use of available animals in their herd or buy them from neighboring farmers (Gcumisa, 2013; Kimbi *et al.*, 2016). Selecting breeding stock from within the herd could lead to high incidences of inbreeding, possible inbreeding depression, and a weakening of genetic pools (Munzhelele, 2015). In Botswana, inbreeding is common because pigs originate from one source (Montsho & Moreki, 2012), resulting in poor quality of stock. Some sows are also kept longer in the breeding herd due to insufficient breeding stock. In the Congo, some farmers lend their boars for mating services to other farmers (Kambashi *et al.*, 2014), where mating is either free (to friends and family) or paid for in weaned female piglets or cash. This reduces the risk of inbreeding and maintenance costs for farmers who do not want to keep boars on site. It also encourages a good relationship among farmers and offers an extra source of income for the owner of the boar. It, however, also increases the risk of spreading diseases. In certain South African provinces, such as Limpopo (Mokoele, 2015), Mpumalanga (Munzhelele, 2015) and Gauteng (Matabane *et al.*, 2015), farmers buy breeding boars at auctions, local farms, and/or neighbors. This is risky for pig production due to the potential of diseases found in some untested and culled boars being sold at auctions (Mokoele, 2015; Munzhelele, 2015). The result of purchasing breeding material at auctions also resulted in poor breeding stock for small-scale farmers in Gauteng. Farmers require a source of clean breeding stock, without which it is difficult to avoid disease transmissions (Madec *et al.*, 2010).

2.10 Nutrition

Nutrition is a primary key in animal production, but is often overlooked by smallholder farmers (Matabane *et al.*, 2015; Munzhelele, 2015). Good nutrition is crucial for animal rearing (Munzhelele, 2015). Feed is one of the most expensive aspects of pig rearing (Duniya *et al.*, 2013; Dione *et al.*, 2014). This explains why the feeding of commercial feed is not commonly observed amongst small-scale pig farmers, only a few have reported to do so in the Congo (Kambashi *et al.*, 2014) and North of Lao (Phengsavanh, 2013). As a result, many small-scale pig farmers resort to feeding their pigs swill as a more affordable option (Matabane *et al.*, 2015; Ibitoye *et al.*, 2016). However, Munzhelele (2015) argues that the perception that swill reduces the cost and enhances the output-input balance has not been weighed against animal health, welfare and productivity. The word 'swill' commonly refers to feed scraps fed to pigs. Swill generally consists of restaurant

waste and kitchen scraps (Madec *et al.*, 2010; Nath *et al.*, 2013; Gcumisa, 2013; Mokoelé, 2015). The use of untreated swill is often prohibited and should be avoided (Madec *et al.*, 2010).

If swill is fed to pigs, it must be boiled for at least an hour before being fed (Madec *et al.*, 2010; Mokoelé, 2015). Due to its high energy and protein contents, the feeding of swill leads to rapid fattening of pigs (Madec *et al.*, 2010). However, the feeding of swill has been associated with poor body condition, underfed pigs (Munzhelele, 2015), low reproduction amongst pigs and lower production outputs (Mokoelé, 2015), poor growth and thus low economic returns (Ibitoye *et al.*, 2016). It may also predispose pigs to diseases (Mokoelé, 2015). The feeding of swill has been assumed to be the cause of a PRRS outbreak in South Africa which caused a large scale strategic stamping out procedure of all affected pig herds as well as those in close proximity (Oosthuizen, 2010). Feeding swill has also been linked to diseases such as Salmonella, FMD (Foot and Mouth Disease), ASF (African Swine Fever), CSF (Classical Swine Fever) and Teschen (Beltrán-Alcrudo *et al.*, 2008; Penrith & Vosloo, 2009).

The feeding of swill to pigs by small-scale farmers has been observed across Africa, particularly in the Congo (Kambashi *et al.*, 2014), China (McOrist *et al.*, 2011), Tanzania (Komba *et al.*, 2013) and the Himalayas (Nath, 2013). It was also observed in South Africa, specifically KZN (Gcumisa, 2013), Mpumalanga (Munzhelele, 2015), Western Cape (Oosthuizen, 2010) and Gauteng (Matabane *et al.*, 2015). The feeding of swill is an issue of concern and requires research on how to minimize the feeding costs while ensuring the basic nutrient requirements of the pigs owned by small-scale farmers are met (Mokoelé, 2015).

2.11 Summary

South Africa contributes to less than 0.5% of the world's pig production and pig production only makes up 2.05% of South Africa's agricultural sector, but the pork industry has been steadily growing. Pigs are reared in every province of South Africa and pig production has the potential to improve the livelihood of people living in rural areas. Pig farming has already been found to provide sustenance and income to farmers farming in the rural areas of KZN, Gauteng, Limpopo and Mpumalanga, as well as small-scale farmers farming in many other developing countries around the world. Pig rearing has shown to be ideal to farm with in rural areas as they require less space than ruminants, have fast growth rates and are less labour intensive. They are a source of manure and, in some cultures, the fat produced by pigs are believed to ward off evil spirits.

However, small-scale pig farmers are often affiliated with low income sources, low education levels, and of older age. Due to their general lower income and education, farmers often face problems with inadequate housing, poor breeding material, poor feeding strategies, an inability to market their pigs and secure a steady income and lack of training. Support from the government and various institutions such as SAPPO (South African Pig Producers Organisation) or universities could provide solutions to challenges faced by farmers, provide them with training and alleviate the poverty in South Africa.

2.12 References

- Adetunji, M.O. & Adeyemo, K.E., 2012. Economic Efficiency of Pig Production in Oyo State, Nigeria : A Stochastic Production Frontier Approach. *Am. J. Exp. Agric.* 2, 382–394.
- Altman, M., Hart, T., & Jacobs, P. 2009. Food Security in South Africa. *Hum. Sci. Res. Counc.* 1, 1–29. Available at: <http://www.tandfonline.com/doi/abs/10.1080/03031853.1992.9524684>.
- Aminu, F.O., Ekiomoado, C. & Ahonkhai, A. 2017. Profitability and Technical Efficiency of Pig Production in Nigeria : the Case of Ekiti State. *Agri. trop. subtrop.* 50, 27–35. doi: 10.1515/ats.
- Beltrán-Alcrudo, D., Labroth, J., Depner, K. & De La Rocque, S. 2008. African swine fever in the Caucasus. *FAO EMPRES Watch*. Available at: <ftp://ftp.fao.org/docrep./FAO/011/aj214e/aj214e00.pdf>.
- Chah, J. M., Dimelu, M.U. & Ukwuani, S.U. 2014. Institutional and production characteristics among smallholder pig producers in Enugu State , Nigeria. *Trop. Anim. Health Prod.* 46, 1173–1176. doi: 10.1007/s11250-014-0623-4.
- Chema, S. & Gathuma, J. M. 2004. Kenya : the development of private services and the role of the Kenya Veterinary Association. *Rev. Sci. Tech. l'OIE.* 23, 331–340.
- Costard, S., Porphyre, V., Messad, S., Rakotondrahanta, S., Vidon, H. 2009. Multivariate analysis of management and biosecurity practices in smallholder pig farms in Madagascar. *Prev. Vet. Med.* 92, 199–209. doi: 10.1016/j.prevetmed.2009.08.010.
- Department of Agriculture, Forestry and Fisheries. 2012. Integrated Growth and Development Plan 2012. [online] Available at: <<https://www.daff.gov.za/docs/Policy/IGDP121.pdf>>

[Accessed 07 August 2019]

- Department of Agriculture, Forestry and Fisheries. 2015. A Profile of the South African Pork Market Value Chain. [online] Available at:
<<https://www.nda.agric.za/doaDev/sideMenu/Marketing/Annual%20Publications/Commodity%20Profiles/Livestock/Pork%20market%20value%20chain%20profile%202015.pdf>>
[Accessed 07 April 2018]
- Darnhofer, I. (2005) Organic farming and rural development: Some evidence from Austria. *Sociol. Ruralis*. 45, 308–323. doi: 10.1111/j.1467-9523.2005.00307.x.
- Dione, M.M., Ouma, E.A., Roesel, K., Kungu, J., Lule, P. & Pezo, D. 2014. Participatory assessment of animal health and husbandry practices in smallholder pig production systems in three high poverty districts in Uganda. *Prev. Vet. Med.* 117. 565–576. doi: 10.1016/j.prevetmed.2014.10.012.
- Duniya, K.P., Akpoko, J.G., Oyakhilomen, O. & Nandi, J.A. 2013. Measurement of Pig Production Profitability in Zangon Kataf and Jema'a Local Government Areas of Kaduna State, Nigeria. *Curr. J. Appl. Sci. Technol.* 3, 1455–1463. doi: <https://doi.org/10.9734/BJAST/2014/4137>
- Gcumisa, S.T. 2013. The untold story of the pig farming sector of rural Kwazulu-Natal: A case study of Uthukela District. MSc thesis. Available at:
http://uir.unisa.ac.za/bitstream/handle/10500/14146/dissertation_gcumisa_st.pdf?sequence=1.
- Haldar, A., Das, D., Saha, B., Pal, P., Das, S., Das, A., Rajkhowa, D., Hazarika, S. & Datta, M. 2017. Smallholder Pig Farming for Rural Livelihoods and Food Security in North East India. *J. Anim. Res.* 7, 471-471. doi: 10.5958/2277-940X.2017.00070.5.
- Ibitoye, S.J., Shaibu, U.M., Sanda, M.E. & Oshadare, D. 2016. Economic Analysis of Local Swine Production Among Small Scale Farmers in Kabba/Bunu Local Government Area of Kogi State, Nigeria. *Gashua J. Irrig. Desertif. Stud.* 2, 1–11.
- Kagira, J.M., Kanyari, P.W.N., Maingi, N. & Githigia, S.M. 2010. Characteristics of the smallholder free-range pig production system in western Kenya. *Trop. Anim. Health Prod.* 42, 865–873. doi: 10.1007/s11250-009-9500-y.

- Kambashi, B., Picron, P., Boudry, C., Thewis, A., Kiatoko, H. & Bindelle, J. 2014. Smallholder pig production systems along a periurban-rural gradient in the Western provinces of the Democratic Republic of the Congo. *J. Agric. Rural Dev. Trop. Subtrop.* 115, 9–22.
- Kimbi, E.C., Mlangwa, J., Thamsborg, S. M., Mejer, H., Lekule, F.P. 2016. Smallholder Pig Marketing Systems in the Southern Highlands of Tanzania. *J. Nat. Sci. Res.* 6, 87–98.
- Komba, E.V.G., Kimbi, E.C., Ngowi, H.A., Kimera, S.I., Mlangwa, J.E., Lekule, F.P., Sikasunge, C.S., Willingham, A.L., Johansen, M.V., Thamsborg, S.M. 2013. Prevalence of porcine cysticercosis and associated risk factors in smallholder pig production systems in Mbeya region, southern highlands of Tanzania. *Vet. Parasitol.* 198, 284–291. doi: 10.1016/j.vetpar.2013.09.020.
- Lekule, F.P. & Kyvsgaard, N.C. 2003. Improving pig husbandry in tropical resource-poor communities and its potential to reduce risk of porcine cysticercosis. *Acta Trop.* 87, 111–117. doi: 10.1016/S0001-706X(03)00026-3.
- Madec, F., Hurnik, D., Porphyre, V. & Cardinale, E. 2010. Good practices for biosecurity in the pig sector: issues and options in developing and transition countries. FAO.
- Madzimure, J., Chimonyo, M., Zander, K.K. & Dzama, K. 2012. Potential for using indigenous pigs in subsistence-oriented and market-oriented small-scale farming systems of Southern Africa. *Trop. Anim. Health Prod.* 45, 135–142. doi: 10.1007/s11250-012-0184-3.
- Matabane, M.B., Nethenzheni, P., Thomas, R., Netshirovha, T.R., Norris, D., Nephawe, K.A. & Nedambale, T.L. 2015. Status of the smallholder pig farming sector in Gauteng Province of South Africa. *Appl. Anim. Husb. Rural Develop.* 8, 19–25. Available at: www.sasas.co.za/aahrd/.
- McOrist, S., Khampee, K. & Guo, A. 2011. Modern pig farming in the Peoples’ Republic of China: growth and veterinary challenges. *Rev. Sci. Tech. l’OIE.* 30, 961–968. doi: 10.20506/rst.30.3.2091.
- Meissner, H.H., Scholtz, M.M. & Palmer, A.R. 2013. Sustainability of the South African livestock sector towards 2050 Part 1: Worth and impact of the sector. *S. Afr. J. Anim. Sci.* 43, 282–297. doi: 10.4314/sajas.v43i3.5.

- Mokoele, J.M. 2016. Reasons for poor production among the emerging small-scale pig farmers of the Limpopo province of the Republic of South Africa. MMed Vet., University of Pretoria.
- Montsho, T. & Moreki, J.C. 2012. Challenges in commercial pig production in Botswana. *J. Agric. Technol.* 8, 1161–1170.
- Munzhelele, P. 2015. Evaluation of the production systems and constraints of smallholder pig farming in three agro-ecological zones of Mpumalanga province, South Africa. MSc (Agric) thesis, University of South Africa.
- Mutua, F.K., Arimi, S., Oraga, W., Dewey, C., Schelling, E. 2010. Farmer Perceptions on Indigenous Pig Farming in Kakamega District, Western Kenya. *Nord. J. African Stud.* 23, 43-57. Available at: <http://www.lrrd.org/lrrd23/7/mutu23144.htm%5Cnhttp://hdl.handle.net/10568/5369>.
- Nath, B.G., Pathak., P.K., Ngachan, S.V., Tripathi, A.K., Mohanty, A.K. 2013. Characterization of smallholder pig production system : productive and reproductive performances of local and crossbred pigs in Sikkim Himalayan region. *Trop. Anim. Health Prod.* 45, 1513–1518. doi: 10.1007/s11250-013-0391-6.
- Oosthuizen, C. M. 2011. A retrospective study of a Porcine Reproductive and Respiratory Syndrome outbreak in South Africa in 2004. MMedVet, University of Pretoria. Available at: <http://upetd.up.ac.za/thesis/available/etd-06102011-155507/>.
- Penrith, M.L. & Vosloo, W. 2009. Review of African swine fever: transmission, spread and control. *J. S. Afr. Vet. Assoc.* 80, pp. 58–62. doi: 10.4102/jsava.v80i2.172.
- Phengsavanh, P. 2013. Forage Legumes as Feed for Pigs in Smallholder Production Systems in the North of Lao PDR Production Systems , Forage Biomass Yield and Protein. PhD diss, Swedish University of Agricultural Sciences.
- Roelofse, J.J. 2013. Economic feasibility study of the establishment of smallholder pig farmers for the commercial market : Empolweni case study. MSc (Engineering management) thesis, University of Stellenbosch, South Africa. Available at: <http://hdl.handle.net/10019.1/85703>.
- Saka, J.O., Adeshinwa, A.O.K. & Ajala, M.K. 2010. Incidence of African Swine Fever (ASF) disease and its associated implications on pig production in Lagos State, Nigeria. 16, 80-90.

SAPPO (2012) Code for the Welfare of Pigs.

Strom G, Djurfeldt, A. A., Boqvist S., Albiñ A, Sokerya S, San S, Davun H, Magnusson, U. 2017. Urban and peri-urban family-based pig- keeping in Cambodia: Characteristics, management and perceived benefits and constraints. PLoS ONE. 12, 1–13. Available at: <https://doi.org/10.1371/journal.pone.0182247>.

Umeh, J.C., Ogbanje, C. & Adejo, M.A. 2015. Technical Efficiency Analysis of Pig Production : A Sustainable Animal Protein Augmentation for Nigerians. J. Adv. Agric. Technol. 2. doi: 10.12720/joaat.2.1.19-24.

Visser, D. 2014. Modern Pig Production. Available at: <https://books.google.co.za/books?id=mpXorQEACAAJ>.

Chapter 3

The demographic nature of small-scale pig farmers in the Western Cape, South Africa

3.1 Abstract

The aim of this study was to generate baseline demographic data on small-scale pig farmers in the Western Cape, South Africa. A structured questionnaire was used to obtain this information. Seventy-five farmers were interviewed comprising of 27 farmers from Khayelitsha, 26 from Mamre and 22 from Malmesbury. A focus group was conducted to supplement the information obtained through the questionnaire. Data was captured through Excel and analyzed by using STATISTICA version 13. Male farmers dominated the study area and most farmers were over the age of 40. Afrikaans, English and isiXhosa were the main languages spoken by farmers. Nearly half of the farmers did not have any form of secondary education. Ninety-five percent of the farmers specifically stated that they reared pigs as a source of income and 29.7% stated that it was their main source of income. Eighty-eight percent of the farmers wanted to expand their piggeries and 42.7% stated that they farm with pigs because they enjoy it. This shows the ambition many small-scale pig farmers have for their farming. This chapter therefore discusses the demographic nature of small-scale pig farmers in the Western Cape.

Keywords: farmer education, income, governmental support

3.2 Introduction

There is uncertainty about the status of household food security in South Africa (Altman *et al.*, 2009). Agriculture, especially the development of small-scale farmers, is considered to be a major tool that could be used to escape poverty and food insecurity in rural households (Abdu-Raheem & Worth, 2011; Pienaar & Traub, 2015; Thamaga-Chitja & Morojele, 2017). The South African agriculture sector can be divided into two distinct groups; the commercial sector which is well developed and is responsible for over 95% of the country's formal agricultural output, and the small-scale sector which is less developed, less resourced, and less productive than that of the commercial sector (Kirsten & van Zyl, 1998; DAFF, 2012; Thamaga-Chitja & Morojele, 2017). However, small-scale production makes up an essential part of food security in rural areas (Visser, 2014).

Meissner *et al.* (2013) noted that livestock farming provides sustenance to poor communities in South Africa, improving their livelihood. Pienaar and Traub (2015) theorized that up-scaling farm production could assist in generating sufficient food for rural households. Pig farming in particular plays an important role in improving the livelihood of small-scale pig farmers in South Africa, particularly in Limpopo (Mokoele, 2015) and KZN (Gcumisa, 2013). It has also proven to have a positive impact in the rural areas of other developing countries such as Western Kenya (Mutua *et al.*, 2010), Tanzania (Kimbi *et al.*, 2016) and Madagascar (Costard *et al.*, 2009), by providing households with an extra source of income and/or sustenance.

Two groups make up the small-scale farming sector; smallholder farmers and subsistence farmers (Pienaar & Traub, 2015). Smallholder farmers are non-commercial farmers who practice agriculture to generate an income (Thamaga-Chitja & Morojele, 2017), while subsistence farmers practice agriculture to save money by providing food for the household (DAFF, 2012). Smallholder and subsistence farmers mainly farm in the former homeland areas of the country and their practices are generally characterized by poor infrastructure and low production outputs (Kirsten & van Zyl, 1998; DAFF, 2012). Small-scale farmers across South Africa are found farming with an array of species such as beef cattle, dairy cattle, sheep, goats, game, poultry and pigs (Meissner *et al.*, 2013); many times farming with multiple species (Madec *et al.*, 2010). Pig farmers can be found in all nine provinces of South Africa with the Western Cape province owning 15.50% of the sows, making it the third highest pig producing province after the North West province (17.20%) and Kwazulu-Natal (16.10%). Small-scale pig producers are made up of an estimated 1 500 farmers in South Africa, of which 220 are based in the Western Cape and wean between 10-15 pigs per year (Visser, 2014).

Small-scale pig farmers in South Africa are usually associated with poor income (Munzhelele, 2015), low education levels (Gcumisa, 2013; Madzimure *et al.*, 2013; Mokoele, 2015; Munzhelele, 2015), and little training on pig rearing (Munzhelele, 2015). Madzimure *et al.* (2013) found that most small-scale farmers in the Eastern Cape were unemployed and survived on their farming practices and social grants, this was also the scenario in KZN (Gcumisa, 2013). Small-scale farmers in Mpumalanga keep pigs as an economic reserve and over 90% of farmers came from previously disadvantaged backgrounds (Munzhelele, 2015). In provinces such as KwaZulu-Natal and Mpumalanga, very few farmers have received any type of training on pig rearing which was

mentioned as the cause of poor development of small-scale farmers (Gcumisa, 2013; Munzhelele, 2015).

Interestingly, although the Western Cape has around 220 small-scale pig farmers, very little is known about their demographic profile. By uncovering the demographic nature of these farmers, there can be a better understanding of the current population, which may provide explanations of current small-scale farming characteristics and assist in planning future developments. This chapter therefore focuses on the structure of the small-scale pig farmers' population in three municipal areas of the Western Cape, South Africa, namely Mamre, Malmesbury and Khayelitsha.

3.3 Methods and materials

3.3.1 Description of the study site

The study encompassed three towns in the Western Cape; Mamre, Malmesbury, and Khayelitsha. The regions where the study was conducted is circled in red on Figure 3.1 below. The districts were chosen due to the abundance of small-scale pig farmers found in each area. The Western Cape Province is home to 5 822 634 occupants. Malmesbury is one of the largest towns under the Swartland region and is considered the administrative centre of the municipality (GPS: 33.4651 S, 18.7338 E). Malmesbury's climate is described as warm and temperate with the winters receiving more rainfall than the summers. Malmesbury's hottest month is February where the area experiences an average temperature of 21.9 °C. Malmesbury's driest month is January where the area experiences 12 mm of rainfall on average. The lowest temperatures on average are 11.9 °C and is experienced in July. June is its rainiest month where the area receives an average of 79 mm of rain (En.climate-data.org, n.d.). According to StatsSA (2011), 21.7% of occupants have no income for their household. Mamre and Khayelitsha areas both fell under the administration of the City of Cape Town municipality. Khayelitsha is home to 391 749 people. Khayelitsha translated from Xhosa means 'new home'. The area was established in 1983 to house homeless Xhosa families in the Cape Flats (GPS: 34.0413 S, 18.6722 E). Nineteen percent of occupants from this area have no income for their households (StatsSA, 2011). The climate in Khayelitsha is described as warm and temperate with the most rainfall during winter months. Khayelitsha's hottest and driest month is in January when the area experiences an average of 21.1 °C and 15.2 mm of rainfall. During its coldest month, July, the area averages at 12.3 °C and receives its highest amount of rain, 107 mm on average (En.climate-data.org, n.d.). Mamre is home to a population of 9 048 people

(GPS: 33.5139 S, 18.4739 E), and 12.7% of people living in this area have no income for their households. Mamre's climate is described as warm and temperate. The winter months are rainier than summer months. Mamre's warmest and driest month is February where the area experiences an average of 20.5 °C and 12 mm of rainfall. The coldest and rainiest month is July where the temperatures average at 11.8 °C and the rainfall is 79 mm on average (En.climate-data.org, n.d.).



Figure 3.1. Map of the Western Cape Province divided by municipal areas.

3.3.2 Surveys

Farmers were sampled based on whether or not they farmed with pigs. Farmers identified and interviewed for this study had to own at least one pig and farm in one of the areas mentioned above. The Social Ethics Committee of Stellenbosch University (ANI-2018-6868) granted ethical clearance. Through the help of the Cape of Good Hope SPCA (Society for the Prevention of Cruelty to Animals), a South African animal welfare organization, and Government extension officers working in Malmesbury and Mamre, contact was made with farmers in each area. Initially, each site was visited with the purpose of building a relationship with the farmers, explaining the project to them and determining when the most appropriate times would be to visit each area. With the use of a structured questionnaire, farmers were interviewed either face-to-face or, for those who were comfortable giving their contact details, via a phone call. Ten interviewers were involved in interviewing farmers, and all were postgraduate students at Stellenbosch University.

Interviewers were briefed beforehand and given a sheet with images of common pig breeds in case the farmer needed to identify a breed. Farmers were given an opportunity to decide in which languages they were most comfortable to be interviewed in and an interviewer fluent in those languages was identified and asked to conduct the interview. Before each interview was conducted, the study and its purpose were explained to each farmer and they were asked to sign a consent form. The snowball technique (Atkinson & Flint, 2001) was applied to identify and make contact with more farmers from each area. Only farmers who were willing to cooperate in the study were included. Interviews were conducted with a total of 75 farmers, which was made up of 27 from Khayelitsha, 26 from Mamre, and 22 from Malmesbury.

3.3.3 Focus groups

A focus group discussion with a small group of farmers was conducted in the town of Mamre's community hall on the 18th of November in 2018. The purpose of this focus group was to acquire information that was not fully covered by the questionnaire (for Chapters 3 and 4) to supplement the discussion. Twelve farmers in total attended the focus group; five from Mamre, four from Khayelitsha and three from Malmesbury. Both men and woman attended the focus group. Farmers were recruited based on their knowledge on their community as well as their pig rearing experience and expertise. The focus group discussion was conducted on a Saturday as many farmers worked during the week.

During the focus group discussion, a facilitator sat with farmers in a circle to assist the flow of the discussion. Farmers were informed beforehand that the session would be recorded and notes would be taken. The discussions were in Afrikaans and English as all of the farmers understood one or the other. All participants were encouraged to participate by the facilitator. A checklist was created beforehand to stay on the topic and ensure that all topics needed were covered. This checklist was created after examining the data gathered and identifying the sections that required more information to properly describe the research gathered. Topics discussed were; community structures and dynamics, theft, roaming pigs, training, breeding and marketing.

3.3.4 Statistical analysis

MS Excel was used to capture the data and STATISTICA version 13 (Dell Inc. (2018) was used to analyse the data. Multiple regression analysis was used when one continuous response variable

was to be related to several other continuous input variables and the strength of the relationship measured with multiple correlation. The relationships among continuous response variables and nominal input variables were analysed using appropriate analysis of variance (ANOVA).

When ordinal response variables were compared versus a nominal input variable, non-parametric ANOVA methods were used. For completely randomized designs the Kruskal-Wallis test was used and for repeated measures designs the Wilcoxon- or Friedman tests was used to test for statistical differences.

The following null-hypothesis was constructed:

H_0 : There is no significant difference between the different study areas in terms of the variables tested for

Variables tested against the three study areas for this chapter were:

- The age of farmers
- Education level of farmers
- Whether or not farmers managed their farm on their own
- Main income sources
- Main reason for farming
- Farmers' experience with pig farming
- The plans they had with their piggeries
- Whether their parents kept pigs
- Whether they received training

A p-value ≤ 0.05 represents statistical significance in the hypothesis testing and 95% confidence intervals were used to describe the estimation of unknown parameters. Means are reported with standard deviations (mean \pm standard deviation).

3.4 Results and Discussion

3.4.1 Race, gender, labourers and age

Respondents interviewed for this study either identified with being black or of mixed origin, no other races were recorded. Those who identified with being mixed-race made up 60.8% of the

small-scale pig farmers interviewed. All the farmers interviewed in Mamre reported that they were mixed-race, whilst in Mamre only 28.6% reported the same with the majority (71.4%) indicating they were black. Farmers interviewed in Khayelitsha were either black (50%) or mixed-race (50%). These results suggest that in terms of culture a more uniform population exists in Mamre than in Malmesbury and Khayelitsha.

Male farmers greatly outnumbered female farmers across all three study areas, making up 82.7% of the total farmers interviewed. In Mamre, males made up 92.3% of the farmers interviewed, in Malmesbury 86.4% and in Khayelitsha 70.4%. The dominance of male small-scale farmers farming with pigs was also observed in other provinces in South Africa, namely Mpumalanga (Munzhelele, 2015) and Gauteng (Matabane *et al.*, 2015). However, in some parts of South Africa, such as the Eastern Cape (Madzimure *et al.*, 2013) and KZN (Gcumisa, 2013), as well as in many other developing countries such as Kenya (Kagira *et al.*, 2010), Cambodia (Strom *et al.*, 2017), and Nigeria (Duniya *et al.*, 2013), most small-scale farmers were found to be women. Results from this study also showed that fewer female farmers managed their farms on their own in comparison to their male counterparts. The majority of the farmers (65.3%) reported that they manage their farms on their own, with no difference found among the three study areas ($P > 0.05$). In Mamre 61.5% of farmers farmed on their own, in Malmesbury 68.2%, and in Khayelitsha 66.7%. From the respondents who stated that they had labourers helping, only 19.2% had female labourers while 88.5% had male labourers. Most of these farmers had more than one labourer. The maximum number of labourers a farmer had was four. Duties for the labourers included activities such as feeding the pigs, providing them with water, cleaning out the pens, administering injections, laying bedding down for the pigs, and monitoring the animals. From the pool of male farmers, 69.4% stated that they farmed on their own while only 46.2% of the females stated that they managed their farms on their own. This could suggest that some gender bias exists amongst small-scale pig farmers in the Western Cape. There is therefore a need to encourage the participation of women in pig rearing in the rural areas of the Western Cape.

Ages of respondents for this study ranged from 21 to 73 years old. Statistically, no significant difference was found among the three study areas, which is further supported by the boxplot (Figure 3.2). Both the eldest and youngest respondent was found in Mamre (50.7 ± 15.2), the area

with the largest age range. Malmesbury (51.6 ± 11.0) and Khayelitsha (48.3 ± 9.8) both had age ranges that began at 30 years old and neither had farmers older than 68.

With an average age of 50 years as well as 78.1% of farmers being at least 40 years of age, the results show that most small-scale pig farmers were advanced in their years (Figure 3.2). Similar results were seen in the Eastern Cape (Madzimure *et al.*, 2013), Kwazulu-Natal (Gcumisa, 2013), Gauteng (Matabane *et al.*, 2015), Mpumalanga (Munzhelele, 2015) and Nigeria (Adetunji & Adeyemo, 2012; Duniya *et al.*, 2013; Ibitoye *et al.*, 2016). Previous studies have recommended that drives and policies should be established to encourage the youth to partake in agriculture (Mokoele, 2015; Munzhelele, 2015). These results indicate that the youth are not particularly inclined to farm with pigs. The fact that most farmers are over 40 years old could also be offputting to the youth. Agriculture, particularly livestock rearing, should thus be promoted in schools.

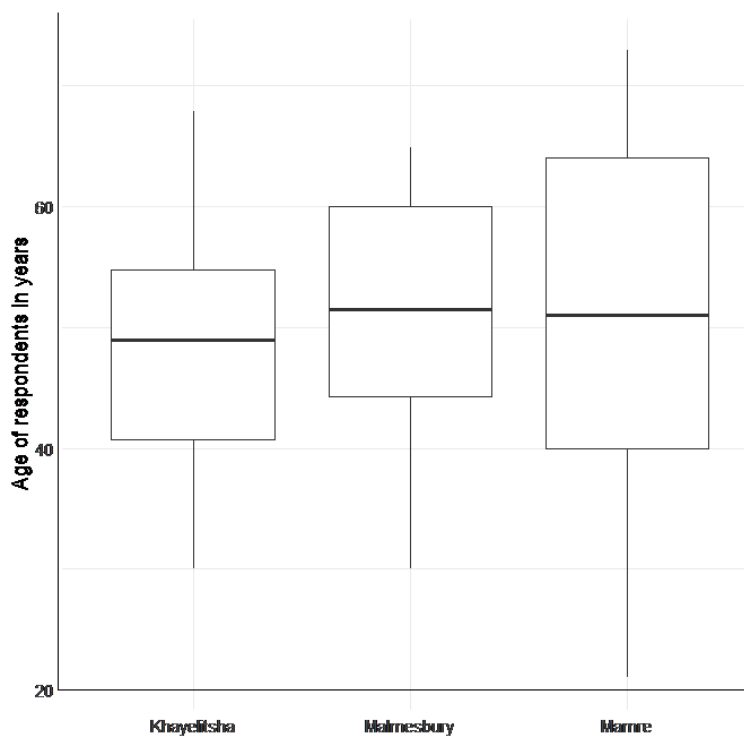


Figure 3.2. Boxplot of age ranges of small-scale pig farmers across three municipal areas in the Western Cape.

3.4.2 Languages and education

Sixty-four percent of the respondents stated that their home language was Afrikaans, with the second highest being Xhosa (28.0%). Mamre farmers could understand and/or speak only two languages: Afrikaans and English, while Malmesbury and Khayelitsha could understand and/or speak a broader range of languages (Table 3.1).

Table 3.1 Home languages spoken/communicated in by small-scale pig farmers in the Western Cape.

	Mamre		Malmesbury		Khayelitsha		Total	
Home Language	N	%	N	%	N	%	N	%
Afrikaans	25	96.2	9	40.9	14	51.9	48	64.0
English	1	3.9	0	0.0	0	0.0	1	1.3
Xhosa	0	0.0	10	45.5	11	40.7	21	28.0
Sesotho	0	0.0	2	9.1	0	0.0	2	2.7
Shona	0	0.0	0	0.0	1	3.7	1	1.3
Pedi	0	0.0	1	4.6	0	0.0	1	1.3
French	0	0.0	0	0.0	1	3.7	1	1.3
Total	26	100	22	100	27	100	75	100

The three main languages understood by farmers were Afrikaans, English and isiXhosa with Afrikaans being the most widely understood language with 74.7% of all respondents being able to understand Afrikaans. Of the three study areas, Mamre held the highest number of Afrikaans speakers (100%). In Malmesbury 59.1% could speak Afrikaans, and in Khayelitsha, 63.0%. Sixty-one percent of all respondents could understand English. Sixty-nine percent of respondents in Mamre could understand English, 31.8% in Mamre, and 77.8% in Khayelitsha. Thirty-nine percent of respondents over all three areas could understand isiXhosa. None of the respondents in Mamre could understand isiXhosa, while 63.6% in Malmesbury and 55.6% in Khayelitsha could. Other languages understood by farmers were Zulu (4.6% in Malmesbury and 11.1% in Khayelitsha), Sesotho (18.2% in Malmesbury), Sepedi (4.6% in Malmesbury), Tswana (4.6% in Malmesbury), Lingele and Swahili (3.7% for both respectively in Khayelitsha).

It is recommended that training should be offered to farmers in English, Afrikaans and/or isiXhosa in these areas, as 98.7% of farmers could understand at least one of these languages. Training material should also be available in all three of these languages. However, 43.6% of respondents had not furthered their education past primary school; thus organizations who wish to distribute training manuals should do so with caution as many farmers may not be literate or proficient in reading. As illustrated by the Table 3.2 below, the majority of the respondents had some level of primary education (38.0%) and secondary education (52.1%). A small number of respondents (5.6%) had no formal education; fewer (4.2%) had some form of tertiary education. All the respondents who stated they had a background in tertiary education had gone to university. A significant difference was found among the three groups for education, possibly due to Khayelitsha having the highest number of small-scale farmers who had gone to secondary school. Many farmers from Mamre (42.3%) had not furthered their education past primary school. Malmesbury had an equal number of farmers that had gone to primary and secondary school (45.5%, respectively). The low education levels observed amongst small-scale farmers might be due to a commonly seen impoverished background.

It was observed that with higher education, fewer farmers managed their farms on their own. Twenty-five percent of farmers with no formal education stated that they had labourers assisting them while of those who had some form of primary, secondary or tertiary education, 33.3%, 35.1% and 66.7% had labourers, respectively. This could be because those with higher education received higher paying jobs and could afford labourers to tend to their piggery when they were at their primary work. Low education levels amongst small-scale pig farmers were observed in Mpumalanga (Munzhelele, 2015), the Eastern Cape (Madzimore *et al.*, 2013) and Western Kenya (Kagira *et al.*, 2010). Matabane *et al.*, (2015) noted that some formal education is of utmost importance for farmers to be able to make use of improved agricultural information and practices. Increased levels of education has been linked with a greater number of pigs purchased (Kimbi *et al.*, 2016), increased income (Ibitoye *et al.*, 2016), improved production (Adetunji & Adeyemo, 2012), better knowledge on disease (Adetunji & Adeyemo, 2012; Komba *et al.*, 2013) and greater ease with the adoption of improved farming methods and technology (Saka *et al.*, 2010; Adetunji & Adeyemo, 2012; Mokoele, 2015). Ibitoye *et al.*, (2016) recommended that pig farmers be offered adult education classes. Farmers should therefore be encouraged to further their education and broaden their understanding of their farming practices.

Table 3.2. Education level of small-scale pig farmers in the Western Cape.

Education	Mamre		Malmesbury		Khayelitsha		Total	
	N	%	N	%	N	%	N	%
No formal	1	3.8	2	9.1	1	4.3	4	5.6
Primary	14	53.8	10	45.5	3	13.0	27	38.0
Secondary	10	38.5	10	45.5	17	73.9	37	52.1
Tertiary	1	3.8	0	0.0	2	8.7	3	4.2
Total	26	100	22	100	23	100	71	100

3.4.3 Financial impact of pig farming

Salaries from other sources were found to be the highest primary source of income amongst small-scale pig farmers (Figure 3.3); however, only 47.3% of respondents considered salaries to be a source of income in their household, while 73.0% considered livestock to be a source of income. Livestock was also found to be the highest secondary source of income amongst small-scale pig farmers and thirty percent of farmers stated that livestock was their primary source of income. The type of livestock owned by farmers are discussed in Chapter 4. Various social grants from the government, i.e. pension, disability, child support were a source of income for 48.7% of farmers. Other sources of income mentioned by farmers were contributions from people in contact with farmers (9.5%), home industries (8.1%), and casual work (6.8%).

All farmers (100.0%) gave a primary source of income while 70.2% of farmers listed a secondary source and only 23.0% had a third income source, this can be seen in Figure 3.3 below.

The primary source of income differed across the three groups ($P \leq 0.05$). Nearly three-quarters (73.1%) of farmers from the Mamre area stated that livestock was a primary source of income for them, 57.7% stated that they earned salaries, 30.8% received social grants, and 34.6% obtained income through other sources. A large percentage (71.4%) of farmers from Malmesbury were dependent on social grants for income, 61.9% of farmers earned salaries, 52.4% of farmers stated that their livestock provided a source of income. Nearly all (88.9%) respondents from Khayelitsha stated that their livestock provided them with a source of income; only 29.6% of farmers earned a salary while 44.4% of farmers received social grants. Nineteen percent of these farmers received contributions from family members or boarders.

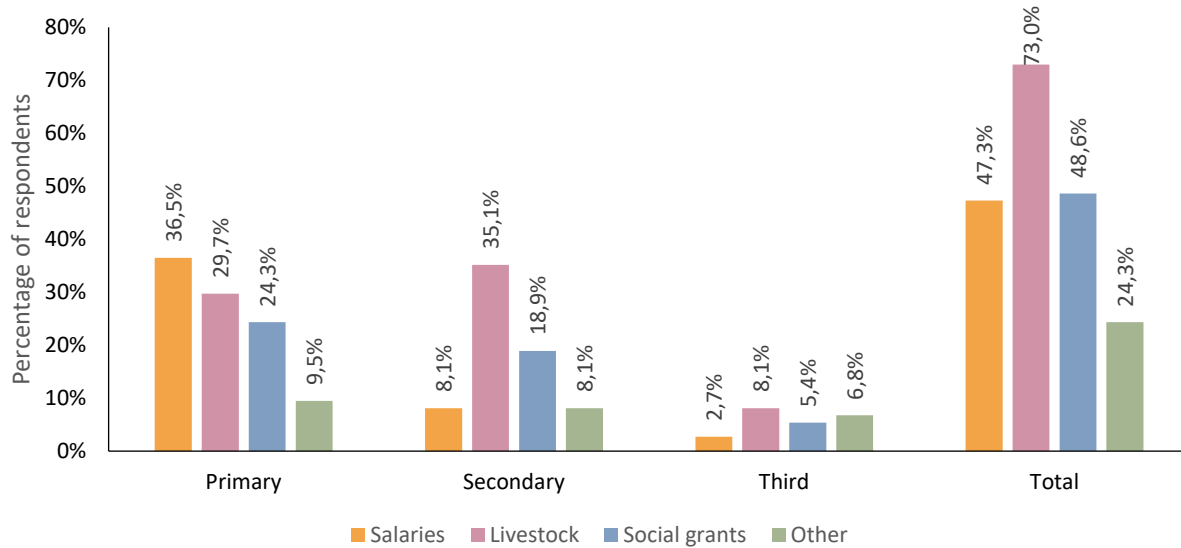


Figure 3.3. Income sources of small-scale pig farmers across three municipal areas in the Western Cape, South Africa

Income was the greatest reason mentioned for the keeping of pigs by small-scale farmers; 94.7% of respondents stated that they kept pigs for income and 68.0% considered it to be their main reason for keeping pigs. The second highest reason for keeping pigs by small-scale farmers was that they enjoyed farming with pigs (42.7%). Twenty-eight percent of respondents mentioned that they kept pigs for consumption while other reasons for keeping pigs included the use of their manure, for investment purposes and/or because they had grown up rearing pigs. The majority of farmers from Mamre (53.9%), Malmesbury (63.6%) and Khayelitsha (85.2%) stated that income was the primary reason for keeping their pigs. This response differed across the three areas ($P < 0.05$). This difference observed may have been due to the fact that more farmers from Mamre farmed with pigs for enjoyment (34.6%) than Malmesbury (13.6%) and Khayelitsha (7.4%). This reason was only the primary reason for 13.6% of Malmesbury farmers and 7.4% of Khayelitsha farmers. In Mamre, 88.5% of respondents kept pigs for income, 50.0% kept them because they enjoyed rearing pigs, 30.8% kept them for consumption, 19.2% kept them for their manure, and only a small percentage (3.9%) kept them as an investment. In Malmesbury, pigs were kept as a source of income (95.5%), for the joy of pig farming (36.4%), consumption (31.8%), and because they had grown up rearing pigs (9.1%). All of the respondents in Khayelitsha reared pigs for a source of income. Less than half (40.7%) of Khayelitsha farmers kept pigs for the pleasure of it, even less

kept them as an investment (22.2%) or for consumption (22.2%), and only 7.41% made use of their manure.

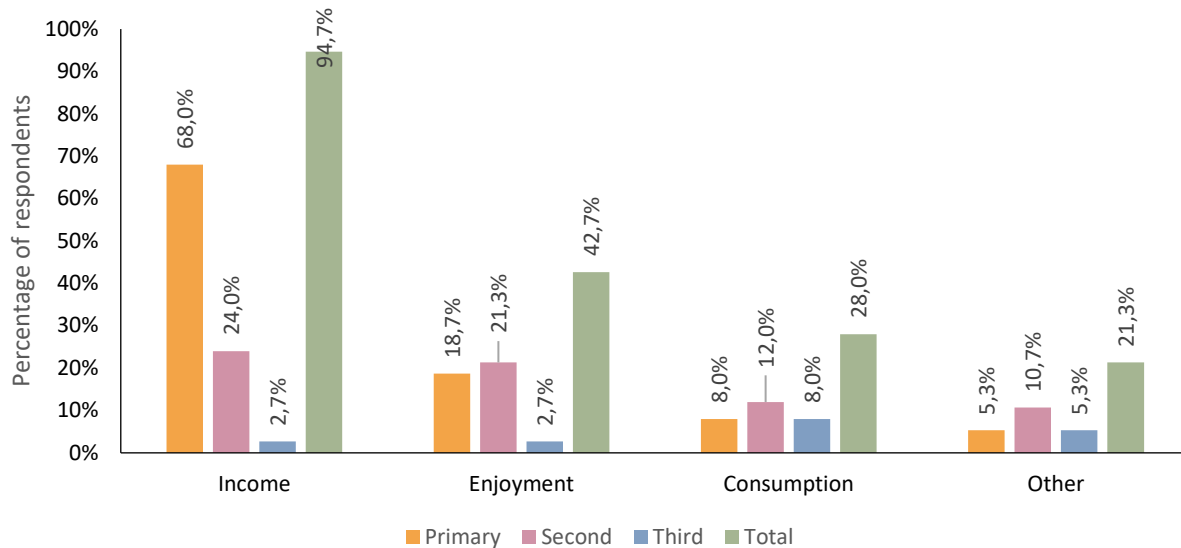


Figure 3.4. Reasons provided by small-scale farmers in the Western Cape for rearing pigs

Although emerging small-scale pig farmers produce poorly in comparison to commercial operations (Mokoele, 2015), small-scale pig rearing has been found to be profitable (Duniya *et al.*, 2013). It can be assumed that livestock keeping makes a financial contribution to many farmers across the study areas; 94.7% of farmers kept pigs for income (Figure 3.4.), 92% sold pigs, and 73% reported that the livestock was a source of income for their household (Figure 3.3).

3.4.4 Experience and future plans

The overall amount of time spent farming by farmers in the Western Cape ranges from new farmers just starting up to farmers who have been farming with pigs for over thirty years. Nearly half the farmers (49.3%) have been farming with pigs between one and nine years (Table 3.3). Similarly, 38% of small-scale farmers from Cambodia have been farming for over a decade (Strom *et al.*, 2017). Few of the farmers interviewed (5.3%) had been farming with pigs for less than a year and nearly a tenth of the farmers had been farming for more than 20 years. The longest a respondent had spent farming with pigs was found to be 32 years while the shortest was 5 months. A difference between regions was found for the length of time farmers practiced pig farming ($P < 0.05$). Mamre farmers seemed to have the most experienced farmers in terms of years spent rearing pigs; the majority of farmers from this area had reared pigs between 11 and 15 years (42.3%). The other

two study areas, Malmesbury and Khayelitsha, had no farmers who had farmed for more than 30 years while 11.5% of Mamre farmers had farmed with pigs for at least three decades.

Table 3.3. Farming experience in years for small-scale pig farmers in the Western Cape.

Length farming (years)	Mamre		Malmesbury		Khayelitsha		Total	
	N	%	N	%	N	%	N	%
<1	1	3.9		0.0	3	11.1	4	5.3
1 TO 9	7	26.9	14	63.6	16	59.3	37	49.3
10 TO 19	13	50.0	8	36.4	6	22.2	27	36.0
≥20	5	19.2		0.0	2	7.4	7	9.3
Total	26	100	22	100	27	100	75	100

When asked about the plans they have for their farms, all respondents from Khayelitsha stated that they would like to expand on their pig farming practices and the majority of farmers from Mamre (80.8%) and Malmesbury (81.5%) said the same ($P < 0.05$). Overall most small-scale pig farmers (87.8%) indicated that they want to expand their pig farm however; many also commented that various reasons limit them from doing so. These reasons include limited space to expand, insecurity on the land they are farming on, lack of capital and/or support from the government. Farmers who did not plan to expand but wanted to continue farming as is (5.4%) stated that the main reason for their decision was that they were at capacity in terms of finances and/or space with the number of pigs they could maintain, this made up 11.5% of Mamre respondents and 4.6% of Malmesbury respondents. Seven percent of the farmers interviewed planned on stopping because they were uncertain about the land they were farming on, were getting too old and/or because they had been doing it for so long that, they had lost their desire to continue. Two farmers were from Mamre and three from Malmesbury.

With 45.3% of farmers reporting that they had at least 10 years' experience with pig rearing, 88% of farmers reporting that they would like to expand their pig farming, with 43% of farmers stating that they farmed because they enjoy it; it can be believed that many farmers across the study area showed ambition towards their farming practices. Similar results were found by Umeh *et al.* (2015) with regards to farming experience. Umeh *et al.* (2015) also found that farming experience may have a positive impact on technical efficiency and managerial abilities. It can thus be concluded that majority of small-scale pig farmers in the Western Cape desired to grow their pig farming

enterprises. This indicates that there is a need for continuous governmental support, especially in the form of training, to equip these farmers with the necessary insight to improve their piggeries. Was there any correlation between experience and the desire to expand? What can you conclude about experience and future plans?

3.4.5 Generational exposure to pig farming

Nearly half of the farmers stated that their parents had kept pigs (49.3%) with the rest stating that they did not (50.7%). Significant differences among the three areas for the number of farmers whose parents kept pigs was noted; Mamre had the greatest percentage of farmers whose parents had owned pigs (69.2%). From Mamre farmers who could recall the breeds owned by their parents, the Large White, Landrace and Hampshire breeds were mentioned. In Malmesbury a larger percentage of farmers (63.6%) stated that their parents had never kept pigs. Breeds mentioned by these farmers whose parents had kept pigs were the Large White, Landrace, and cross breeds. The majority of farmers in Khayelitsha (59.3%) stated that their parents had not kept pigs. Those Khayelitsha farmers whose parents did keep pigs mentioned breeds such as the Large White, the Landrace, Duroc, Hampshire, some cross breeds and Windsnyer. Most farmers whose parents kept pigs stated that their parents reared exotic breeds. All farmers in this study bred with crossed breeds with the three main breeds mentioned by farmers interviewed for this study being the Large White (86.1%), Landrace (68.1%) and Duroc (18.1%). The results indicate that farmers preferred to keep exotic breeds, like their parents before them.

3.4.6 Support and training

Other than training, none of the farmers had received any support from government and/or organizations specific to their pig farming enterprise. The majority of small-scale pig farmers (62.7%) stated that they had some sort of formal training on pig rearing. No significant differences were found among the three study areas in terms of how many respondents had gone for training. However, more farmers from Malmesbury (54.6%) reported that they had not received any training than those who had. Moreover, some of those who had received training in Malmesbury specified that they had done it many years ago. Most respondents from Mamre (69.2%) and Khayelitsha (70.4%) had gone for training on pig rearing. Training times ranged from only a few hours over a weekend to once a week for six months. Most courses were a few days long and covered basic management practices such as vaccinations, injections, castration, nutrition, handling, housing,

and/or reproduction. Farmers mentioned Agrimark (an agricultural retail and trade store), Elsenburg college (a governmental agricultural training institute in the Western Cape), DAFF (Department of Agriculture, Forestry and Fisheries) and the SPCA as the organizations that offered training regularly. The impact of training on the production outputs of small-scale pig farmers in the Western Cape is further discussed in Chapter 5.

3.5 Conclusion

Male farmers dominated across the three small-scale pig-producing areas evaluated and farmers generally employed male workers instead of females. This suggests that women are not well represented amongst small-scale farmers in the Western Cape and opportunities to get involved in farming are given more to males. This is contrary to what is seen in other provinces in South Africa and other developing countries where women were more often found farming with pigs at small-scale level than men. Most farmers were over 40 years old, indicating that the youth generally do not participate in pig farming. Women as well as the youth should be encouraged to take part in farming, as it is an opportunity to provide extra income for their household, create jobs and could be an alternative to further education or even reduce the financial burden of said education costs.

English, Afrikaans and isiXhosa were the three main languages spoken and understood by farmers. Ninety-nine percent of farmers could understand and/or speak at least one of these three languages. It is recommended that, training should be provided for these farmers in these three languages.

Education was relatively low amongst small-scale pig farmers in the Western Cape. This could be disadvantageous to them as previous studies have shown that farmers with higher education were often able to access information easier and adapt to new and improved farming practices and technology with greater ease than farmers with lower education that are farming in the same area. Small-scale farmers in the Western Cape should, therefore, be encouraged by governmental officials to further their education if possible. Their minds should also often be stimulated by frequent or, at the very least, annual workshops to inform them on the latest advancements in pig rearing.

Livestock has been shown to make a financial contribution to farmers farming across all three study areas, with majority of farmers stating that pig rearing provided them a source of income. Nearly ninety-percent of farmers want to grow and expand their piggery this shows the ambition

many farmers have for their farming practices. This all highlights the importance of pig rearing across the three study areas.

Although there were no differences found among the three areas as pertaining to those who had gone for training on pig rearing and those who had not, fewer farmers from Malmesbury indicated that they had any training. Farmers from Malmesbury who did state that they had gone for training also mentioned that it had been more than 6 years ago. There is thus a great need for training in that area but training is also a critical part of pig rearing and the development of small-scale farmers. Workshops and training on pig rearing should be available to farmers, especially small-scale farmers, as frequently as possible.

3.6 References

- Abdu-Raheem, K.A. & Worth, S.H., 2011. Household Food Security in South Africa: Evaluating Extension's Paradigms Relative To the Current Food Security and Development Goals. *Landbouvoorl./S. Afr. J. Agric. Ext.* 39, 91–103. Available at: <http://www.scielo.org.za/pdf/sajae/v39n2/08.pdf>.
- Adetunji, M.O. & Adeyemo, K.E., 2012. Economic Efficiency of Pig Production in Oyo State, Nigeria : A Stochastic Production Frontier Approach. *Am. J. Exp. Agric.* 2, 382–394.
- Altman, M., Hart, T., & Jacobs, P. 2009. Food Security in South Africa. *Hum. Sci. Res. Counc.* 1, 1–29. Available at: <http://www.tandfonline.com/doi/abs/10.1080/03031853.1992.9524684>.
- Atkinson, R. & Flint, J. 2001 Accessing Hard to Reach Populations for Research. *Soc. Res. Updat.* doi: 10.1016/j.jchromb.2016.02.033.
- Costard, S., Porphyre, V., Messad, S., Rakotondrahanta, S., Vidon, H. 2009. Multivariate analysis of management and biosecurity practices in smallholder pig farms in Madagascar. *Prev. Vet. Med.* 92, 199–209. doi: 10.1016/j.prevetmed.2009.08.010.
- Department of Agriculture, Forestry and Fisheries. 2012. Integrated Growth and Development Plan 2012. [online] Available at: <<https://www.daff.gov.za/docs/Policy/IGDP121.pdf>> [Accessed 07 August 2019]
- Duniya, K.P., Akpoko, J.G., Oyakhilomen, O. & Nandi, J.A. 2013. Measurement of Pig Production Profitability in Zangon Kataf and Jema'a Local Government Areas of Kaduna State, Nigeria.

- Curr. J. Appl. Sci. Technol. 3, 1455–1463. doi: <https://doi.org/10.9734/BJAST/2014/4137>
- En.climate-data.org. (n.d.). *Climate Western Cape: Temperature, climate graph, Climate table for Western Cape - Climate-Data.org*. [online] Available at: <https://en.climate-data.org/africa/south-africa/western-cape-469/>[Accessed 4 Feb. 2020].
- Gcumisa, S.T. 2013. The untold story of the pig farming sector of rural Kwazulu-Natal: A case study of Uthukela District. MSc thesis. Available at: http://uir.unisa.ac.za/bitstream/handle/10500/14146/dissertation_gcumisa_st.pdf?sequence=1.
- Ibitoye, S.J., Shaibu, U.M., Sanda, M.E. & Oshadare, D. 2016. Economic Analysis of Local Swine Production Among Small Scale Farmers in Kabba/Bunu Local Government Area of Kogi State, Nigeria. *Gashua J. Irrig. Desertif. Stud.* 2, 1–11.
- Kagira, J.M., Kanyari, P.W.N., Maingi, N. & Githigia, S.M. 2010. Characteristics of the smallholder free-range pig production system in western Kenya. *Trop. Anim. Health Prod.* 42, 865–873. doi: 10.1007/s11250-009-9500-y.
- Kimbi, E.C., Mlangwa, J., Thamsborg, S. M., Mejer, H., Lekule, F.P. 2016. Smallholder Pig Marketing Systems in the Southern Highlands of Tanzania. *J. Nat. Sci. Res.* 6, 87–98.
- Kirsten, J.F. & van Zyl, J. 1998. Defining small-scale farmers in the South African context. *Agrekon.* 37, 551–562. doi: 10.1080/03031853.1998.9523530.
- Komba, E.V.G., Kimbi, E.C., Ngowi, H.A., Kimera, S.I., Mlangwa, J.E., Lekule, F.P., Sikasunge, C.S., Willingham, A.L., Johansen, M.V., Thamsborg, S.M. 2013. Prevalence of porcine cysticercosis and associated risk factors in smallholder pig production systems in Mbeya region, southern highlands of Tanzania. *Vet. Parasitol.* 198, 284–291. doi: 10.1016/j.vetpar.2013.09.020.
- Madec, F., Hurnik, D., Porphyre, V. & Cardinale, E. 2010. Good practices for biosecurity in the pig sector: issues and options in developing and transition countries. FAO.
- Madzimure, J., Chimonyo, M., Zander, K.K. & Dzama, K. 2012. Potential for using indigenous pigs in subsistence-oriented and market-oriented small-scale farming systems of Southern Africa. *Trop. Anim. Health Prod.* 45, 135–142. doi: 10.1007/s11250-012-0184-3.

- Matabane, M.B., Nethenzheni, P., Thomas, R., Netshirovha, T.R., Norris, D., Nephawe, K.A. & Nedambale, T.L. 2015. Status of the smallholder pig farming sector in Gauteng Province of South Africa. *Appl. Anim. Husb. Rural Develop.* 8, 19–25. Available at: www.sasas.co.za/aahrd/.
- Meissner, H.H., Scholtz, M.M. & Palmer, A.R. 2013. Sustainability of the South African livestock sector towards 2050 Part 1: Worth and impact of the sector. *S. Afr. J. Anim. Sci.* 43, 282–297. doi: 10.4314/sajas.v43i3.5.
- Mokoele, J.M. 2016. Reasons for poor production among the emerging small-scale pig farmers of the Limpopo province of the Republic of South Africa. MMed Vet., University of Pretoria.
- Munzhelele, P. 2015. Evaluation of the production systems and constraints of smallholder pig farming in three agro-ecological zones of Mpumalanga province, South Africa. MSc (Agric) thesis, University of South Africa.
- Mutua, F.K., Arimi, S., Oraga, W., Dewey, C., Schelling, E. 2010. Farmer Perceptions on Indigenous Pig Farming in Kakamega District, Western Kenya. *Nord. J. African Stud.* 23, 43-57. Available at: <http://www.lrrd.org/lrrd23/7/mutu23144.htm%5Cnhttp://hdl.handle.net/10568/5369>.
- Pienaar, L. & Traub, L.N. 2015. Understanding the smallholder farmer in South Africa : Towards a sustainable livelihoods classification. No. 1008-2016-79955.
- Saka, J.O., Adeshinwa, A.O.K. & Ajala, M.K. 2010. Incidence of African Swine Fever (ASF) disease and its associated implications on pig production in Lagos State, Nigeria. 16, 80-90.
- StatsSA. 2011. [online] Available at: <<http://www.statssa.gov.za/>>. [Accessed 6 July 2018]
- Strom G, Djurfeldt, A. A., Boqvist S., Albiñ A, Sokerya S, San S, Davun H, Magnusson, U. 2017. Urban and peri-urban family-based pig- keeping in Cambodia: Characteristics, management and perceived benefits and constraints. *PLoS ONE.* 12, 1–13. Available at: <https://doi.org/10.1371/journal.pone.0182247>.
- Thamaga-Chitja, J.M. & Morojele, P. 2017. The Context of Smallholder Farming in South Africa: Towards a Livelihood Asset Building Framework. *J. Hum. Ecol.* 45, 147–155. doi: 10.1080/09709274.2014.11906688.

TIBCO Software Inc. 2018. Statistica (data analysis software system), version 13. <http://tibco.com>

Umeh, J.C., Ogbanje, C. & Adejo, M.A. 2015. Technical Efficiency Analysis of Pig Production : A Sustainable Animal Protein Augmentation for Nigerians. J. Adv. Agric. Technol. 2. doi: 10.12720/joaat.2.1.19-24.

Visser, D. 2014. Modern Pig Production. Available at:
<https://books.google.co.za/books?id=mpXorQEACAAJ>.

Chapter 4

Farming characteristics of small-scale pig farming systems in the Western Cape, South Africa

4.1 Abstract

The aim of this study was to uncover the farming characteristics of small-scale pig farmers in the Western Cape, South Africa. Farmers were often found farming with poultry as well as pigs. Quantitative data was gathered by means of a structured questionnaire and supplemented with qualitative data gathered through a focus group. The relationships between continuous response variables and nominal input variables were analyzed using appropriate analysis of variance (ANOVA). For the comparison of ordinal response variables and nominal input variables, non-parametric ANOVA methods were used. The number of pigs owned did not differ among the three study areas. On average, small-scale pig farmers in the Western Cape kept more pigs than seen in other developing countries and provinces of South Africa. This shows that there is a greater market available for these farmers. Most farmers stated that they sell to anyone willing to buy, indicating that they did not have a stable market to sell to. Other farmers stated that they sold to private buyers or the informal market. This provides those living in informal settlements with affordable protein. It is, however, dangerous as no regulations exist for the trading and slaughtering of these pigs. Twenty-eight percent of farmers did not mark their pigs for identification. This is illegal and increases the risk of livestock theft. Eighty-five percent of sows and 72.0% of boars used for breeding were obtained from the same area, either by selecting from the herd or from neighboring farmers, which increases the risk for inbreeding. This chapter discusses the farming characteristics and management practices of small-scale pig farmers in the Western Cape.

Keywords: biosecurity, informal market, inbreeding, swill feeding

4.2 Introduction

Livestock forms an integral and indispensable part of social life and sustenance of poor communities in South Africa (Meissner *et al.*, 2013). Pig farming in particular has shown to play an important role in improving the livelihood of emerging small-scale pig farmers in Limpopo (Mokoele, 2015) and Kwazulu-Natal (KZN) (Gcumisa, 2013). Meissner *et al.*, (2013) also stated that livestock farming provides sustenance to poor communities in South Africa, improving the livelihood of people living in rural areas. Farming with pigs has proven to have a similar impact

on the livelihood of people living in the rural areas of Western Kenya (Mutua *et al.*, 2010), Tanzania (Kimbi *et al.*, 2016) and Madagascar (Costard *et al.*, 2009).

Previous studies have shown that small-scale farmers can benefit from farming with pigs be it for generating extra income or for providing protein in the form of meat for household consumption (Gcumisa, 2013; Duniya *et al.*, 2013; Mutua *et al.*, 2010; Kagira *et al.*, 2010). Genetically, pigs are able to convert feed to meat more efficiently than ruminants (Roelofse, 2013), they also have a faster growth rate and breed easily, able to farrow twice a year and produce multiple piglets each time (Mutua *et al.*, 2010). Pigs require less space to be reared on than ruminants, especially when reared intensively (Mutua *et al.*, 2010; Gcumisa, 2013). Other benefits of keeping pigs include the production of manure for fertilizer (Meissner *et al.*, 2013) and some farmers in Western Kenya and KZN claimed that pigs and/or the fat they produce could be used to ward off evil spirits (Mutua *et al.*, 2010; Gcumisa, 2013).

Pig farmers in the rural sector, however, also face many challenges. One of the major challenges faced is disease outbreaks. South Africa, specifically, has been challenged with outbreaks of Classical Swine Fever (CSF) (Penrith & Vosloo, 2009) and Porcine Reproductive and Respiratory Disease (PRRS) (Oosthuizen, 2010), costing the country millions of Rands in compensation to the farmers for culling their pigs. In KZN, vaccination and biosecurity measures do not exist and treatment of sick pigs is minimal (Gcumisa, 2013). Duniya *et al.*, (2013) stated that the greatest constraints faced by emerging small-scale pig farmers in Nigeria are high cost of piglets, high cost of feeds, outbreak of diseases and high piglet mortality rates. This was also observed in Western Kenya where 81% of small-scale pig farmers lost production due to diseases and high cost or lack of feed (Kagira *et al.*, 2010). Other challenges such as parasites, poor housing, poor veterinary services, ineffective drugs and a general lack of knowledge on piggery management were highlighted by Dione *et al.* (2014). Nutrition is a great concern for the rearing of pigs in the rural communal sector. Some farmers cannot afford to feed commercial feeds (Dione *et al.*, 2014). Swill (food scraps/waste that is fed to pigs) is often the most common feed found for pigs (Gcumisa, 2013), with the concern lying in the spread of disease such as the PRRS outbreak in 2004 of which the probable cause was uncooked swill (Oosthuizen, 2010). Lack of sufficient space to keep pigs and poor record keeping are also problems, as well as feeding, marketing, and breeding as the main challenges affecting the sector (Mutua *et al.*, 2010).

The pig sector has the potential to contribute to the livelihood of farmers. However, unless data is gathered on the challenges and benefits faced by emerging small-scale farmers, this potential cannot be realized (Mutua *et al.*, 2010). This is especially true for small-scale pig farmers in the Western Cape as no baseline information currently exists on their farming characteristics. It has been noted through observation that farmers supported by government had better infrastructure, facilities, and better or improved breeding stock (Mokoele, 2015). Some studies have recommended the formation of farmer groups to increase profitability amongst small-scale pig farmers (Mutua *et al.*, 2010; Mokoele, 2015). Mentoring farmers on feeding, housing and controlled breeding (Gcumisa, 2013) and financial as well as pig production expertise (Roelofse, 2013) have also been suggested to improve on the success of pig farming in rural areas within the South African context. However, the needs of farmers must first be identified and highlighted before effective measures can be planned and put in place to address some of these challenges.

This chapter, therefore, focusses on the second objective of the study, which is to compare the nature of small-scale pig farmers across the three study areas in the Western Cape with the aims of highlighting strengths and weaknesses found within the sector.

4.3 Methods and Materials

The study site, statistical analysis and surveys used are described in Chapter 3.

The following null-hypothesis was constructed:

H₀: There is no significant difference between the different study areas with regards to the variables tested

The variables tested against the study areas were:

- Number of pigs owned in terms of
 - Total number owned
 - Mature boars owned
 - Mature sows and gilts owned
 - Suckling pigs owned
 - Weaners owned
- The number of pigs farmers slaughtered for household consumption over a 12 month period

- The number of pigs sold by farmers over a 12 month period
- Whether farmers kept records
- How farmers identified their pigs
- The type of housing systems used
- The type of materials used for pen construction
- The type of flooring used
- Whether farmers administered iron injections
- Whether farmers castrated their boars
- Whether farmers clipped the tails of their pigs
- Whether farmers clipped the teeth of their pigs
- Whether farmers cleaned outside their pens
- Whether farmers cleaned inside their pens
- Whether farmers disinfected their pens
- Whether farmers cleaned their water troughs
- What was done with manure after removal
- Whether farmers had a vaccination program
- Whether farmers made use of medication
- How farmers responded to sick pigs
- Whether farmers made use of veterinarians
- Whether farmers have experienced their pigs being stolen
- Whether farmers have experienced their pigs escaping
- Whether farmers have had problems with wild animals harming their pigs
- Whether farmers sent dead pigs for a post mortem
- Main cause of piglet mortalities
- Main cause of weaner mortalities
- Main cause of grower mortalities
- Main cause of breeding boar mortalities
- Main cause of breeding sow mortalities
- Marketing channels used
- Age at which pigs were sold

- Breeding boar obtainment
- Breeding sow obtainment
- Age at which gilts were first mated
- Births per year
- Litter sizes
- Whether or not farmers observed farrowing
- Whether or not farmers weaned their pigs
- Weaning age
- Piglet feed used
- Weaner feed used
- Grower feed used
- Breeding boar feed used
- Pregnant sow feed used
- Nursing sow feed used
- Empty sow feed used

4.4 Results and Discussion

4.4.1 Farm characteristics

Livestock owned by small-scale pig farmers

All 75 farmers interviewed had to own at least one pig; thus it is not surprising that most of respondents (92.0%) considered pigs to be their primary farming practice (Figure 4.1). Forty-four percent of respondents kept only pigs as livestock, while 56.0% of respondents had a secondary farming practice. Poultry was the second most popular farmed livestock species found amongst small-scale pig farmers, with 38.7% of respondents stating that they farmed with poultry as well as pigs. This was also seen in KwaZulu-Natal (Gcumisa, 2013), Cambodia (Strom *et al.*, 2017), and the Republic of the Congo (Kambashi *et al.*, 2014). Small-scale farmers in KwaZulu-Natal stated that they farmed with chickens because they were easier to rear and required less feed (Gcumisa, 2013), while farmers from Western Kenya kept them because they required little space (Kagira *et al.*, 2010). This is beneficial to small-scale farmers farming on communal farming sites where there is limited space to rear livestock on. Few farmers interviewed for this study farmed

with cattle (12.0%) and goats (16.0%). In the case of this study, other farming practices consisted of farming with sheep, horses, donkeys, rabbits and vegetables (Figure 4.1). No significant difference was found among the three areas in terms of the diversity of livestock farmed with.

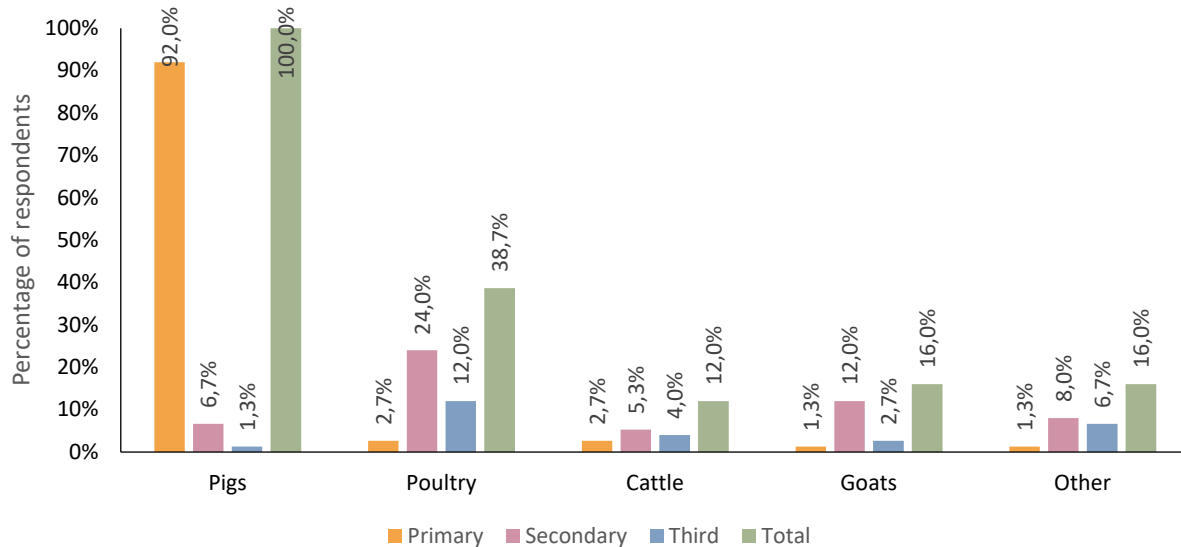


Figure 4.1. Different farming practices implemented by small-scale pig farmers in the Western Cape

Eighty-one percent of small-scale pig farmers interviewed in Mamre considered pigs to be their primary farming practice. Other primary farming practices listed by farmers were poultry (3.9%), cattle (7.7%), goats (3.9%) and sheep (3.9%). Fifty percent of farmers farmed with poultry, making it the second highest farming practice by small-scale pig farmers in Mamre. Goat farming followed with 19.2%, then cattle farming (15.4%), horses and donkeys (11.5%), vegetables (11.5%), sheep (3.9%) and rabbits (3.9%). Mamre had the most diverse farming practices of the three areas.

Ninety-five percent of farmers in Malmesbury farmed primarily with pigs with the other 4.6% primarily farming with poultry. Cattle farming was practiced by 18.2% of small-scale pig farmers while poultry farmers made up 13.6% of the Malmesbury respondents. Goats were kept by 9.1% of the respondents and 4.6% of farmers practiced other farming practices such as horse and donkey rearing.

All of the small-scale pig farmers in Khayelitsha stated that they considered pigs to be their primary farming practice. Poultry was found to be the highest secondary practice in this area with 48.2%

of farmers stating that they farmed with poultry as well. Nineteen percent of farmers farmed with goats, and 3.7% with cattle. Eleven percent of farmers farmed with other farming practices which included vegetable farming and sheep rearing.

These findings suggest that, in general, small-scale pig farmers in the Western Cape either preferred to farm solely with pigs, or farm with livestock that could be easily reared in smaller areas alongside their pig farming practices.

Pigs owned, sold and consumed

Small-scale farmers interviewed for this study seemed to own more pigs on average than what had been reported in other countries. On average, the Western Cape small-scale farmers kept 37.4 pigs while small-scale farmers in Western Kenya, Cambodia, and Nigeria owned 3.6, 12, and 18 on average respectively (Kagira *et al.*, 2010; Strom *et al.*, 2017; Chah *et al.*, 2014). In KwaZulu-Natal province, small-scale farmers owned five pigs per village (Gcumisa, 2013). No difference was observed for the number of pigs owned, regardless of their production stages, across the three areas, nor were there for the number sold or consumed over a twelve month period (Table 4.1.).

Table 4.1. Mean (\pm standard deviation) number of pigs owned, sold and consumed by small-scale farmers in the Western Cape.

	Mamre	Malmesbury	Khayelitsha	P
Total	40.5 \pm 53.3	24.1 \pm 18.4	45.3 \pm 63.5	>0.05
Boars	2.1 \pm 1.7	2.5 \pm 2.6	2.4 \pm 2.2	>0.05
Sows/gilts	14.6 \pm 19.2	7.8 \pm 7.8	12.2 \pm 9.3	>0.05
Suckling	13.7 \pm 20.6	8.0 \pm 9.8	5.8 \pm 10.0	>0.05
Weaners	10.2 \pm 21.5	6.5 \pm 8.7	10.6 \pm 17.1	>0.05
Consumption/years	2.6 \pm 3.1	1.9 \pm 4.2	1.0 \pm 1.3	>0.05
Sold/years	66.6 \pm 117.8	12.2 \pm 12.7	40.2 \pm 148.5	>0.05

Traceability and record keeping

The method by which farmers marked their pigs for identification did not differ across the three areas, neither did the number of respondents who kept records of their pigs. Majority of farmers (60.9%) made use of tattoo markings to identify their pigs, 5.8% made use of ear tags, and 4.3% clipped the ears of their pigs. Over a quarter of farmers did not use any method of identification to

mark their pigs. Not only is this illegal (Visser, 2014), it is also poor stockmanship as pigs need to be identifiable in order to keep proper records of specific pigs, which in turn allows the farmer to evaluate the performance of the pigs (Visser, 2014). Proper identification of pigs also protects farmers in the incidence of theft, without it farmers cannot claim their pigs back or report livestock theft to the proper authorities. Pigs also need to be identified so that, should problems occur or diseases break out, it can be traced back to its source (Madec *et al.*, 2010).

More farmers in Khayelitsha (47.8%) stated that they did not mark their pigs than in the other two areas (20.0% in Mamre and 14.3% in Malmesbury). Only 34.8% of farmers in Khayelitsha marked their pigs with tattoos, the rest made use of ear clippings (8.7%) or ear tags (4.3%) or a combination of methods (4.3%). Most farmers in Malmesbury made use of tattoos (76.2%), the rest tagged their pigs' ears (9.5%). Seventy-two percent of farmers from Mamre made use of tattoos, the rest made use of ear clippings or tags (4.0% respectively). Just over half of respondents stated that they did keep records of their pigs. Farmers commented that they stored these records by use of a logbook, laptop, tablet or sheets of paper. A few farmers reported that they only kept records to monitor things such as the birth dates of piglets, number of pigs owned and/or to know when to put the sow back with a boar. Forty-eight percent of respondents from Mamre kept records, 52.4% from Malmesbury, and slightly more (53.9%) from Khayelitsha. Poor record keeping amongst small-scale pig farmers was also observed elsewhere in South Africa, particularly in Gauteng (Matabane *et al.*, 2015), KZN (Gcumisa, 2013), Mpumalanga (Munzhelele, 2015), the Eastern Cape (Madzimore *et al.*, 2013) and Limpopo (Mokoele, 2015). Mokoele *et al.*, (2015) stated that lack of records was one of the factors limiting improvement for small-scale pig farmers. Record keeping was also poor amongst small-scale farmers in Western Kenya (Mutua *et al.*, 2010) and Nigeria (Ibitoye *et al.*, 2016). Poor or no record keeping makes it difficult to design a breeding program (Montsho & Moreki, 2012; Gcumisa, 2013) and evaluate the financial wellness and production of the farm (Mokoele, 2015). It also makes it difficult to validate the answers given by farmers when doing research or gathering information for agricultural improvement (Mokoele, 2015). By keeping records of sows mated, farmers can reduce inbreeding and predict farrowing dates to ensure that proper preparations are made for when sows farrow (Gcumisa, 2013). Farmers should be encouraged and trained on record keeping. This could also assist state veterinarians, extension officers, the SPCA, universities, and other institutions who need detailed information from farmers

in order to implement solutions to common problems and design workshops that address the most urgent needs of the farmers.

4.4.2 Housing and materials used

Housing

The majority of the small-scale pig farmers (58.7%) stated that they farmed intensively with their pigs. This was beneficial as keeping pigs in intensive systems protects the public from diseases (Lekule & Kyvsgaard, 2003), increases production (Mutua *et al.*, 2010), weight gain and profit (Dione *et al.*, 2014). It has also been found to lower pre-weaning mortalities (Madzimure *et al.*, 2013). In accordance with the present results, Gcumisa (2013) in KZN and Matabane *et al.*, (2015) in Gauteng demonstrated that most small-scale pig farmers keep their pigs in intensive structures. This is, however, in contrast to small-scale pig farmers in Mpumalanga, who mainly allowed pigs to roam freely or kept them in semi-intensive systems (Munzhelele, 2015). For the present study thirty-nine percent practiced semi-intensive pig farming, where farmers usually build their pig houses inside a camp. In these camps, pigs roam freely within the confines of the farmer's property, separate from other pigs. Certain farmers only allowed a specific production stage to roam in the camp, such as suckling pigs, weaners, boars or empty sows. The rest of the small-scale pig farmers interviewed for this study practiced extensive pig rearing (2.7%) where pigs had an open camp to roam through with simple shelters to protect from extreme weather without confining them. Images 4.1 – 3 presents some of the different housing systems seen across the three study areas. No differences were found among the three study areas and type of housing system used ($P > 0.05$). During a focus group discussion, farmers talked over their frustrations about free roaming pigs in the area. They mentioned that many farmers, especially those in the Malmesbury area, allowed their pigs to roam freely during the day to scavenge for food and water, this not only holds risk for the farmer self, but surrounding pigs and farmers as well (Images 4.4 – 5). Dione *et al.* (2014) stated that theft was most common when piglets were allowed to scavenge for their food. Madec *et al.* (2010) stated that the scavenging pig system is the most basic traditional system of pig rearing and is most commonly reported in rural and urban areas of developing countries. Farmers commented that pigs only leave the confines of their pens if not well taken care of. Farmers also stated that roaming pigs resulted in uncontrolled mating, easy transfer of diseases, theft, and pigs fighting, but roaming pigs also tried to break into their pens from the outside and

thus allow other farmers' pigs to escape. Munzhelele (2015) stated that the scavenging pig system allows pigs to scavenge for feeds with no disease control and results in inbreeding due to uncontrolled mating and leaner meat due to the amount of exercise pigs get from walking around the area. It was also observed by Munzhelele, (2015) that scavenging pigs search for food around sewerages and garbage areas, as also noted in Malmesbury, as mentioned by one farmer during the focus group. A study in Tanzania found that human faeces could be easily accessible to escaping and scavenging piglets (Kimbi *et al.*, 2016). This increased the risk of diseases and infections (Beltrán-Alcrudo *et al.*, 2008; Munzhelele, 2015). Studies have shown that some small-scale farmers allow their pigs to roam when they are away to reduce feed and resource costs (Phengsavanh, 2013; Dione *et al.*, 2014). Incidences of the scavenging system were seen in the Eastern Cape (Madzimure *et al.*, 2013), Kwazulu-Natal (Gcumisa, 2013), Mpumalanga (Munzhelele, 2015), Uganda (Dione *et al.*, 2014), Tanzania (Komba *et al.*, 2013), and Western Kenya (Kagira *et al.*, 2010).



Image 4.1. Weaner pigs housed in an intensive system in Mamre with the bottom of a plastic container used as a feeding trough



Image 4.2. Piglets in a semi-intensive system (intensive structure at the back) with concrete flooring



Image 4.3 (A and B). Semi-intensive systems where pigs are free to roam in a confined camp area with intensive systems for when the farmer decides to confine them



Image 4.4. Roaming pigs in Malmesbury



Image 4.5. A roaming pig amongst other livestock and garbage

Building materials used for housing

The materials used for the construction of pig pens differed across the three study areas ($P < 0.05$) due to the numerous materials reported by the farmers. The most popular materials pens were constructed of across the three areas were wood (40.0%), corrugated iron (16.0%), or a combination of the two (32.0%). Other materials used to construct pens were cement blocks (5.3%), polystyrene (1.3%), or plastic (1.3%). Efforts to reduce resource costs were also noted in the construction of pens. Iron and wood were the most common materials found for the construction of pig pens in Mamre with 53.9% of farmers making use of a combination of the two to construct their pens. Twenty-seven percent primarily used corrugated iron, and 7.7% primarily used wood. Other materials used by farmers in Mamre for the construction of pig pens were cement blocks, used by 7.7% of small-scale farmers, and one farmer made use of polystyrene. Similarly, small-scale pig farmers in Malmesbury also preferred iron and wood. Thirty-six percent built pig pens from wood, 31.8% used a combination of iron and wood, while 9.1% used mainly iron, and another 9.1% made pens from cement blocks. Some farmers had open enclosures that did not have pens (4.6%) others used any materials they could find. As with the other two areas, Khayelitsha farmers favoured iron and wood. A large percentage (74.1%) of farmers constructed their pig pens with wood, 11.1% used simply iron, and another 11.1% made use of a combination of the two. Other materials used by farmers were plastic or polystyrene. Some of the materials used to construct pens are presented below (Images 4.6 – 9).



Image 4.6. A pen constructed of cement blocks



Image 4.7. A pen constructed of corrugated iron



Image 4.8. A pen constructed of wood with corrugated iron used for the roof and soil flooring



Image 4.9. Multiple materials used for the construction of pens

Farmers are thought to prefer wood because it is cheaper and easier to obtain than most other materials. It is also easy to repurpose when making use of discarded wooden structures. Corrugated iron, on the other hand, is strong and provides shelter from the rain without wearing and rotting like wood, as mentioned by farmers. During a focus group discussion, farmers commented that they make use of second hand iron plates to reduce the risk of theft, making it a cheaper material to use. Small-scale pig farmers' preference for wood and iron was also reported in previous studies (Gcumisa, 2013; Roelofse, 2013; Munzhelele, 2015). Dione *et al.*, (2014) stated that the housing constructed by pig farmers is strongly dependent on the financial status of the farmer, which was clearly seen across the three study areas as most farmers made use of materials that could be easily repurposed and were, therefore, either free or more affordable. Findings by Nath *et al.*, (2013), Gcumisa, (2013) Roelofse, (2013) and Munzhelele, (2015) further support the idea that small-scale pig farmers make use of cheap and locally sourced materials.

Flooring

When combining the results from the three areas, flooring consisted of either concrete (62.7%), soil (29.3%) or wood (8.0%). Concrete flooring is the preferred type of flooring used for pig rearing as it is easy to clean and disinfect and, when slanted, it facilitates the flow of water out of the pens (Madec *et al.*, 2010). It is also more durable than other materials, making it more economical for long term farmers (Nath *et al.*, 2014). Soil flooring has proved to be impossible to disinfect (Madec *et al.*, 2010), but was found to be used by majority of farmers in Kwa-Zulu Natal (Gcumisa, 2013) and Kenya (Kagira *et al.*, 2010). Although wood flooring could be as effective as concrete initially, it tends to rot and result in injuries to the pigs, as mentioned by one farmer. The use of wood flooring was previously observed in the Himalayas (Nath *et al.*, 2013). The type of flooring used by small-scale farmers across the three areas differed ($P < 0.01$). This difference may have been as a result of the large percentage of Mamre farmers that had laid concrete flooring for their pigs (96.2%). The rest of the Mamre farmers made use of soil flooring (3.9%). Farmers from Malmesbury used concrete flooring (54.6%), soil (40.9%), or a combination of the two (4.6%), for their pig pens. In Khayelitsha, more farmers had soil flooring for their pigs (44.4%) while the rest had concrete (33.3%) or wood (22.2%). Soil proved to be a problem around winter time when the rain would cause thick layers of mud which pigs sunk into (Image 4.10). Farmers who could afford it bought wooden slates to lay over the mud and provide some relief for their pigs (Image 4.11).

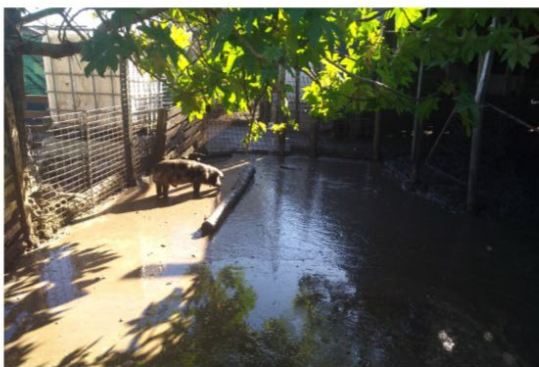


Image 4.10. Mud problems in Khayelitsha



Image 4.11. Farmers throw planks on the mud for temporary solutions

Bedding

A total of 56 farmers reported that they lay bedding, however, the questionnaire was changed some time after the interviews were completed in Khayelitsha where the use of bedding became a separate question and thus emphasis was placed on it for farmers to answer. This meant that there may have been respondents who did in fact make use of bedding but did not indicate that they did. Thus, at least 74.7% of farmers interviewed for this study laid bedding for their pigs. Some farmers admitted that they only lay down bedding when sows are about to farrow or during winter to try and shield piglets from the cold. Sawdust seemed to be the preferred material used for bedding amongst small-scale pig farmers interviewed for this study. Seventy-one percent of respondents made use of sawdust while 14.3% stated that they did not use any bedding. Other materials used for bedding included straw, sawdust, soil, kaff, and newspapers.

4.4.3 Health and biosecurity

Post-farrowing management practices

Piglets are born with low iron levels, they ingest some iron through the sow's milk but their iron quantity decreases rapidly if not supplemented (Visser, 2014). Most farmers (87.7%) indicated that they injected their pigs with iron (Figure 4.2). Sixty-five percent of farmers administered iron injections within the first week of the piglet's life. Fifty-two percent stated that they did this during the first three days after farrowing. These farmers stated that they did so according to the instructions on the iron supplement they bought. Some of the farmers waited until the piglets were weaned before administering iron injections. The number of farmers who administered iron injections did however differ across the three study areas ($P < 0.01$), this was likely due to the fact that all respondents from Mamre stated that they administer iron injections. In Uganda, some farmers released pigs to scavenge and ingest the soil as they believe red-soil contained natural iron (Dione *et al.*, 2014), a few farmers in the present study also mentioned doing something similar.

Castration is performed to prevent uncontrolled mating (Madzimore *et al.*, 2013). It is also done to prevent boar taint in the meat of male pigs and ease management after boars reach sexual maturity (Visser, 2014). The SAPPO Welfare Code (2012) recommended that castration without anesthetic be done before seven days of age, after which boars may only be castrated by a licensed veterinarian with the use of an anesthetic. However, due to the pain this inflicts on pigs, European stakeholders are moving away from surgical castration and are working to develop pork production

systems void of this practice (Weiler & Bonneau, 2019). Just over half of all farmers interviewed (54.8%) castrated their boars, this practice differed across the three study areas ($P < 0.05$). This difference was especially seen between the Khayelitsha and Mamre areas. More than three-quarters of farmers in Khayelitsha castrated their boars while this was only practiced by half of the farmers interviewed in Malmesbury, and only 36.0% of farmers in Mamre. Similar results were seen in Western Kenya, where 49% of farmers castrated their boars (Kagira *et al.*, 2010). Most small-scale farmers in the Himalayas and Uganda castrated their pigs (Nath *et al.*, 2013; Dione *et al.*, 2014). Farmers commented that they made use of surgical knives or blades to castrate the boars. Responses on the age of boars when castrated ranged anything from three days old and older. The implications of castrating boars in these areas could prevent or reduce aggression in boars and reduce the risk of uncontrolled mating should the pigs escape from their pens.

Tails of pigs are clipped to prevent other pigs chewing on the tails and cannibalism amongst piglets (Visser, 2014). Teeth clipping is not approved by the SAPPO Welfare Code for Pigs, unless the piglets are causing severe damage to the sow's teats or each other (SAPPO, 2012; Visser, 2014). Hardly any farmers clipped the teeth or tails of their pigs (16.2%). This was also seen amongst small-scale farmers in Uganda (Dione *et al.*, 2014). The number of farmers who clipped the teeth of their pigs differed across the three areas ($P < 0.05$) but it did not for the number of farmers who clipped the tails of their pigs ($P > 0.05$). Although more farmers in Mamre (28.0%) seemed inclined to clip the teeth of their pigs than the other two areas (Figure 4.2). Malmesbury farmers showed the highest percentage of farmers to clip the tails of their pigs. Farmers who did clip the teeth of their pigs made use of side cutters to do so. Some farmers clipped the teeth within the first week after farrowing, others waited until the pig was mature. Farmers made use of various tools to remove the tails of pigs some of which were elastic bands, scissors, blades or knives. All the farmers who clipped the tails of pigs did so within the first four days after birth.

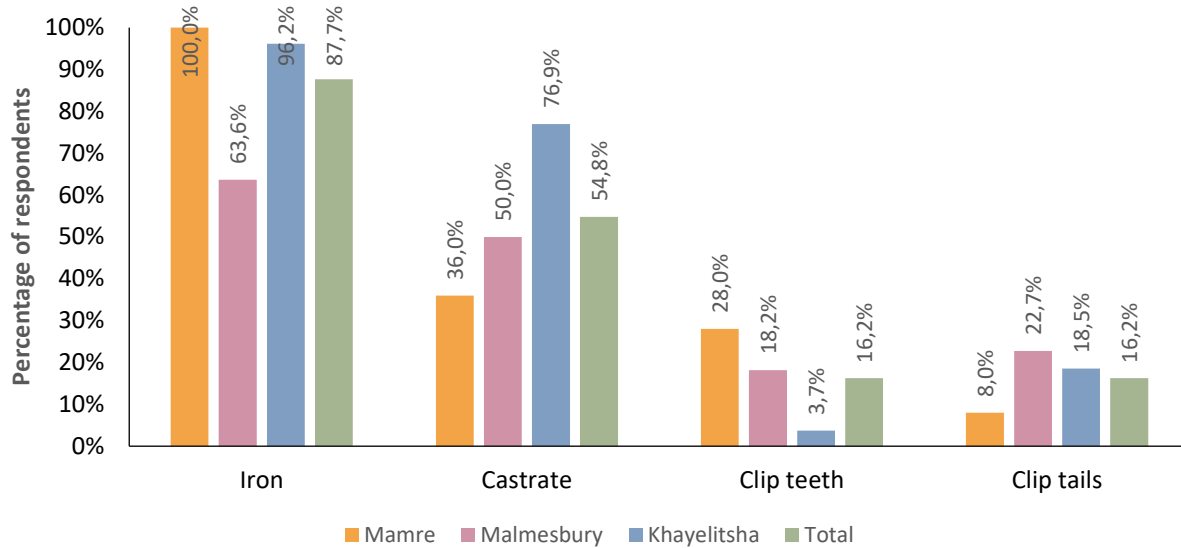


Figure 4.2. Post-farrowing management practiced by small-scale pig farmers

Biosecurity

With regards to cleanliness, most farmers reported to clean both inside (98.7%) and outside (86.5%) their pig pens (Table 4.2). Cleaning inside pens involved the removal of waste, such as manure, and other materials (such as bedding) that could allow the growth of harmful bacteria. Cleaning outside pens involved removing garbage and debris from around the pens. The frequency at which this was done varied amongst farmers. Certain farmers cleaned daily, others every second or third day, some only cleaned once a week. No differences were observed among farmers in this regard, but more farmers cleaned inside their pens than outside.

Malmesbury farmers differed from Mamre and Khayelitsha farmers for the number of farmers who disinfected their pens. Less than half (47.6%) of farmers from Malmesbury disinfected their pens while majority of farmers from Mamre (84.0%) and Khayelitsha (70.4%) did. This is interesting and makes sense for Malmesbury farmers as many of them made use of soil flooring, which is impossible to disinfect (Madec *et al.*, 2010). However, many farmers from Khayelitsha also made use of soil flooring and 70.4% still stated that they did disinfect their pens, leading to the assumption that certain farmers still attempt to disinfect their pens regardless of soil flooring. This can be done by diluting the disinfectant and spraying it over the sand. Certain farmers have mentioned clearing pigs and waste out of pens and then spraying it with disinfectant, this could destroy the top layer of bacteria and pathogens breeding there. For the disinfection of their pens

most farmers stated that they use Jeyes Fluid®, a common and affordable brand of disinfectant fluid in South Africa. The frequency at which farmers disinfected their pens also varied amongst farmers, ranging from those who stated they disinfected once a week to those who disinfected once a month. The variations seen in these results indicate that there is a need to educate pig farmers on the importance of disinfecting pens as well as how to properly disinfect various materials found in the construction of their pens.

Table 4.2. Percentages of small-scale pig farmers who clean and disinfect their pens in the Western Cape.

	Mamre		Malmesbury		Khayelitsha		Total		P
	N	Y	N	Y	N	Y	N	Y	
Outside	4.0%	96.0%	9.1%	90.9%	25.9%	74.1%	13.5%	86.5%	>0.05
Inside	0.0%	100.0%	4.6%	95.5%	0.0%	100.0%	1.4%	98.7%	>0.05
Disinfect	16.0%	84.0%	52.4%	47.6%	29.6%	70.4%	31.5%	68.5%	<0.05

Water troughs

Eighty-three percent of farmers provided water for their pigs by means of a water trough, the rest used nipple drinkers, some of whom attached them to buckets, and others connected them directly to a water source. Similar results were seen in KwaZulu-Natal (Gcumisa, 2013). The type of water troughs and nipple drinker systems can be seen below (Images 4.12 – 15). The cleaning of water troughs are a necessity to remove the algae build up and ensure that pre-existing bacteria does not contaminate the water. Clean, fresh water is an essential appetite stimulant (Kyriazakis & Whittemore, 2006). For those who had water troughs, 79.7% stated that they cleaned the troughs; water troughs were cleaned either daily or once or twice a week. A difference was found across the three areas for the number of respondents who cleaned out their water troughs ($P < 0.05$). All farmers interviewed in Mamre (100%) stated that they did clean out their water troughs, 77.3% did so in Malmesbury, and 66.7% in Khayelitsha. This indicates that most farmers in the study areas understood the importance of providing water in a clean trough.



Image 4.12. Water trough constructed of cement and bricks



Image 4.13. Bottom of a plastic container used as a water trough



Image 4.14. A nipple drinker attached to a plastic bucket



Image 4.15. Aerial shot of nipple drinker that is attached to a water source

Manure removal

The method of waste removal differed across the three areas ($P < 0.01$), this may be due to Malmesbury farmers having a primary method of dumping the manure off site and no respondents reported to make use of it in any different way. Farmers from Mamre largely kept it as compost for their own use (52.0%) while 28.0% dumped it off site, 12.0% gave it away and only 8.0% sold it. Forty-six percent of farmers from Khayelitsha dumped the manure as well while 25.0% kept it as manure, 21.4% sold the manure as compost and 7.1% gave it away. Overall, a greater percentage (56.8%) of farmers discarded of manure by dumping it on a heap away from their farm, while others kept it as compost (26.7%), sold it as compost (10.7%) or simply gave the manure away (6.7%). Faeces (especially from infected pigs) contain great concentrations of pathogens, viruses, bacteria and/or parasites that could contaminate feed, water and bedding (Madec *et al.*, 2010). Manure should thus be removed frequently to prevent contamination and possible infection of

pigs. Manure build up could also cause pigs to slip and injure themselves and cause ammonia build up in the pens.

Health of pigs

The number of farmers who made use of vaccination and veterinary services did not differ across the three areas, however, use of medication did (Table 4.3). This difference may have been as a result of all respondents from Mamre stating that they made use of medication for their pigs. Overall, it seemed that most farmers made use of medical assistance to treat their pigs. Farmers who did not make use of medication and vaccinations stated that they could not afford it. Small-scale farmers in Nigeria and the Democratic Republic of the Congo have also complained about being unable to afford medicine for their pigs (Kambashi *et al.*, 2014; Ibitoye *et al.*, 2016). Some farmers did not know they could contact veterinarian to help, an issue that was also seen in the Mpumalanga province (Munzhelele, 2015) and Kenya (Mutua *et al.*, 2010). There is, therefore, a definite need for stable relationships to be built between small-scale farmers and state veterinarians from the SPCA and extension services. It is recommended that farmer days be organized between the two parties for the purpose of educating farmers on pig health management as well as to allow farmers to become familiar with state veterinarians and extension officers. These farmer days can also serve to encourage farmers to purchase medication as a group to split the costs.

Table 4.3. Percentages of small-scale pig farmers in the Western Cape making use of medical assistance for pig health.

	Mamre		Malmesbury		Khayelitsha		Total		P
	N	Y	N	Y	N	Y	N	Y	
Vaccination	8.3%	91.7%	22.7%	77.3%	11.1%	88.9%	13.7%	86.3%	>0.05
Medication	0.0%	100.0%	50.0%	50.0%	11.1%	88.9%	17.7%	82.4%	<0.05
Veterinarian used	16.0%	84.0%	57.1%	42.9%	34.6%	65.4%	34.7%	65.3%	>0.05

Handling of sick pigs

The way farmers responded to sick pigs differed across the three study areas ($P < 0.05$). Table 4.4 gives an overview of how small-scale farmers in this study responded upon discovering a sick pig

in their piggery. All the farmers from Khayelitsha stated that they separated sick pigs from the herd and placed them into private pens for treatment. This was the response for most farmers in Mamre (79.2%) and Malmesbury (70.0%). From Table 4.4 it can be seen that only 4.3% of respondents had a veterinarian tend to sick pigs even though 65.3% of farmers stated that they made contact with a veterinarian when necessary. This suggests that farmers often tended to sick pigs on their own and only called for veterinarians in extreme cases. This tactic could be beneficial as it would reduce the amount of visits required from veterinarians. However, it may also be dangerous if farmers are unable to identify certain diseases. It is therefore recommended that training days be offered to the farmers on disease management and the identification of common pig diseases.

Table 4.4. Small-scale pig farmers in the Western Cape's responses to sick pigs

	Mamre		Malmesbury		Khayelitsha		Total	
	N	%	N	%	N	%	N	%
Cull or Kill	1	4.2	1	5.0		0.0	2	2.9
Leave in pen		0.0	2	10.0		0.0	2	2.9
Take to vet	1	4.2	2	10.0		0.0	3	4.3
No sick pigs	3	12.5	1	5.0		0.0	4	5.7
Remove	19	79.2	14	70.0	26	100.0	59	84.3
Total	24	100	20	100	26	100	70	100

4.4.4 Losses

Livestock theft is a common problem across South Africa (DAFF, 2013). It is also commonly seen amongst small-scale farmers in other developing countries (Duniya *et al.*, 2013; Dione *et al.*, 2014). The areas used in this study were no exception. The results show that a large percentage of farmers across the three areas experience a problem with theft. Sixty-two percent of farmers interviewed stated that they had experienced their pigs being stolen. However, the number of farmers who had experienced livestock theft differed significantly across the three areas. Theft was a massive problem in the Malmesbury area as 86.4% of farmers reported that they had

experienced their pigs being stolen (Table 4.5). Over half of farmers in Mamre also experienced problems with theft. Fewer farmers in Khayelitsha (46.2%) reported trouble with theft. This may be because farmers in the iThemba (Khayelitsha) area lived in the same area their pigs were reared in and would thus hear if there was an intruder on their property, whereas the communal farming site in Malmesbury and Mamre was separate from the area in which they lived.

Possible reasoning for the high incidences of theft in the Malmesbury area might be due to the farming sites being closely situated to the neighbourhood as well as a main road, making it easy for people to abduct pigs while also observing when the farmers were absent. Farmers from this area reported that their piglets are also often stolen by other farmers in the area who then place the piglets with their own sows. Respondents from all three areas had experienced theft of mature pigs where the thief/thieves would cut off the head of the pig or its ear with a tattoo or tag on and take the carcass. This was done to ensure that the pig could not be identified. One farmer from Malmesbury described an incident where someone had replaced her healthy piglets with their sick ones, forcing her to cull them all. Many farmers in the Malmesbury area (61.9%) also earn salaries and must go to work early in the morning then only come back in the evening, leaving their pigs unattended during the day. Results, as mentioned in Chapter 3, show that there is a difference between what farmers considered to be their largest source of income and experience of theft ($P < 0.01$). Eighty-one percent of farmers who stated that their main source of income was their salary had experience with their pigs being stolen, whereas only 27.3% of farmers who considered livestock to be their main source of income had experience with their pigs being stolen. Seventy-one percent of farmers who considered other sources of income to be their greatest source of income had experience with theft. This indicates that farmers who had a greater dependence on their pigs, such as those who considered livestock to be their main source of income, went to greater lengths to ensure that their pigs would not be stolen.

Not many farmers have experienced their pigs escaping ($P > 0.05$). Those who had commented that pigs escape more frequently in winter when the pens, which are usually made of wood, are wet. Other farmers stated that it was due to poor infrastructure, but pigs usually returned quickly because they became hungry. Appropriate pig structures must be built to prevent pigs escaping (Madec *et al.*, 2010; Komba *et al.*, 2013).

A quarter of farmers on average stated that they had a problem with wild animals posing a danger to their pigs. Many farmers stated that they had issues with dogs fighting with pigs or eating them ($P > 0.05$). Others described problems with mice and rats where the rodents stole the pigs' feed, bit the piglets, and/or startled the sow into stepping on her piglets. One farmer commented that he had an issue with snakes biting the pigs and another complained about birds stealing the pig feed. The intrusion of wild animals coming into contact with pigs should be prevented at all costs. To do so, farmers should ensure that the infrastructure is well maintained to prevent pigs from escaping and other animals from entering in. In the case of smaller animals, such as birds and rodents, pens should be kept clean, feed should be properly stored and regular rodent and pest control should take place to prevent birds and rodents from entering pens and bringing diseases in from outside (Madec *et al.*, 2010).

Table 4.5. An overview of external losses experience by small-scale pig farmers in the Western Cape.

Reasons for external losses	Mamre		Malmesbury		Khayelitsha		Total		P value
	N	% Yes	N	% Yes	N	% Yes	N	% Yes	
Stolen	15	57.7	19	86.4	12	46.2	46	62.2	<0.05
Escapes	4	15.4	5	22.7	7	25.9	16	21.3	>0.05
Wild animals	6	23.1	3	13.6	10	37.0	19	25.3	>0.05

4.4.5 Mortalities

Seventy-six percent of all farmers interviewed stated that they did not send dead pigs for post-mortem. In Mamre this comprised of 72.0% of farmers, in Malmesbury it was 85.7%, and in Khayelitsha, 72.0%, this response did not differ across the three study areas ($P > 0.05$). Madec *et al.* (2010) states that small-scale farmers should immediately inform veterinarians when unusual deaths of animals occur to control possible disease outbreaks. The main reasons stated by farmers for not sending dead pigs for post-mortem was because it is too expensive or because it seems unnecessary as they already know what the pigs died of. Other reasons were that they felt they

could not rely on the veterinarians, claiming that they either took too long, did not report back, or did not come at all. Some farmers mentioned that they did not know where to go, whom to contact, or were not aware that they had the option of sending pigs for post mortem. Farmers who did decide to have a post-mortem done either made use of the SPCA or an extension officer, this service is free to small-scale farmers. Similar results were found by Gcumisa (2013) in KZN. Those respondents who did not send pigs for post-mortem either burned (1.7%), buried (78.0%) their pigs, or did both (20.3%), which was recommended by Madec *et al.* (2010) should the farmer know what the cause of the death was. Farmers who both burned and buried dead pigs commented that they did this to prevent dogs from digging the carcasses up. These findings suggest that, in general, farmers are aware that proper disposal of a carcass is important when managing a piggery. This is critical, especially when majority of pig farmers do not send pigs for post-mortem. The results also show that there is a need for state veterinarians and extension officers to improve their relationship between themselves and the farmers. It is recommended that farmer days be hosted with state veterinarians, extension officers and pig farmers. If good relationships are not established, abnormal mortalities will go unnoticed and the risk increases for diseases to break out in communal farming areas.

Piglet mortalities

Piglets are at greatest risk for death and various reasons for piglet mortalities were noted (Figure 4.3). Piglet mortality due to the sow laying on her piglets and ultimately suffocating them was experienced by 68.9% of farmers interviewed, while 43.2% had experienced piglet mortalities due to the cold. Farmers mentioned that the number of piglet mortalities increased in the winter due to the piglets huddling close to the sow for warmth then not moving away fast enough when she changed her position. Similar results were found in Mpumalanga (Munzhelele, 2015), KZN (Gcumisa, 2013), the Eastern Cape (Madzimure *et al.*, 2012), the Himalayas (Nath *et al.*, 2013), and Botswana (Montsho & Moreki, 2012). Farmers could not protect the piglets with use of farrowing crates as they could not afford it. Some farmers placed a plank against the wall in the corner of the pen so that, when the sow lay down, she could not press her body into the corners, allowing a safe space for the piglets to lie down near the sow (Images 16 – 17).



Image 4.16. A divider placed in the corner of the farrowing pen so that piglets have a safe space to move in where the sow can't lie on them



Image 4.17. Metal rods placed in the corner so that the sow can't lie there, giving the piglets a safe space to move

Other reasons for piglet mortalities mentioned by farmers included wild animals, such as rats and dogs, biting or killing the piglets. Low immunity and lack of milk (and colostrum) from the sow was another reason. Other reasons given included piglets that could not compete within their cohort, were bitten by the sow, had worms, or diarrhoea. Some farmers were not sure why their piglets died and one farmer from each area stated that their piglets rarely died.

Forty-seven percent of farmers considered piglets being laid on by the sow as the main cause of piglet deaths and death due to the cold weather was considered to be the main cause of piglet mortality by 29.2% of farmers. Abortions/still births was considered to be the main reason by 6.9% of farmers with disease following (5.6%). No significant differences were found among the three areas for the main causes given for piglet mortalities. These results show that farmers across the study area faced the same problem with regards to piglet mortalities and thus, should training be offered, means to reduce these mortalities should be highlighted.

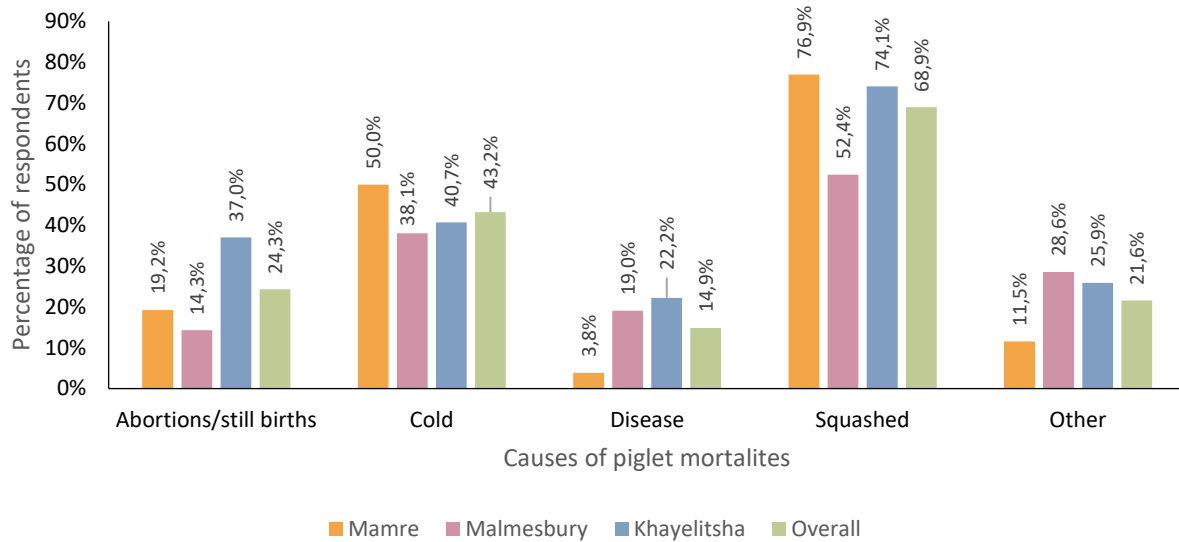


Figure 4.3. Piglet mortality causes experienced by small-scale pig farmers in the Western Cape

Weaner mortalities

Most farmers (76.4%) stated that once weaned, their piglets rarely died. This was more commonly seen in Malmesbury as only 9.5% stated that they experienced frequent weaner deaths. In Mamre only 19.2% of farmers experienced weaner deaths. In Khayelitsha it was more prone to happen as 40.0% stated that they frequently lost weaners.

In Mamre, the main reasons for weaner losses were lack of immunity (7.7%), sudden death, fighting, and incorrect feed (3.9%). The two farmers from Malmesbury that had experienced frequent weaner mortalities stated that it was due to either disease or internal parasites. Farmers from Khayelitsha, who had greater losses in weaners when compared to Mamre and Malmesbury, had various reasons for piglet mortalities; the main reason stated were disease (14.8%), deaths caused by fighting (11.1%), or sudden death (3.7%). Other causes of weaner mortalities experienced by only one or two farmers were cold, pneumonia and/or drought. Significant differences were found among the three study areas based on main reasons for weaner deaths. It is therefore suggested that more in depth research be done on the weaner mortalities, especially in Khayelitsha in order to develop possible solutions to these problems.

Post-weaning mortalities

Most farmers (80.7%) stated that they do not experience post weaner mortalities or rarely do; this overall percentage was made up of 88.2% of Mamre farmers, 95.0% of Malmesbury farmers and

64.0% of Khayelitsha farmers. Significant differences were found for post-weaning mortalities among the three study areas.

Farmers who experienced post-weaning mortalities stated that the cause of these deaths were mostly from disease, although only 9.7% of all farmers have lost grower pigs because of this, all of which were from Khayelitsha and made up 24.0% of the farmer's interviewed there. Other causes of post-weaning losses in Khayelitsha were the recent drought (4.0%), pigs in spasms (4.0%), and malnutrition (4.0%). Fighting in overcrowded pens, malnutrition, toxic feed or worms, were only reported by one farmer as mortality reasons. Reasons for post-weaning deaths in Mamre were due to pigs fighting or because they had ingested toxic feed. This was not a common problem as each case was only reported once. Only one farmer from Malmesbury had experienced post-weaning mortalities and reported that the deaths were caused by internal parasites. Because post-weaning mortalities are so rare and most of them are caused by disease or poor management, it is recommended that farmers be encouraged to call upon an extension officer or the SPCA when experienced. This would prevent the spread of diseases and allow farmers to gain a better understanding on how to manage their piggeries.

Breeding stock mortalities

Breeding sow and boar mortalities were not often experienced by the farmers interviewed. Only 1.7% of farmers reported that they had lost a breeding sow and even less (2.8%) had lost a breeding boar. None of the farmers from Malmesbury reported that their breeding sows or boars ever died. Eighty-eight percent of farmers from Mamre and 75.0% from Khayelitsha stated that they rarely or never lost a breeding sow.

Toxic feed was the single reason reported for the loss of a breeding boar and was mentioned by a farmer in Mamre, more reasons were found for breeding sow mortalities. Four percent of farmers, all from Khayelitsha, mentioned disease as cause of death for their breeding sows. Furthermore, single cases were reported for sow losses by toxic feed, prolapse and lack of feed. One farmer stated that they did not know the cause of the sow's death and one farmer commented that she was found bloated at death. Mortalities due to toxic feed had been noticed in the Mamre area before by Roelofse (2013).

As expected, the risk of losing a pig decreases with age, with piglets being most prone to piglet mortalities and older stock (breeding pairs) being least likely to die while in production. Table 4.6.

reflects the percentage of farmers who have experienced pig mortalities at specific production stages.

Table 4.6. Percentages of small-scale pig farmers who commonly experienced mortalities in respective production stages.

	Mamre	Malmesbury	Khayelitsha	Total
Piglet	96.2%	95.2%	96.3%	96.0%
Weaner	19.2%	9.5%	40.0%	23.6%
Post-weaner	11.8%	5.0%	36.0%	19.4%
Breeding sow	11.5%	0.0%	25.0%	12.7%
Breeding boar	7.7%	0.0%	0.0%	2.8%

From the results it can be noted that disease was not often mentioned by farmers for the death of their pigs, however, in the conditions these farmers rear their pigs and the lack of biosecurity, pigs are at great risk for contracting diseases. It may be that farmers do not notice or are not well informed on the symptoms of the diseases that leave the pigs fatigued or more sensitive to cold. Therefore, when a piglet cannot get out of the way fast enough and the sow lies on them, or if their immunity is too low due to nutritional deficiencies and they succumb to the cold, farmers assume that it was just the cold or just the sow, because it is what they are familiar with.

4.4.6 Marketing

As seen in previous studies (McOrist *et al.*, 2011; Kambashi *et al.*, 2014; Mokoetele, 2015; Munzhelele, 2015), small-scale pig farmers generally sell to informal markets without having a particular market group (Figure 4.4). Ninety-two percent of farmers interviewed sold their pigs, the 8% that remained either kept the pigs for personal use or were just starting out and had not started selling yet. Certain respondents mentioned selling to more than one market. Many farmers from Mamre and the majority of farmers from Khayelitsha and Malmesbury sold to anyone willing to buy their pigs, this made up 63.8% of all farmers and gives an impression that many farmers did not have a stable income flow from their farming practices but were rather depended on the market fluctuations. These results are consistent with those found in earlier studies (Kambashi *et*

al., 2014; Mokoelé, 2015). The type of channel used by the majority of Mamre farmers (58.3%) was through a personal buyer. Results from the focus group discussion indicated that most of these farmers sold to the same buyer, resulting in many farmers from the Mamre area selling their pigs as weaner stock. The result of having a personal buyer meant that income was secured for the farmers provided they reared healthy piglets. This motivated farmers to care better for their livestock in order to be able to sell them continually; it also provided them with a more reliable source of income for their pigs. Farmers who stated they sold to the informal market commented that they were referring to people who lived in informal settlements near the area they farmed in. Similar findings for selling pigs to informal markets were found in Mpumalanga (Munzhelele, 2015) and China (McOrist *et al.*, 2011). Farmers generally did not sell to abattoirs as they either did not own enough pigs to do so or did not want to risk their pigs being condemned by the abattoirs. Farmers were also able to sell pigs of lower quality to informal markets and without health checks on their livestock (Munzhelele, 2015). Only one farmer from Khayelitsha (iThemba) stated that they sold to an abattoir and it is not shown in Figure 4.4. Kagira *et al.*, (2010) found that marketing constraints such as poor prices and inadequate information were common amongst small-scale pig farmers.



Figure 4.4. An overview of the marketing channels used by small-scale pig farmers in the Western Cape

Pigs were mainly sold as growers (52.1%) across the three study areas (Table 4.7). However, 88.0% of farmers in the Mamre area sold their pigs as weaners due to the presence of a personal buyer mentioned previously.

Table 4.7. A comparison of the production stages at which small-scale pig farmers in the Western Cape sell their pigs.

	Mamre		Malmesbury		Khayelitsha		Total	
	N	%	N	%	N	%	N	%
Weaners	22	88.0	4	18.2	2	7.7	28	38.4
Growers	8	32.0	9	40.9	21	80.8	38	52.1
Depends on customer	1	4.0	1	4.5	1	3.8	3	4.1
Breeding stock		0.0	7	31.8	1	3.8	8	11.0
Cooked meat		0.0	1	4.5		0.0	1	1.4
Fresh meat	1	4.0	2	9.1	3	11.5	6	8.2

The age at which farmers sold their pigs differed across the three areas ($P < 0.05$). Figure 4.5 compares the age at which different production stages of pigs are marketed. On average, pigs sold for breeding aged 47 weeks, ranging from 32 to 52 weeks. Five farmers in total stated that they sold their pigs as fresh meat, meaning they slaughtered them before sale and prepared the meat for the customers. Of those who sold the pigs as fresh meat, three farmers slaughtered at 52 weeks (1 year), one at 32 weeks and another at 20 weeks. The average age for growers sold was 30 weeks, however the age at which growers were sold varied across the three target areas, ranging from nine weeks to a year. The age at which weaners were sold varied very little across the three study areas, aside from three outliers, 24, 12 and 4, which is indicated by black dots on the graph. On average, weaners were sold at 7.4 weeks.

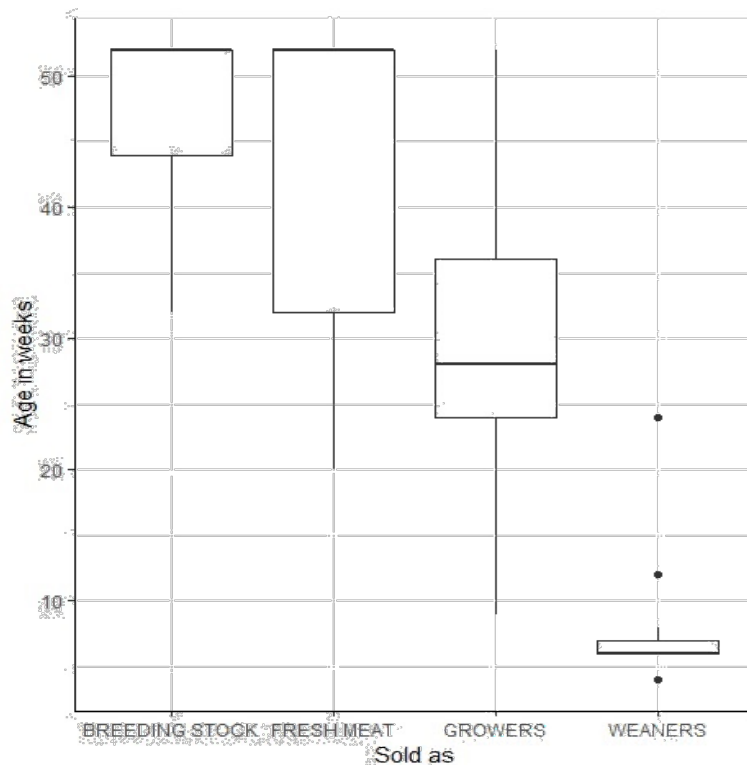


Figure 4.5. Age (in weeks) at which pigs are sold at different production stages by small-scale pig farmers in the Western Cape.

Farmers reported that pigs were either marketed when they had reached the desired age for them to be sold or slaughtered, depending on what they were being reared for, or around the time of festivities when the demand was higher or the farmers needed extra income. These findings are further supported by Meissner *et al.*, (2013), who commented that pig sales were occasional to meet urgent financial requirements. Most farmers (73.3%) stated that they sold anytime of the year. Farmers commented that they sold the pigs as they reached the required age or live weight, or when they needed a continuous income or sold as the demand rose. Some stated that they relied on the market to determine when pigs were sold. Others had to continuously sell their pigs because they had limited space to keep them. Some reared more pigs for the festive season (Dec-Jan) or April (Easter/long weekends) when more people buy and they can increase prices due to customers being paid bonuses. Farmers also commented that they sell more over this period because they wanted an extra income to afford their own festivities. Some farmers preferred to sell in Spring due to higher demand or in summer. Farmers that stated they sell in winter did so because they claimed it was too cold to breed then and bred specifically during warmer months so that pigs

could be more mature and thus able to withstand the cold better in colder months. When asked about whether the farmers were faced with cultural or religious challenges, only one farmer responded with a yes, saying that her neighbours are of the Islam faith and do not approve of her keeping pigs. Other than that, no other farmer experiences challenges rearing or selling pigs due to culture or religion. This shows that small-scale pig farming in the Western Cape has the potential to be sold throughout the year and with little to no cultural challenges. The production of pork in rural areas of the Western Cape thus has the potential to provide a continuous and affordable source of protein to people living in informal settlements.

4.4.7 Reproduction management

Breeds used

When asked during a focus group discussion, farmers unanimously agreed that they knew of no one farmer in their respective areas that bred with pure breeds. However, when asked about the type of breeds used, some farmers did not directly indicate that they used cross breeds but mentioned more than one breed (Table 4.8). This leads to the assumption that said farmers were not made aware that they were meant to indicate crossed breeds if their breeding stock was not a pure line or farmers were not aware that their pigs were cross bred, as it could be difficult to distinguish between certain breeds and its cross to an untrained eye. Therefore, for this study, the breeds reported were based on phenotypic characteristics as it is assumed that no pure breeds were owned by farmers farming within the areas studied. Three main breeds mentioned by farmers were the Large White (86.1%), Landrace (68.1%), and Duroc (18.1%). All respondents who answered this question mentioned that they bred with at least two of these breeds, indicating that small-scale pig farmers in the Western Cape prefer to farm with exotic commercial breeds rather than indigenous breeds. These results are similar to those observed amongst small-scale pig farmers in Mpumalanga (Munzhelele, 2015), Kwa-Zulu Natal (Gcumisa, 2013), Tanzania (Kimbi *et al.*, 2016), the Himalayas (Nath *et al.*, 2013), other breeds mentioned were the Kolbroek and potbelly. Some of the breeds observed are presented by Images 4.18 – 19.



Image 4.18. Different breeds seen



Image 4.19. Pot belly breed

The majority of those farmers who specifically mentioned that they breed with crossbreeds stated that they had crosses of Large White and Landrace (65.7%). Twenty-three percent bred with a cross between the Duroc, Large White and Landrace. Many farmers commented that they brought in boars with Duroc characteristics to reduce the risk of inbreeding in the herd. Two farmers stated that they bred with a cross between the Duroc and a Large White. The farmers reasoned that they bred with Landrace and Large White crosses for their market value and popularity, their easy temperament, meat quality, growth rate and large litters. These findings match those of previous studies (White, 1999; Madzimure *et al.*, 2012; Kimbi *et al.*, 2016), indicating that farmers are moving away from the use of indigenous breeds and prefer to breed with exotic pigs.

Table 4.8. An overview of the different breeds small-scale pig farmers bred with in the Western Cape.

Breeds used	Mamre		Malmesbury		Khayelitsha		Total	
	N	%	N	%	N	%	N	%
Landrace	20	83.3	11	52.4	18	66.7	49	68.1
Large white	22	91.7	18	85.7	22	81.5	62	86.1
Duroc	8	33.3	1	4.8	4	14.8	13	18.1
Other	1	4.2		0.0	1	3.7	2	2.8
	24		21		27		72	

Obtainment of breeding stock

As indicated by Table 4.9, breeding boars were mainly obtained from neighbouring farmers (54.7%). The obtainment of breeding boars did not differ across the three areas ($P > 0.05$) whereas the obtainment of breeding sows did differ ($P < 0.05$). This difference was due to most farmers from Khayelitsha obtaining sows from neighbours (66.7%), while the other areas greatly preferred to choose their sows from within the herd. Boars were more likely to be found outside of the herd. However, obtainment from the herd as well as neighbouring farmers meant that the breeding stock was obtained from within the area. Thus, 85.4% of sows used for breeding and 72.0% of breeding boars were obtained from within the same area. Sixteen percent of respondents stated that they obtained both the breeding sow and boar from the herd. Fifteen percent of farmers made use of breeders to obtain their breeding stock. Breeders mentioned by farmers were people who worked at an agricultural training institute named Elsenburg.

Table 4.9. An overview of the breeding stock obtainment for small-scale pig farmers in the Western Cape.

	Mamre		Malmesbury		Khayelitsha		Total	
	Boar	Sow	Boar	Sow	Boar	Sow	Boar	Sow
Neighbours	57.7%	30.8%	36.4%	13.6%	66.7%	66.7%	54.7%	38.7%
Herd	11.5%	61.5%	27.3%	59.1%	14.8%	22.2%	17.3%	46.7%
Breeders	19.2%	3.9%	18.2%	13.6%	7.4%	3.7%	14.7%	6.7%
Farmers outside town	3.9%	0.0%	9.1%	0.0%	7.4%	3.7%	6.7%	1.3%
Commercial farms	7.7%	0.0%	0.0%	0.0%	0.0%	0.0%	2.7%	0.0%
Various/unknown sources	0.0%	3.9%	0.0%	4.6%	0.0%	0.0%	0.0%	2.7%
Stock sale	0.0%	0.0%	9.1%	9.1%	3.7%	3.7%	4.0%	4.0%

The obtainment of breeding stock from the same area was also observed amongst small-scale pig farmers in Mpumalanga (Munzhelele, 2015), the Eastern Cape (Madzimure *et al.*, 2013), Nigeria (Saka *et al.*, 2010), Tanzania (Kimbi *et al.*, 2016), the Democratic Republic of Congo (Kambashi

et al., 2014), and the Himalayas (Nath *et al.*, 2013). It has been recommended that farmers obtain their breeding boars from distant communities (Madzimure *et al.*, 2013) as obtaining the breeding stock from such a small genetic pool increases the risk of inbreeding. Inbreeding has resulted in a reduction in the mature body size of pigs, decreased litter sizes, weaker piglets and an increase in still births (Madzimure *et al.*, 2013). Farmers may end up recycling genetic material between one another which could also lead to an increase in disease transfer (Saka *et al.*, 2010). The breeding stock should thus come from safe and trustworthy resources, which has also been recommended by previous studies (Beltrán-Alcrudo *et al.*, 2008; Saka *et al.*, 2010; Matabane *et al.*, 2015). The risk of inbreeding is worsened by the 21.6% of farmers who did not control mating; this did not differ significantly across the three study areas. As illustrated in Table 4.10, most farmers practiced controlled mating (78.4%) although nearly one third of farmers in Malmesbury (31.8%) and over quarter of farmers in Khayelitsha (26.9%), did not. More farmers in Mamre practiced controlled mating than in the other areas focused on for this study. However, the number of farmers who practiced controlled mating did not differ significantly across the three study areas.

Table 4.10. The percentage of small-scale pig farmers who practiced controlled mating in the Western Cape.

	Mamre		Malmesbury		Khayelitsha		Total	
	Y	N	Y	N	Y	N	Y	N
Controlled mating (%)	92.31	7.69	68.18	31.82	73.08	26.92	78.38	21.62

Gilts first service

Visser, (2014) states that when hand mated, gilts can be introduced to a boar from the age of 168 days (roughly five and a half months). It's recommended that gilts are first mated upon reaching their second or third oestrus, which is at an average age of 220 – 240 days (roughly seven to eight months).

The age at which farmers first placed their gilts with a boar differed significantly across the three areas, which can be observed in Figure 4.6. A number 60.0% of farmers from Malmesbury allowed their gilts to be served before the recommended age. It is uncertain whether successful matings occur during this time and is assumed that farmers stated the age at which they place the gilts with

a boar with the intention of having that sow be successfully mated. Some farmers from Malmesbury placed their sows with boars as early as four weeks old. As this occurs before sexual maturity, it is assumed that farmers placed their sows with boars at a young age to allow sows to become familiar with boars or because they are unsure of when the appropriate age is to first allow gilts to be mated. Twenty-three percent of farmers from Khayelitsha placed their gilts with a boar before the recommended age. Only a few Mamre farmers (13.0%) did the same. Certain farmers from Mamre waited as long as a year (21.7%) or two (8.7%) before they placed their gilts with a boar. At least 75% of farmers from Mamre and Khayelitsha allowed their gilts to first be mated according to the industry recommended age.

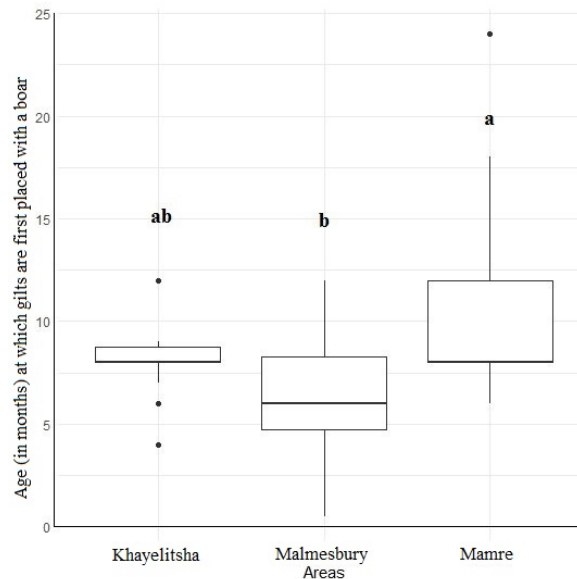


Figure 4.6. A comparison of the age at which small-scale pig farmers in the Western Cape first placed their gilts with a boar.

The difference between the three areas are indicated by the lowercase letters above the boxes. Those who had the same letters did not differ from one another. Thus, it can be noted that Malmesbury (6.4 ± 3.25) differed significantly from Mamre (10.6 ± 5.02), and Khayelitsha (8.2 ± 1.94) did not differ from either of the areas.

Results from Malmesbury are similar to those found in Kwa-Zulu Natal (Gcumisa, 2013) and the Democratic Republic of Congo (Kambashi *et al.*, 2014). Regardless of these results, no farmers from Malmesbury had reported sow mortality, indicating that early serving of the gilts did not have fatal results, however it is unclear whether or not the mating's were successful. Seventy-seven percent of farmers also reported that their sows produced litter sizes that were larger than ten. However, Malmesbury farmers did keep and sell (on average) much fewer pigs than the other two study areas. The results show that there is a need for farmers to be educated on proper breeding practices. It is therefore recommended that training days be organized where farmers can be educated the risks and implications of poor breeding management, especially relating to gilt management.

Observed farrowings

The number of respondents who observed their sows farrowing did not differ across the three study areas ($P > 0.05$) (Table 4.11). Most farmers observed sows when they farrowed (76.1%). Some farmers were not always able to observe the farrowing, as they did not live on the site or near the site where their pigs were held. Farmers commented that they would arrive to feed the pigs the next morning and realize she had given birth during the night when they had been at home. Other farmers commented that when they noticed their sows giving signs that she was preparing to give birth, they would remain close to her until she finished. To observe sows when they farrow is important as she may have difficulty giving birth and require assistance or piglets may be weak and need help finding the teat or suckling on the sow, which could result in them being unable to attain the first milk containing colostrum. Colostrum should be taken by piglets as soon as possible after birth to provide piglets with energy and aid in developing their passive immunity system (Visser, 2014). Farmers should therefore be trained to identify when their sows give indications of farrowing, as well as how to manage sows before, during and after farrowing.

Table 4.11. Percentage of small-scale pig farmers who observed their sows farrowing.

	Mamre		Malmesbury		Khayelitsha		Total	
	N	%	N	%	N	%	N	%
Y	18	72.0	18	85.7	18	72.0	54	76.1
N	1	4.0	2	9.5	4	16.0	7	9.9
When available	6	24.0	1	4.8	3	12.0	10	14.1

Farrowing per year

When asked how often their sows farrowed a year, farmers generally answered how many times they had observed their sows farrow over a recent twelve-month period, thus some stated three (Figure 4.7). The number of times sows farrowed a year did not differ between farmers across the three areas. ($P > 0.05$). Seventy-three percent of farmers stated that their sows farrowed twice a year. Similar findings were observed in Mpumalanga (Munzhelele, 2015) and Botswana (Montsho & Moreki, 2012). Only 9.5% of respondents stated that their sows farrowed only once a year. A study in the Eastern Cape (Madzimure *et al.*, 2013) reported that most small-scale pig farmers' sows farrowed only once a year. Nearly three-quarters of farmers stated that their breeding sows farrow twice a year ($P > 0.05$), 17.6% had their sows farrowing three times a year and 9.5% said their sows only farrowed once a year. Nearly all (80.8%) farmers interviewed in Mamre stated that their sows farrowed twice a year. Malmesbury farmers more frequently experienced three farrows a year than the other two areas. These results indicate that most small-scale pig farmers in the Western Cape experienced healthy farrowing rates with their sows farrowing at least twice a year. This is vital for continuous production of pigs and shows that farmers have the potential to make a significant profit out of their piggeries.

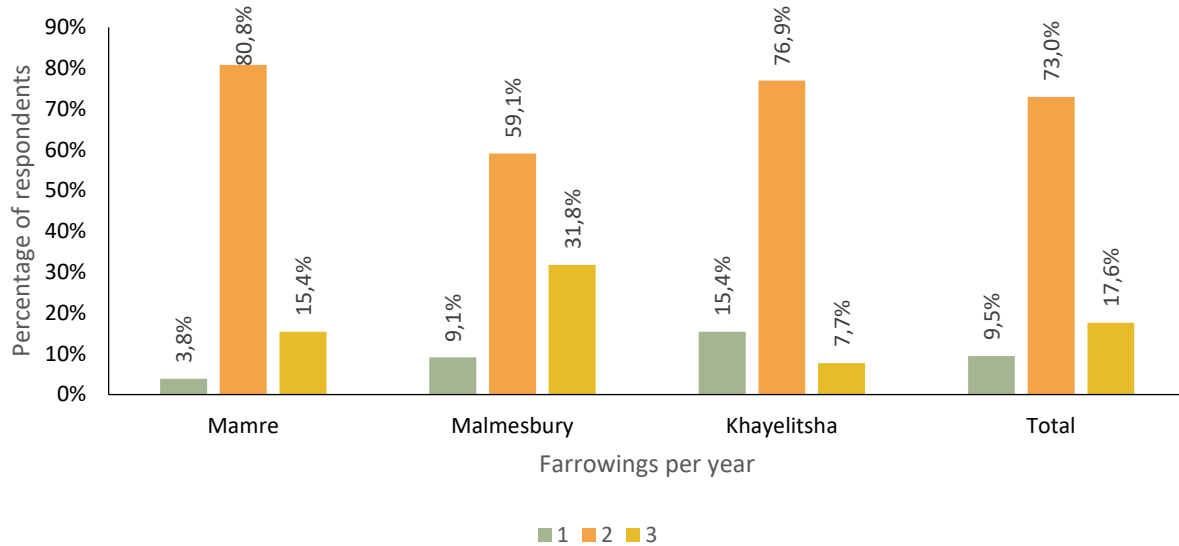


Figure 4.7. The number of times small-scale pig farmers experience their sows farrowing per year.

Weaning

All farmers in Mamre and Malmesbury weaned their piglets from the sow. In Khayelitsha, however, 15.4% of farmers stated that they did not wean their piglets. This resulted in a significant difference between the three areas. All those who did not wean their pigs stated that sows farrow twice a year, it is however uncertain how the sows were mated again if their piglets were not weaned. Those who stated that they did not wean, left the piglets in the same pen with their mother as they grew up; as a result 94.6% of all farmers interviewed stated that they weaned their piglets.

Weaning should usually take place when piglets are at least four weeks old (Madec *et al.*, 2010; Visser, 2014). Only 22.9% of farmers weaned at this age while other farmers allowed piglets to suckle on their mother longer (Table 4.12).

The age at which farmers weaned their pigs did not differ across the three areas ($P > 0.05$). From Table 4.12 it can be noted that most Mamre farmers (6.1 ± 1.40) preferred to wean at 5-6 weeks. Khayelitsha farmers (6.7 ± 2.75) seemed to prefer weaning at either 3-2 weeks or 7-8 weeks whilst Malmesbury farmers (7.3 ± 3.52) varied greatly from one another in terms of when they weaned their pigs. As mentioned before, many farmers from Mamre sold their pigs as weaners, this was likely the reason why this group weaned earlier on average than the other two farming areas.

Overall, farmers weaned late according to industry standards. This may be as a result of lower feed quality being fed, inbreeding or smaller body sizes, which would all cause piglets to be weaker and thus they cannot yet be separated from their mother at four weeks. Late weaning of piglets was observed in Tanzania (Kimbi *et al.*, 2016), Western Kenya (Kagira *et al.*, 2010) and the Democratic Republic of the Congo (Kambashi *et al.*, 2014).

Table 4.12. An overview of the age at which small-scale pig farmers in the Western Cape wean their piglets.

Age in weeks	Mamre		Malmesbury		Khayelitsha		Total	
	N	%	N	%	N	%	N	%
3 TO 4	1	3.8	6	28.6	9	39.1	16	22.9
5 TO 6	22	84.6	6	28.6	2	8.7	30	42.9
7 TO 8	2	7.7	5	23.8	9	39.1	16	22.9
12	1	3.8	4	19.0	3	13.0	8	11.4
	26	100	21	100	23	100	70	100

As expected, most farmers who weaned later (after seven weeks) had sows farrowing only once a year. Eighty-eight percent of those who weaned between five and six weeks stated that their sows farrowed more than once a year. The percentage of farmers who experienced one farrowing per year was lowest for those who weaned between five and six weeks (Figure 4.8), which is a week later than for commercial standards. It would, however, make sense for small-scale farmers to allow their piglets to suckle for a while longer as they are not reared in the ideal conditions found in the commercial sector.

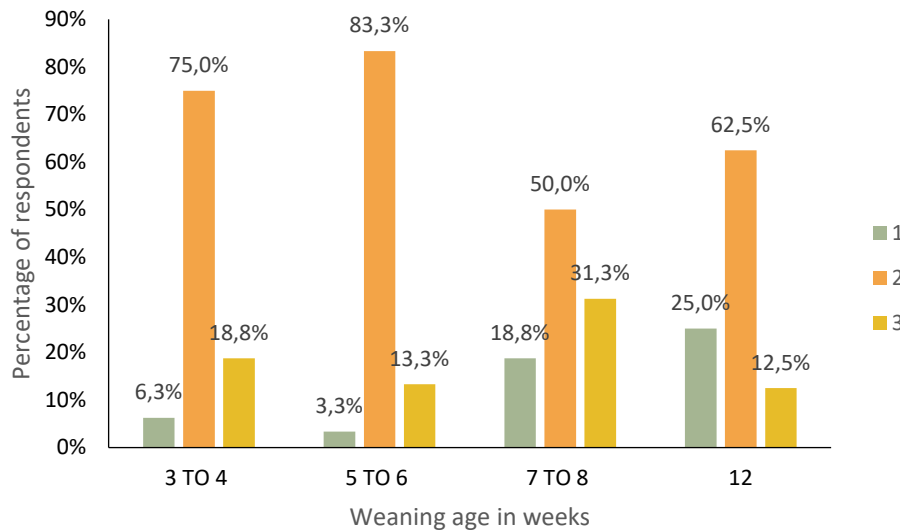


Figure 4.8 Overview of farrowing per year by the age small-scale pig farmers in the Western Cape weaned their pigs.

How soon after weaning sows are re-mated?

In the commercial pig farming sector, sows are re-mated 3-5 days after weaning (Visser, 2014). As seen in Table 4.13 only a small percentage of farmers allowed their sows to be mated within the first week after weaning (25.0%). Most farmers interviewed mated their pigs after one to three months after weaning (40.3%). The empty/non-productive phase of the breeding sow (time between weaning of piglets and mating of sow) did not differ significantly across the three areas. Respondents from the Malmesbury area had the longest average empty period (in weeks) for their sows (7.3 ± 3.52), followed by Khayelitsha (6.7 ± 2.75) and Mamre (6.1 ± 1.40). Some farmers commented that they placed the sow with a boar once they noticed her showing signs of heat. Other farmers first looked at the condition of the sow before they placed her with a boar again. This may have been the reason they extended the dry period of the sow. Considering the informal structures sows are kept in, much of her energy would go to not only nursing the piglets while they suckle on her, but also trying to maintain homeostasis. This could cause sows to lose more body condition than they would have in a commercial sector, forcing farmers to first build her body condition up before allowing her to take a boar again. The delay in allowing the sow to be mated again would, however, lower the profitability of keeping her as she would have to be maintained for those one to three months and would farrow fewer times a year, but would protect her from losing too much of her body reserves.

Table 4.13. The length of the breeding sow's empty period (in weeks) amongst small-scale pig farmers in the Western Cape.

	Mamre		Malmesbury		Khayelitsha		Total	
	N	%	N	%	N	%	N	%
Immediately	2	7.7	1	4.8		0.0	3	4.2
Within a week	10	38.5	1	4.8	4	16.0	15	20.8
Two weeks	1	3.8		0.0	4	16.0	5	6.9
21 days	3	11.5	3	14.3	3	12.0	9	12.5
1 to 3 months	8	30.8	12	57.1	9	36.0	29	40.3
4 to 8 months	1	3.8	4	19.0	5	20.0	10	13.9
When on heat	1	3.8		0.0		0.0	1	1.4
	26	100	21	100	25	100	72	100

Litter sizes

Large litter sizes were also observed in this study, with very few farmers (5.4%) observing litter sizes smaller than eight and the majority of farmers (59.5%) reporting that their sows normally birthed more than ten piglets per farrowing. Large litter sizes were also observed amongst small-scale pig farmers in Mpumalanga (Munzhelele, 2015) and the Eastern Cape (Madzimure *et al.*, 2013). Small-scale pig farmers reporting to have small litter sizes were seen in Limpopo (Mokoele, 2015), the Himalayas (Nath *et al.*, 2013), and Lao PDR (Phengsavanh, 2013). Litter sizes reported by farmers did not differ across the three areas ($P > 0.05$). This, as well as the amount of times farmers experienced their sows farrowing a year, indicates that farmers have the potential to grow their pig farming enterprises and make a success of it if the pigs kept healthy and a proper market is established.

Table 4.14. Piglets born per litter to small-scale pig farmers in the Western Cape

Litter size	Mamre		Malmesbury		Khayelitsha		Total	
	N	%	N	%	N	%	N	%
<8	2	7.7	0	0.0	2	7.7	4	5.4
8 to 10	14	53.8	5	22.7	7	26.9	26	35.1
>10	10	38.5	17	77.3	17	65.4	44	59.5

4.4.8 Nutrition

Type of feed

The type of feed farmers gave to their pigs was categorized into three main categories namely commercial, mixed and by-products and waste. The type of feed gives an indication of the quality of feed as commercial feed is generally more balanced and of higher quality than that of by-products/waste. Commercial feed refers to feed manufactured by animal feeding companies. This type of feed generally takes the form of pellets and is usually more expensive and specifically designed for pigs and their respective production stages. The quality of commercial feed may, however, not be fully exploited by respondents in this study as many farmers stated that, to save money, one type of commercial feed was fed across all production stages or feed that was manufactured for different animals, such as chickens or cows, were fed. Farmers bought commercial feed at a local agricultural store, such as Agrimark, or sourced it through neighbours or pet stores. Alternative feed such as waste and by-products were acquired through private suppliers, factories, local shops and silos. Images of some of the feed given as well as the feeding troughs used are presented by Images 4.20 – 23.



Image 4.20. Plastic bucket halved and used as a feeding trough



Image 4.21. Wooden feed trough



Image 4.22. Expired bread from grocery stores used as feed



Image 4.23. Expired meat products fed to pigs

By-products and waste refer to by-products from factories and silos in surrounding areas, expired food from grocery stores and kitchen waste. Farmers mentioned feeding milk, dough, fishmeal, feedlime, cereals, soya, bran and/or vegetables. Dough and expired food from King Pie, a local pie franchise in South Africa, was a popular food source for mature pigs amongst farmers. One of the farmers from Khayelitsha commented that their pigs enjoyed the variety of dough flavours from the pies. Mixed feed refers to a combination of commercial feed and by-products and waste, as farmers try to maximize the quality of feed while minimizing the costs. By mixing commercial feed with by-products farmers opt for reaping the benefits of commercial feed at a lower cost (Dietze, 2012). Although using by-products from crops can be fed to pigs, feed needs to be carefully balanced to meet the nutritional requirements of the pigs in terms of protein, carbohydrates, fats, vitamins and minerals so as to keep the pigs healthy, help the gain weight and maximize reproductive functioning (Lekule & Kyvsgaard, 2003). Swill (feed scraps) needs to be heated and treated before feeding (Mokoele, 2015). However, when asked about the preparation of the swill feed, none of the farmers interviewed mentioned heating the by-products and waste

before feeding it to their pigs. Feeding of swill to pigs is frowned upon by many countries as it was observed to increase the risk of diseases such as PRRS and African swine fever (Mokoele, 2015), lower the body condition as well as the reproduction performance of pigs, reduce litter sizes, increase mortality (Munzhelele, 2015), which reduces production outputs (Mokoele, 2015). Regardless, swill feeding is still a popular form of pig feed in Kwa-Zulu Natal (Gcumisa, 2013), Mpumalanga (Munzhelele, 2015), Limpopo (Mokoele, 2015), Gauteng (Matabane *et al.*, 2015), the Democratic Republic of Congo (Kambashi *et al.*, 2014), Cambodia (Strom *et al.* 2017), Botswana (Montsho and Moreki, 2012), Nigeria (Ibitoye *et al.*, 2016), Uganda (Dione *et al.*, 2014), China (McOrist *et al.*, 2011), Tanzania (Komba *et al.*, 2013), North of Lao PDR (Phengsavanh, 2013), and the Himalayas (Nath *et al.*, 2013).

The type of feed farmers fed pigs differed across the three study areas for piglets, growers, pregnant sows, nursing sows, and boars ($P < 0.05$). It, however, did not differ for weaners and dry sows ($P > 0.05$).

Piglet feed

Providing high quality, easily digestible creep feed for piglets at regular intervals is essential for the smooth transitioning from liquid to solid feed during the weaner phase (Visser, 2014). Table 4.15 indicates the different feed types given to piglets across the three areas. Commercial piglet creep feed is the highest quality feed that can be given to piglets as it is specially formulated to optimize production for that specific stage of the pig's life. Commercial feed is, however, also the most expensive form of feed. Some farmers stated that they made the sow's feed more accessible to piglets so that they could nibble on it as they pleased. Eight farmers in total did not provide any form of accessible creep feed for their piglets and simply allowed them to suckle on the sow's milk. Fifteen percent of farmers bought commercial creep feed for their piglets while others used cheaper feed options. Commercial feed given to piglets took many forms as farmers often looked for cheaper alternatives that were still perceived to be quality feed. Chicken grower, cow meal, grower meal, sow and boar meal, and unspecified pellets were the commercial feeds mentioned for piglets to nibble on before weaning. These feeds were either mixed with water to soften the feed or given as is. The obvious difference between the three areas was that fewer farmers from Malmesbury fed commercial creep feed when compared to other areas. It was also the only area

where farmers allowed their suckling piglets to ingest by-products and waste. Your conclusion/implications?

Table 4.15. Type of feed provided for piglets by small-scale pig farmers in the Western Cape.

	Mamre		Malmesbury		Khayelitsha		Total	
	N	%	N	%	N	%	N	%
Commercial	19	73.08%	11	55.00%	18	69.23%	48	66.67%
Mixed	2	7.69%	3	15.00%	7	26.92%	12	16.67%
By-products or waste		0.00%	4	20.00%		0.00%	4	5.56%
Sow's milk	5	19.23%	2	10.00%	1	3.85%	8	11.11%
	26	1	20	1	26	1	72	1

Weaner feed

With 61.6% of farmers stating that they fed their weaner piglets commercial feed, farmers were just as inclined on average to opt for quality feed in their weaner stock as they are for their piglets (Table 4.16). Mixed rations were given either as is, mixed with water or cooked together.

Although piglet feed given differed across the areas, it can be noted that farmers in this study invested more money into their younger pigs – piglets and weaners – as 66.7% of respondents gave their piglets commercial feed and 61.6% gave their weaners commercial feed. This implies that farmers understood the need to give extra care during the more vulnerable stages of their pigs.

Table 4.16. Type of feed provided for weaner stock by small-scale pig farmers in the Western Cape.

	Mamre		Malmesbury		Khayelitsha		Total	
	N	%	N	%	N	%	N	%
Commercial	19	73.1	12	57.1	14	53.8	45	61.6
Mixed	7	26.9	4	19.0	8	30.8	19	26.0
By-products or waste		0.0	5	23.8	4	15.4	9	12.3

Post weaning and breeding boar feed

From Figure 4.9 it can be noted that, aside from Malmesbury, the type of feed given to boars follow a similar trend to post-weaner pigs. Some respondents commented that they fed all their mature pigs (breeding sows, breeding boars and grower pigs) the same feed, which could account for some of the similarities noticed below (Figure 4.9).

Twelve percent of farmers stated that they did not keep grower pigs but sold pigs as weaners. This statement held for 30.8% of farmers in Mamre and 4.8% of farmers in Malmesbury, but did not for any of the farmers in Khayelitsha. Post-weaning stages were generally fed feed of lower quality when compared to pre-weaning stages; only 15.4% of farmers fed commercial feed at this stage, slightly more (18.3%) fed commercial feed to their boars. Five percent of farmers from Malmesbury stated that they were not sure what they fed their grower pigs or their breeding boars and another 4.8% stated that they fed whatever feed they could find. These results were removed to simplify Figure 4.9 but may have been the cause of the difference found between the three groups in terms of what was fed to breeding boars and grower pigs. Farmers from Mamre and Khayelitsha all gave clear answers on what they fed their grower pigs and their breeding boars. This indicates that there is a need to investigate the type of feed given to mature pigs in communal farming areas of the Western Cape as well as educate farmers on proper feeding habits and potential risks and benefits of feeding by-products and wastes. Farmers should be trained to have a clear understanding of what type of feed would be beneficial to their pigs and what would be detrimental to their health.

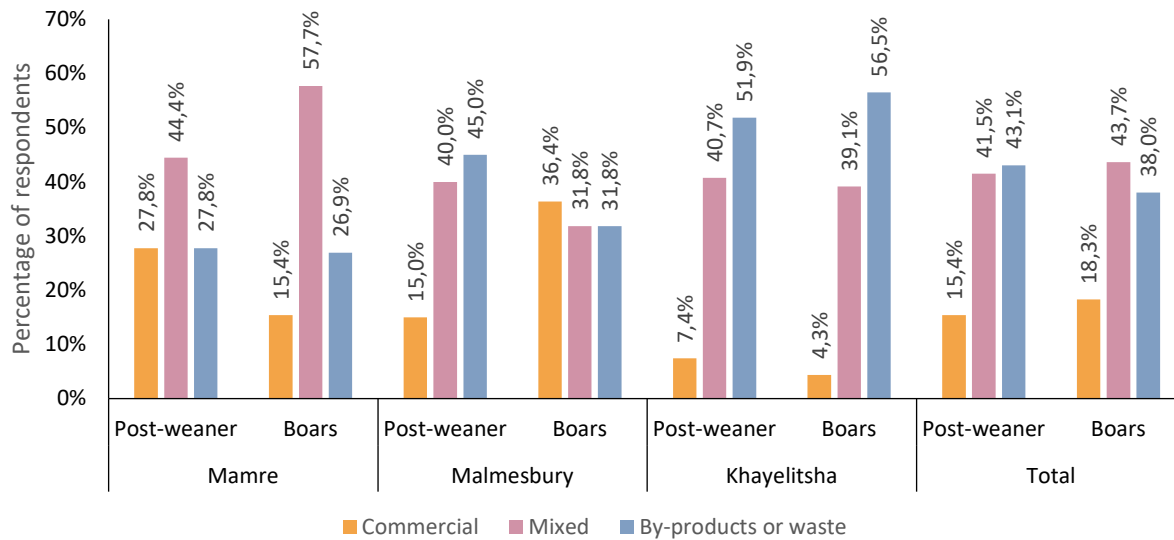


Figure 4.9. Comparison of types of feed given to pigs at post-weaning stage and breeding boars

Breeding sow feed

From previous tables and figures it can be seen that the percentage of respondents who fed commercial feed declined as production stages matured (Table 4.15 – 16 and Figure 4.9). However, many farmers seemed to increase the quality of their breeding sow's feed during gestation as the percentage of farmers who fed by-products increased from pregnant sow to nursing sow and increased more as sows went from nursing piglets to being empty. Figure 4.10 illustrates the type of feed sows are given at each production stage. On average small-scale pig farmers fed better quality feed to sows while they were pregnant. Farmers were less likely to give sows commercial feed when dry. Some respondents stated that they put the dry sows on a grower diet then increased the quality of feed once she fell pregnant.

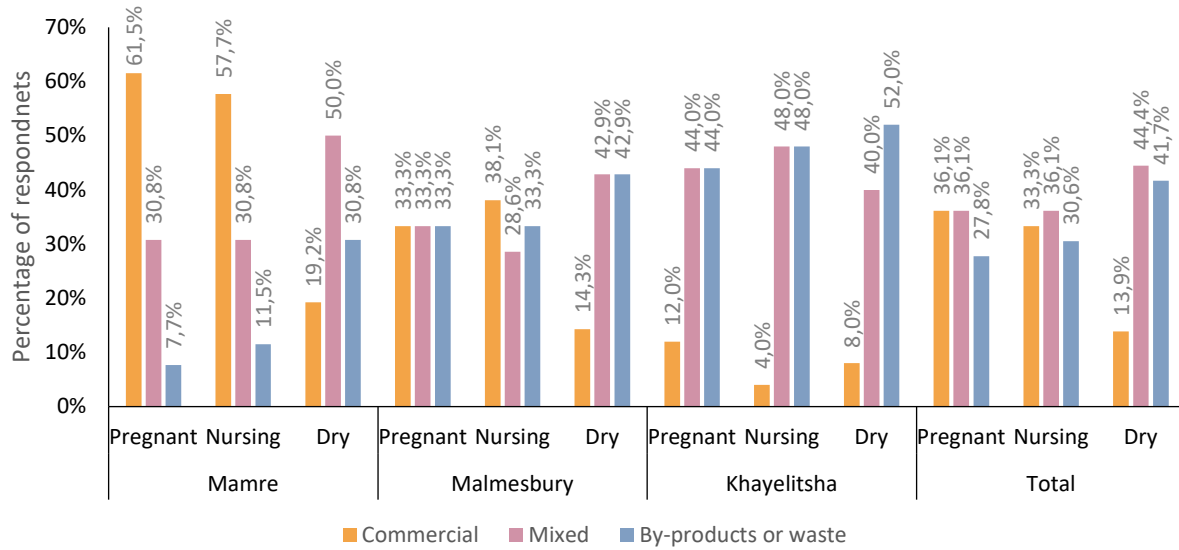


Figure 4.10. Comparison of types of feed given to breeding sows during different production stages by small-scale farmers in the Western Cape

The increase in feed quality of pregnant sows was especially seen in Mamre. Many farmers from the Mamre area seemed inclined to feed commercial feed when their sows were in production. Farmers from Khayelitsha were more prone to give their pigs by-products, whether it is mixed with commercial feed or given as is. The by-products given took many forms. Malmesbury farmers differed drastically within the area when it came to what was fed to breeding sows. An equal number of farmers fed commercial feed, mixed and by-products to pregnant sows. There was an increase in the amount of commercial feed given to nursing sows, but also in the feeding of by-products for this area. As with other areas, dry sows kept by Malmesbury farmers were mostly fed mixed or by-products. These results indicate that there is a need to educate farmers on proper nutritional management of their breeding sows.

4.5 Conclusion

Interestingly, farmers interviewed for this study generally kept more pigs on average than what was seen in many other South African provinces and countries. This indicates that there is a bigger market available for small-scale pig farmers in the Western Cape than seen in many other developing countries and provinces. As many farmers stated that they sell to people living in informal settlements, more pigs being reared for this market indicates financial growth amongst people living there. This can, however, be very dangerous as there are no regulations set for the

marketing of these pigs and farmers might unknowingly sell a diseased pig. . Diseases were not mentioned as the cause of death by many farmers, but when considering how pigs are reared and the lack of biosecurity, it should be considered that farmers could not always recognize the diseases that killed their pigs and should therefore be trained to identify diseases by their symptoms. The majority of farmers from Malmesbury and Khayelitsha and many from Mamre stated that they sold to anyone who would buy their pigs. This indicates that many farmers did not have a dependable and consistent market to sell to. More than half of the farmers from Mamre sold their pigs to a personal buyer who bought weaner pigs. Having a personal buyer meant they had a secured income should healthy piglets be weaned. This could motivate farmers to care better for their livestock. The majority of the sows and boars used for mating came from the same area farmers reared their pigs, either from the herd itself or from neighbors. This increases the risk of inbreeding greatly and is something farmers should be cautioned about.

From the results it can be seen that Malmesbury was at a disadvantage in comparison to the other areas. The farmers from Malmesbury experienced higher incidences of theft, fewer made use of medication or assistance, and fewer had training. Those who reported to have gone for training on pig rearing mentioned that they had gone many years ago. Veterinarian and extension officer support is required as well as versatility in the staff to accommodate most of the farmers in understanding their language and cultures.

Involvement of government is needed to organize and execute farmers' days where farmers can receive training and voice their struggles with communal pig farming. A platform should be created where input can be given from both the farmers and the government, where practical solutions can be developed and both parties can have a better understanding of one another. This would also go a long way in building trust between farmers and veterinarians and extension officers. Through these farmers' days, training programs can be developed, and funding can be allocated to where it would be most significant. Further research should be done to design a housing system that is both cost effective and appropriate for the scale and environment in which most of these farmers rear their pigs. Commercial piggeries should sell spent sows to small-scale pig farmers to increase the genetic value and diversity that enters the communal farming site. It also ensures that the breeding material is disease free. Farmers should be encouraged to source from areas outside of their municipalities and should quarantine new pigs before using them for

production. Governmental assistance with pen flooring is critical. Pigs from Khayelitsha were often deep in mud in winter where soil flooring was used.

4.6 References

- Beltrán-Alcrudo, D., Labroth, J., Depner, K. & De La Rocque, S. 2008. African swine fever in the Caucasus. FAO Empres Watch. Available at:
<ftp://ftp.fao.org/docrep./FAO/011/aj214e/aj214e00.pdf>.
- Chah, J. M., Dimelu, M.U. & Ukwuani, S.U. 2014. Institutional and production characteristics among smallholder pig producers in Enugu State , Nigeria. *Trop. Anim. Health Prod.* 46, 1173–1176. doi: 10.1007/s11250-014-0623-4.
- Costard, S., Porphyre, V., Messad, S., Rakotondrahanta, S., Vidon, H. 2009. Multivariate analysis of management and biosecurity practices in smallholder pig farms in Madagascar. *Prev. Vet. Med.* 92, 199–209. doi: 10.1016/j.prevetmed.2009.08.010.
- Department of Agriculture, Forestry and Fisheries. 2013. Trends in the Agricultural Sector. [online] Available at: <
<https://www.daff.gov.za/Daffweb3/Portals/0/Statistics%20and%20Economic%20Analysis/Statistical%20Information/.Trends%20in%20the%20Agricultural%20Sector%202016.pdf>>
 [Accessed 07 April 2018]
- Dietze, K. (2011) Pigs for Prosperity. FAO diversification booklet. 15.
- Dione, M.M., Ouma, E.A., Roesel, K., Kungu, J., Lule, P. & Pezo, D. 2014. Participatory assessment of animal health and husbandry practices in smallholder pig production systems in three high poverty districts in Uganda. *Prev. Vet. Med.* 117. 565–576. doi: 10.1016/j.prevetmed.2014.10.012.
- Duniya, K.P., Akpoko, J.G., Oyakhilomen, O. & Nandi, J.A. 2013. Measurement of Pig Production Profitability in Zangon Kataf and Jema’a Local Government Areas of Kaduna State, Nigeria. *Curr. J. Appl. Sci. Technol.* 3, 1455–1463. doi: <https://doi.org/10.9734/BJAST/2014/4137>
- Gcumisa, S.T. 2013. The untold story of the pig farming sector of rural Kwazulu-Natal: A case study of Uthukela District. MSc thesis. Available at:
http://uir.unisa.ac.za/bitstream/handle/10500/14146/dissertation_gcumisa_st.pdf?sequence

=1.

- Ibitoye, S.J., Shaibu, U.M., Sanda, M.E. & Oshadare, D. 2016. Economic Analysis of Local Swine Production Among Small Scale Farmers in Kabba/Bunu Local Government Area of Kogi State, Nigeria. *Gashua J. Irrig. Desertif. Stud.* 2, 1–11.
- Kagira, J.M., Kanyari, P.W.N., Maingi, N. & Githigia, S.M. 2010. Characteristics of the smallholder free-range pig production system in western Kenya. *Trop. Anim. Health Prod.* 42, 865–873. doi: 10.1007/s11250-009-9500-y.
- Kambashi, B., Picron, P., Boudry, C., Thewis, A., Kiatoko, H. & Bindelle, J. 2014. Smallholder pig production systems along a periurban-rural gradient in the Western provinces of the Democratic Republic of the Congo. *J. Agric. Rural Dev. Trop. Subtrop.* 115, 9–22.
- Kimbi, E.C., Mlangwa, J., Thamsborg, S. M., Mejer, H., Lekule, F.P. 2016. Smallholder Pig Marketing Systems in the Southern Highlands of Tanzania. *J. Nat. Sci. Res.* 6, 87–98.
- Komba, E.V.G., Kimbi, E.C., Ngowi, H.A., Kimera, S.I., Mlangwa, J.E., Lekule, F.P., Sikasunge, C.S., Willingham, A.L., Johansen, M.V., Thamsborg, S.M. 2013. Prevalence of porcine cysticercosis and associated risk factors in smallholder pig production systems in Mbeya region, southern highlands of Tanzania. *Vet. Parasitol.* 198, 284–291. doi: 10.1016/j.vetpar.2013.09.020.
- Lekule, F.P. & Kyvsgaard, N.C. 2003. Improving pig husbandry in tropical resource-poor communities and its potential to reduce risk of porcine cysticercosis. *Acta Trop.* 87, 111–117. doi: 10.1016/S0001-706X(03)00026-3.
- Madec, F., Hurnik, D., Porphyre, V. & Cardinale, E. 2010. Good practices for biosecurity in the pig sector: issues and options in developing and transition countries. *FAO*.
- Madzimure, J., Chimonyo, M., Zander, K.K. & Dzama, K. 2012. Potential for using indigenous pigs in subsistence-oriented and market-oriented small-scale farming systems of Southern Africa. *Trop. Anim. Health Prod.* 45, 135–142. doi: 10.1007/s11250-012-0184-3.
- Matabane, M.B., Nethenzheni, P., Thomas, R., Netshirovha, T.R., Norris, D., Nephawe, K.A. & Nedambale, T.L. 2015. Status of the smallholder pig farming sector in Gauteng Province of South Africa. *Appl. Anim. Husb. Rural Develop.* 8, 19–25. Available at:

www.sasas.co.za/aahrd/.

- McOrist, S., Khampee, K. & Guo, A. 2011. Modern pig farming in the Peoples's Republic of China: growth and veterinary challenges. *Rev. Sci. Tech. l'OIE*. 30, 961–968. doi: 10.20506/rst.30.3.2091.
- Meissner, H.H., Scholtz, M.M. & Palmer, A.R. 2013. Sustainability of the South African livestock sector towards 2050 Part 1: Worth and impact of the sector. *S. Afr. J. Anim. Sci.* 43, 282–297. doi: 10.4314/sajas.v43i3.5.
- Mokoele, J.M. 2016. Reasons for poor production among the emerging small-scale pig farmers of the Limpopo province of the Republic of South Africa. *MMed Vet.*, University of Pretoria.
- Montsho, T. & Moreki, J.C. 2012. Challenges in commercial pig production in Botswana. *J. Agric. Technol.* 8, 1161–1170.
- Munzhelele, P. 2015. Evaluation of the production systems and constraints of smallholder pig farming in three agro-ecological zones of Mpumalanga province, South Africa. MSc (Agric) thesis, University of South Africa.
- Mutua, F.K., Arimi, S., Oraga, W., Dewey, C., Schelling, E. 2010. Farmer Perceptions on Indigenous Pig Farming in Kakamega District, Western Kenya. *Nord. J. African Stud.* 23, 43-57. Available at: <http://www.lrrd.org/lrrd23/7/mutu23144.htm%5Cnhttp://hdl.handle.net/10568/5369>.
- Nath, B.G., Pathak., P.K., Ngachan, S.V., Tripathi, A.K., Mohanty, A.K. 2013. Characterization of smallholder pig production system : productive and reproductive performances of local and crossbred pigs in Sikkim Himalayan region. *Trop. Anim. Health Prod.* 45, 1513–1518. doi: 10.1007/s11250-013-0391-6.
- Oosthuizen, C. M. 2011. A restrospective study of a Porcine Reproductive and Respiratory Syndrome outbreak in South Africa in 2004. *MMedVet*, University of Pretoria. Available at: <http://upetd.up.ac.za/thesis/available/etd-06102011-155507/>.
- Penrith, M.L. & Vosloo, W. 2009. Review of African swine fever: transmission, spread and control. *J. S. Afr. Vet. Assoc.* 80, pp. 58–62. doi: 10.4102/jsava.v80i2.172.

- Phengsavanh, P. 2013. Forage Legumes as Feed for Pigs in Smallholder Production Systems in the North of Lao PDR Production Systems , Forage Biomass Yield and Protein. PhD diss, Swedish University of Agricultural Sciences.
- Roelofse, J.J. 2013. Economic feasibility study of the establishment of smallholder pig farmers for the commercial market : Empolweni case study. MSc (Engineering management) thesis, University of Stellenbosch, South Africa. Available at: <http://hdl.handle.net/10019.1/85703>.
- Saka, J.O., Adeschinwa, A.O.K. & Ajala, M.K. 2010. Incidence of African Swine Fever (ASF) disease and its associated implications on pig production in Lagos State, Nigeria. 16, 80-90.
- SAPPO (2012) Code for the Welfare of Pigs.
- Strom G, Djurfeldt, A. A., Boqvist S., Albihn A, Sokerya S, San S, Davun H, Magnusson, U. 2017. Urban and peri-urban family-based pig- keeping in Cambodia: Characteristics, management and perceived benefits and constraints. PLoS ONE. 12, 1–13. Available at: <https://doi.org/10.1371/journal.pone.0182247>.
- Visser, D. 2014. Modern Pig Production. Available at: <https://books.google.co.za/books?id=mpXorQEACAAJ>.
- Weiler, U. & Bonneau, M. 2019. Why it is so difficult to end surgical castration of boars in Europe: Pros and cons of alternatives to piglet castration. IOP Conf. Ser. Earth Environ. Sci. 333 p. 12001. doi: 10.1088/1755-1315/333/1/012001.
- White, C. (1999) ‘Breeds of swine’, pp. 1–8.

Chapter 5

An insight into what governs the success of small-scale pig farmers in the Western Cape, South Africa

5.1 Abstract

The aim of this study was to determine the factors that impact the production of small-scale pig farmers in the Western Cape, South Africa. It further sets out to determine how the top producing small-scale pig farmers in the study area (TSSP) differed from the average producers (ASSP). A focus group was conducted to identify these factors. In order of importance, farmers listed clean water, medication, proper feed, good hygiene, proper housing, knowledge, labourers (time spent with pigs), recordkeeping, research, land owned and warmth as the key factors that impact their production. The Mann-Whitney test or the Kruskal-Wallis test was used to compare ordinal response variables to nominal input variables. The results show that those who invested in the health of their pigs sold more pigs on average. All TSSP medicated their pigs when they became sick and administered iron injections, while some ASSP did not. More TSSP had a vaccination program than ASSP. Those who cleaned and disinfected their pens sold more pigs on average than those who did not. TSSP did not feed by-products and waste to their suckling piglets or weaner pigs. Many farmers seemed to adjust their feeding strategies after weaning by feeding less commercial feed and more by-products and waste. This not only allowed farmers to save money on feeding but made it possible to produce a fatter slaughter pig, which was what some top producers stated their market preferred. The number of years farming impacted production significantly. Most TSSP had been farming for over a decade and those who had been farming for over three decades sold the most pigs on average.

Keywords: average small-scale producers, , pig production, top small-scale producers,

5.2 Introduction

Small-scale pig farmers in developing countries face many problems that limit their production and thus the growth of their piggery. Various disease breakouts have occurred in small-scale farming sites and is still an on-going problem (Kagira *et al.*, 2010; Duniya *et al.*, 2013; Dione *et al.*, 2014; Munzhelele, 2015; Umeh *et al.*, 2015; Ibitoye *et al.*, 2016; Strom *et al.*, 2017). This is due to the very limited biosecurity that exists within communal farming areas (Gcumisa, 2013; Roelofse, 2013); the close proximity in which farms are to one another also makes it difficult to

prevent the spread of diseases. The access farmers have to veterinarians is also often limited (Duniya *et al.*, 2013; Ibitoye *et al.*, 2016). Feeding constraints also limit the growth of pigs. Feed is often found to be too expensive for farmers (Kagira *et al.*, 2010; McOrist *et al.*, 2011; Duniya *et al.*, 2013; Dione *et al.*, 2014; Ibitoye *et al.*, 2016; Strom *et al.*, 2017) and results in farmers feeding swill to their pigs (Gcumisa, 2013; Roelofse, 2013) or allowing pigs to scavenge for themselves (Dione *et al.*, 2014). Duniya *et al.* (2013) noted that problems such as high feed costs, diseases, mortalities and theft cause smallholder pig producers to keep fewer pigs, constraining them from growing their piggeries and selling more pigs. Small-scale farmers generally also make use of cheaper, less durable materials to build their pens which results in poor protection against environmental factors for their pigs (Duniya *et al.*, 2013; Roelofse, 2013). Poor breeding material has also been found to limit the production of smallholder pig farmers (Montsho & Moreki, 2012; Roelofse, 2013; Matabane *et al.*, 2015).

Due to their fear of having their pigs condemned at abattoirs (Munzhelele, 2015), small-scale farmers are often unable to market their pigs formally and must market into informal markets where the price is sometimes limited (Mutua *et al.*, 2010; Kimbi *et al.*, 2016). Marketing of smallholder pig farmers was found to be a problem in Western Kenya (Mutua *et al.*, 2010), Tanzania (Kimbi *et al.*, 2016) and the Gauteng (Matabane *et al.*, 2015) province as farmers struggled to gain access to the formal market. This results in farmers having an inconsistent income and often market their pigs at lower value (Mutua *et al.*, 2010; Kimbi *et al.*, 2016). Previous studies have shown that smallholder farmers generally produced pigs of lower value at marketing, resulting in lower outputs and thus lower profits (Munzhelele, 2015; Kimbi *et al.*, 2016). Farmers who farm in communal, rural areas often experience high incidences of theft (Duniya *et al.*, 2013; Nantima *et al.*, 2015). Even if all other adversities are overcome, farmers have limited space to expand their piggery as the land they farm on rarely belongs to them but is rather governmental land (Mutua *et al.*, 2010).

It is important to remember that small-scale pig rearing practices differ greatly from commercial practices. Small-scale farmers face different challenges and must thus make use of alternative methods to overcome those challenges in order to make a success of what they have. As they grow their piggery, they may adopt more commercial practices but they must first break past the poverty and market barrier and build up their business. The aim of this chapter was to identify which factors

play a significant role in small-scale pig farming production in the Western Cape, South Africa. Specifically, this chapter explores factors which farmers across the three study areas found most important to making a success of their piggery.

5.3 Methods and materials

The study site, statistical analysis and surveys were described in Chapter 3.

5.3.1 Focus group

A focus group was on held on the 23rd of February to identify factors small-scale farmers considered important for production and to determine whether these factors played a significant role on the number of pigs sold. The focus group was held in the town of Mamre as it was the town furthest away from Stellenbosch University and a direct route could be planned to transport farmers from the other two areas. Three farmers from Malmesbury, four from Khayelitsha and five from Mamre attended the focus group. The design of the questionnaire as well as the process of management applied during the interviews were approved by the University of Stellenbosch's Social Ethics Committee (ANI-2018-6868).

Each farmer was handed five pieces of paper and the question, "What factors positively impact the production of small-scale pig farmers in the Western Cape?" was presented to them. Each farmer was allowed some time to think and asked to write down the five factors they consider were most important for the successful rearing of pigs for production. Farmers then handed their answers to the facilitator who read the ideas out loud one by one, ensuring that the anonymity of the respondents was ensured at all times. After each idea was read out the question "Is this a new idea?" was asked. Farmers could then engage and debate with one another. If it was a new concept/idea, it was stuck on a wall, separate from other ideas. Each idea was grouped together in clusters (Image 5.1) on a wall. This was followed by a brief discussion to make farmers think about the ideas they presented. Each farmer was then given six little pieces of red paper to vote which six factors they thought most important of all the ideas posted. Votes were tallied and recorded. Ranked from highest to lowest votes, the factors small-scale farmers considered most important for the success of their farm were;

- Clean water
- Medication

- Proper feed
- Good hygiene
- Proper housing
- Knowledge
- Labourers (time spent with pigs)
- Record keeping
- Research
- Land owned
- Warmth

Factors such as water, research, warmth and land could not be statistically analysed as quantifiable data was not available but are discussed in this chapter. A discussion was held around each factor and responses recorded.



Image 5.1. Factors farmers considered important for production as well as their votes.

5.3.2 Statistical analysis

Qualitative information collected from the focus group was used to identify and discuss the variables mentioned under statistical analysis then quantitative information collected from the surveys (discussed under Methods and materials in Chapter 3) was used to analyse those variables.

The variables tested for this chapter were as follows:

- Medication
 - Veterinarian use

- Vaccination use
- Medication use
- Iron injections administered
- Hygiene
 - The disinfection of pens
 - The practice of cleaning around pens
- Feed
 - Type of piglet feed given
 - Type of weaner feed given
 - Type of grower feed given
 - Type of feed given to breeding boar
 - Type of feed given to the pregnant sow
 - Type of feed given to the nursing sow
 - Type of feed given to the dry sow
- Housing
 - Housing system used
 - Materials used for pen construction
 - Flooring used in pens
- Knowledge
 - Years farming with pigs
 - Training
- Labourers working on farms
- Record keeping

These variables were tested against two null-hypotheses:

1. H_0 : The variables do not have a significant impact on the number of pigs sold on average
2. H_0 : There is no significant difference between the means of the top producing small-scale pig farmers and the average producing small-scale pig farmers

An ANOVA was run for the testing of the null-hypothesis followed by a Fisher's LSD test where means differed.

5.4 Results & discussion

5.4.1. Water, research, land and warmth

Clean water

Clean water was voted the most important factor for the successful production of pigs. Kyriazakis & Whittemore (2006) stated that a continuous supply of fresh and uncontaminated drinking water is essential to pig health. In each of the study sites, water was not accessible through direct water sources to individual farms. The study areas were generally not serviced with water or electricity, this was also seen in Botswana (Montsho & Moreki, 2012). Farmers had to make use of vehicles and large tanks to drive water to their farms or carry it in buckets and transport it by foot. Even farmers who made use of nipple drinkers connected the drinkers to tanks and/or barrels filled with water. In each of the study sites, a few farmers had 1000L tanks which they filled up when necessary.

At certain areas within the Khayelitsha study site, taps were made available as a communal source of water. Most farmers made use of buckets to transport the water to their pigs, which they mentioned became taxing. Other farmers connected a hose to the taps and ran it to their farms. This became a source of frustration to other farmers who would have to wait for those farmers to finish before they were able to use the taps. In Mamre, many farmers dug boreholes to provide their pigs with water as they did not have communal farming taps and majority of farmers lived in town, away from their farms. Other farmers in Mamre collected water from a nearby dam and transported them through buckets or tanks on a vehicle. Malmesbury farmers live near enough to their pigs that they could collect water from their homes and either carry or drive it to their farms. Farmers from Malmesbury would also make use of surface water when enough rainwater accumulated in a small, shallow pond near their farms.

Some farmers mentioned that it was more important than feed and that it was critical for cooling pigs off in summer. Clean water was one of the factors that received the most votes, indicating that farmers understood the need for clean water in production.

Research

The fact that farmers considered research to be one of the most important factors for pig production shows the understanding and appreciation farmers have for institutions willing to assist them.

During the focus group, one farmer mentioned that she and her husband gladly assists students who want to do research on the small-scale sector because they understand how sharing such information can benefit them. Visser (2014) stated that the small-scale sector is poorly researched and the nature of it makes it difficult to discover the true extent of their production.

The benefits of research in these areas provide government and other benefactors with a deeper understanding of this sector and its specific needs, providing crucial information for more informed decisions and rural development. Hall & Aliber (2010) stated that the primary constraint in state support to small-scale farmers is not the funds available in the budget but rather the misallocation of funds. This could be seen with programs such as CASP (Comprehensive Agricultural Support Program) which was established in 2004 with the function of supporting new farmers (DAFF, 2012). CASP was allocated large sums of money during 2011/12 and yet the impact this program has made on smallholder farmers remains unclear (Thamaga-Chitja and Morojele, 2017). With proper research done, available funds can efficiently be used and properly allocated to improve the livelihood and farming practices of small-scale farmers.

Land

Farmers commented that in order to expand on their farming enterprises, they needed more space, which was not possible without more land to farm on. Farmers are only allocated a certain space to farm in with limited space to expand. Farmers also mentioned that they had no sense of permanency in their farming regions as they could expect to be moved should government decide to make use of the land for something else.

Warmth

Visser (2014) stated that piglets must be placed near a heat source as soon as possible after birth. This is because piglets are born with very little backfat and hair to protect them against the cold. Farmers mentioned that warmth for their piglets was important, especially during winter months as that is when they experience an increase in piglet mortalities due to the cold and because they huddle close to the sow and are easily crushed by her. Farmers do not have access to electricity on their farms, making it impossible for them to install heat lamps or heaters to warm their pigs. Although farmers listed warmth as a factor for successful farming, no votes were given to this factor. Farmers justified this by stating that it was only a problem for a few months and some of them ensured that they mated their sows in such a way that she would not have piglets during the

winter. The provision of heat lamps in communal farming areas could potentially be dangerous as most of the materials farmers use for the building of their pens, such as wood or plastic, are flammable and fires could spread easily from one farm to the next. Alternative solutions should thus be developed to decrease piglet mortalities during winter times by keeping piglets warm without being a fire hazard. Ideally these solutions should require no electricity or constant water supply and should be safe to place in pig pens.

5.4.2. An overview of the number of pigs sold by small-scale pig farmers in the Western Cape

The boxplot below presents an overview of the number of pigs sold over a 12 month period by small-scale pig farmers in the Western Cape. The time it took to market pigs was not considered for this section of the results and neither was the production stage at which the pigs were sold. Three outliers; 780, 500 and 327, have been removed from the figure below (Figure 5.1.) to simplify the boxplot. It must be noted, however, that those outliers were included when further analysing the data. The maximum number of pigs sold by a farmer was reported to be 780; this farmer stated that he sells to an abattoir and was the only farmer interviewed who did. The highest number sold by a farmer who did not sell to an abattoir was 500 pigs. The majority (83.1%) of farmers sold less than 50 pigs over the span of a year. When taking all observations into account, the average number of pigs sold by farmers interviewed for this study was 41.21 while the median was 8.00 (indicated by the bold horizontal line inside the box-plot. The dots above the box are indicators of further outliers; Figure 5.1).

The factors that had a significant impact on the number of pigs sold per year were the experience of the farmer (the number of years they had been farming with pigs), the piglet feed fed and the grower feed fed to the pigs.

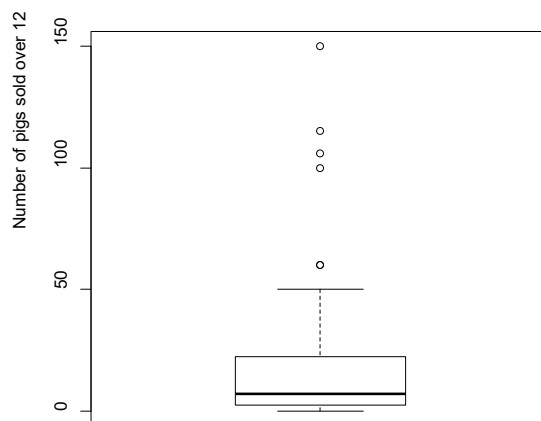


Figure 5.1. Boxplot of the number of pigs sold by small-scale pig farmers in the Western Cape over a 12 month period

Due to the fact that so few farmers sold more than 50 pigs a year, the farmers were separated into two groups; those who sold more than 50 pigs over a 12 month period, and those who sold less, and the second hypothesis was developed (H_0 : There is no significant difference between the means of the top producing small-scale pig farmers and the average producing small-scale pig farmers). This was to further investigate what the top producing farmers in this study did in order to be more successful. Those who sold more than 50 pigs will be referred to as ‘top small-scale producers’ (or TSSP) and those who sold less will be referred to as ‘average small-scale producers’ (or ASSP). None of the TSSP were found in Malmesbury while three were from Khayelitsha and nine from Mamre. The two groups were compared in order to gain a better understanding of how and why some farmers underperform in comparison to others farming in the same or similar environment. The two boxplots below given an overview of how many pigs are sold by the TSSP against the ASSP (Figures 5.2.a. and 5.2.b.)

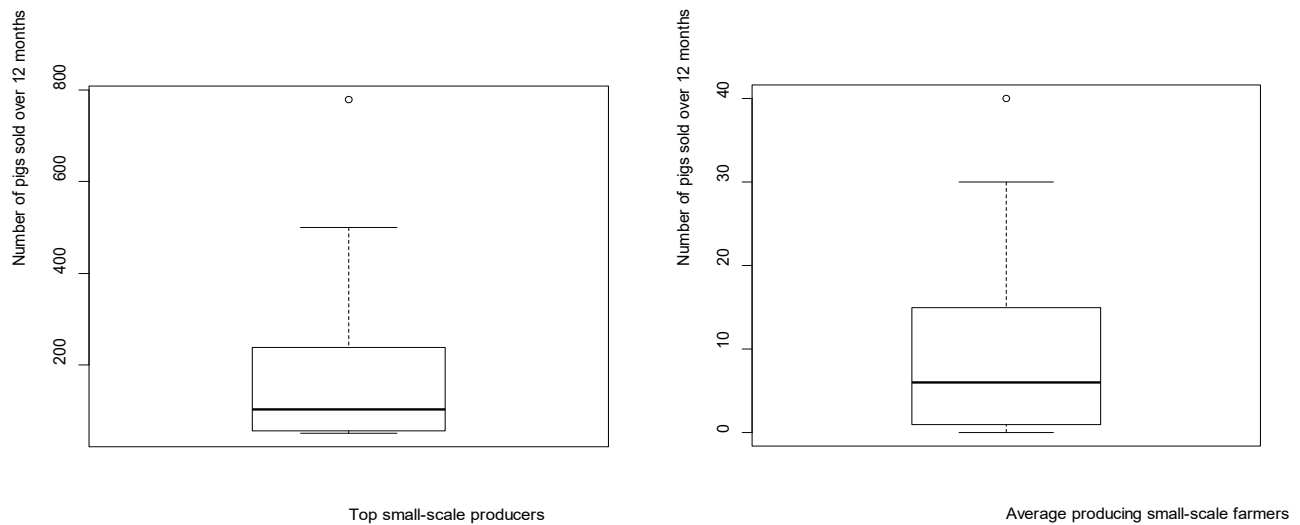


Figure 5.2.a – b. An overview of the number of pigs sold by top small-scale producers (TSSP) (a) and average small-scale producers (ASSP) (b) in the Western Cape over a 12 month period

The number of pigs sold over 12 months by the TSSP vary more than that of the ASSP (Figure 5.2.a – b.); the TSSP had a larger standard deviation of 229.1 while the ASSP had a standard deviation of 9.8. Pigs sold by TSSP ranged from 50 pigs to 780, while the pigs sold by ASSP ranged from 0 – 40. For the TSSP, 75% sold between 50 and 194 pigs over 12 months, with an average of 195.7 pigs sold and a median of 103.0. The ASSP sold an average of 9.8 pigs over 12 months with a median of 6.0. Seventy-five percent of ASSP sold fewer than 15.0 pigs over 12 months.

Thirteen farmers in total stated that they had not sold a single pig over the 12 months prior to their interview. This could be due to a number of factors such as farmers not having found a market willing to buy from them, their pigs not being in the proper condition to be sold, and they may have lost all or most of their pigs due to diseases or theft. It could also be possible that some farmers stated that they sold no pigs even if they had because they thought they could somehow benefit from this study if they could not sell pigs.

Factors on which the two groups differed significantly were the number of years farming, whether farmers cleaned outside their pens, whether medication was given, piglet feed fed and grower feed fed. These factors are discussed further in this chapter.

5.4.3 Medicine

The impact of medication on production seemed to be of high importance to small-scale pig farmers as it was the factor that received the most votes (after clean water) during the focus group. This factor was broken into four components; the use of medication when pigs became ill, the use of a veterinarian when pigs became ill or abnormal deaths occurred, the practice of iron injections, and whether farmers had a vaccination program. Table 5.1. presents the summary statistics for these factors compared to the average number of pigs sold by farmers who stated yes or no for the implementation of these practices. The results are given as the average pigs sold \pm the standard deviation.

Table 5.1. An overview of the impact of different health management practices on the number of pigs sold by small-scale pig farmers in the Western Cape.

	Yes	No	P value
Medicine use	52.62 \pm 131.52	7.46 \pm 8.21	<0.05
Veterinarian use	48.72 \pm 134.46	29.04 \pm 69.37	0.16
Iron injections	46.00 \pm 123.57	13.11 \pm 13.33	0.68
Vaccination program	44.62 \pm 123.32	10.89 \pm 15.82	0.26

From Table 5.1 it can be noted that only the use of medication had a significant impact on the number of pigs sold by small-scale farmers. However, it seems that farmers who made use of medication, veterinary services, iron injections and vaccinations sold more pigs on average than those who did not. This gives an indication of the importance of proper health management in pigs, especially those farming in communal areas where diseases are easily transferred between farms due to the close proximity in which pigs of different farms are reared as well as the lack of biosecurity.

Table 5.2 compares the two small-scale producer groups, top and average, and their health management practices. The two groups only differed in terms of medication use, however, the iron injection variable had a P-value of 0.056, which borders rejection of the null-hypothesis. All TSSP made use of medication and administered iron injections. The two groups were similar with regards to the number who had a vaccination program (>86%). No difference was seen between the two groups for veterinarian use.

Table 5.2. A comparison of the medical procedures practiced by top and average small-scale pig producers in the Western Cape.

	Top producers				Average producers				P-value
	Yes	%	No	%	Yes	%	No	%	
Vaccination program	10	90.9	1	9.1	51	86.4	8	13.6	0.67
Veterinarian use	8	66.7	4	33.3	38	66.7	19	33.3	1.00
Medication use	12	100.0	0	0.0	41	77.4	12	22.6	<0.05
Iron injections	12	100.0	0	0.0	49	84.5	9	15.5	0.06

Although medicine has been shown to have a significant impact on the production outputs of small-scale pig farmers in the Western Cape, some farmers still do not make use of medication for their pigs. This could be due to inadequate training on the administration and acquirement of medicine, or their inability to afford medication as mentioned by farmers in this study and as seen in other countries (Kambashi *et al.*, 2014; Ibitoye *et al.*, 2016). It is recommended that, due to the financial struggles faced by small-scale farmers, medication be provided at a lower cost and that farmers form groups when buying medication for their pigs so as to split the expenses, making it more affordable for each farmer.

Thirty-three percent of farmers did not make use of a veterinarian for their pigs. Farmers who did not make use of veterinarians commented that they did not know how to get into contact with a veterinarian, that veterinarians took too long to respond to their needs, were too expensive or were a waste of time. This shows poor relationship between veterinarians and farmers. Training and farmers days where extension officers and veterinarians offer the training should be provided by government and other institutions. This is a means by which farmers can build connections with one another as well as build a good relationship with extension officers and veterinarians. This also serves as a platform where farmers can be advised on whom to contact to address specific issues and provides extension officers and those in research to identify key problems amongst small-scale farmers.

Training on the construction of a vaccination program, the type and administration of vaccinations to use is highly recommended. Proper training in this regard could lead to an increase in healthy pigs reared by small-scale farmers which would increase the number of pigs being marketed and

sold. This is also a means by which to reduce the risk of selling infected pigs to the informal market.

5.4.4 Hygiene

Farmers interviewed for this study lived in close proximity to one another, limiting the implementation of segregation, which Madec *et al.* (2010) describes as one of the three main elements of biosecurity along with cleaning and disinfecting. If healthy animals cannot be segregated from sick animals, diseases can rapidly transfer from one farm to the next. In addition to this, many allowed any visitors to come onto their farm without special clothing or a disinfecting foot bath. Certain farmers also allowed dogs and cats to walk with the pigs in open camps. Wild animals such as birds, rats and mice could easily move between pens and transfer diseases between the farms. This increased the importance of cleaning and disinfecting pens as it was one of the few things farmers could do to protect their pigs against diseases and pathogens. Table 5.3 compares the number of pigs sold on average by farmers who cleaned and disinfected their pens against those who did not.

Table 5.3. A comparison of the number of pigs sold over a 12 month period by farmers who cleaned and disinfected their pens and those who did not.

	Yes	No	P value
Clean outside pen	46.54 ± 123.47	8.70 ± 8.29	0.25
Disinfect pen	52.02 ± 138.91	20.65 ± 32.79	0.17

As only one farmer stated that they did not clean inside their pens, it was not necessary to compare this factor to the number of pigs sold. Although no significant differences were found among farmers who cleaned outside their pens and disinfected their pens and those who did not, it is clear that those who did sold on average more than those who did not.

A significant difference existed between the two production groups with regards to the numbers of farmers who cleaned outside of their pens, but not for the number of farmers who disinfected (Table 5.4). All TSSP cleaned outside and around their pens, while 16.9% of the ASSP did not. The two groups were similar with regards to how many farmers disinfected their pens, although one third of farmers did not disinfect their pens, regardless of how many pigs they sold.

Table 5.4. A comparison of the number of farmers who clean and disinfect their pens between top small-scale producers against average small-scale producers

	Top producers				Average producers				P-value
	Yes	%	No	%	Yes	%	No	%	
Outside	12	100.0	0	0.0	49	83.1	10	16.9	<0.05
Disinfect	8	66.7	4	33.3	39	67.2	19	32.8	0.97

Past studies encourage farmers to clean their pens on the inside and the outside, as well as to disinfect pens when pigs are not present (Madec *et al.*, 2010; Mokoele, 2015). The pen and equipment used during pig rearing should be cleaned and disinfected periodically (Beltrán-Alcrudo *et al.*, 2008; Madec *et al.*, 2010; Mokoele, 2015). This is done to prevent parasites and re-infestations (Dione *et al.*, 2014), and to lower the risk of endemic disease breakouts (Madec *et al.*, 2010). Feeding and water troughs must also be kept cleaned. If troughs are not cleaned, feed may become stale and/or contaminated, resulting in a decrease in the appetite of pigs (Kyriazakis & Whittemore, 2006). Clean feed should also be accompanied by clean drinking water (Kyriazakis & Whittemore, 2006).

The results indicate that keeping a clean environment within and around the pen is essential for the positive production of small-scale pig farmers. The fact that one third of farmers do not disinfect their pens is worrying and indicates that there is a need for farmers to be educated on the important role disinfection plays in a piggery.

5.4.5 Feed

As mentioned in Chapter 4, the feed farmers gave to their pigs was categorized into three main categories namely commercial, mixed and by-products and waste. Commercial feed refers to nutritionally balanced feed manufactured by animal feeding companies, by-products and waste refer to by-products from factories and silos in surrounding areas, expired food from grocery stores and kitchen waste, and mixed feed refers to a combination of commercial feed and by-products and waste. This is discussed in more detail in Chapter 4.

The table below (Table 5.5) gives an overview of how different feed impacts the number of pigs sold by small-scale pig farmers. The piglet and grower stages were the only stages at which the type of feed given had a significant impact on the number of pigs sold per year. The two production groups, TSSP and ASSP, also differed significantly with regards to what feed they fed at these stages. In terms of the two production groups, p-values of 0.10, 0.64, 0.95, and 0.62 were found for weaner feed, nursing sow feed, pregnant sow feed, and empty sow feed respectively.

Table 5.5. An overview of the impact type of feed has on the number of pigs sold by small-scale pig farmers over 12 months.

	Commercial		Mixed		By-products		Sow's milk		P-value
	N	$\bar{x} \pm sd$	N	$\bar{x} \pm sd$	N	$\bar{x} \pm sd$	N	$\bar{x} \pm sd$	
Piglet feed	46	32.96 ± 77.93 ^b	12	11.00 ± 7.26 ^b	3	18.33 ± 16.07 ^b	6	202.83 ± 77.93 ^a	<0.05
Weaner feed	41	63.41 ± 147.81	19	14.05 ± 16.22	7	7.57 ± 9.31	*	*	0.13
Grower feed	10	111.10 ± 238.62 ^a	25	9.72 ± 11.27 ^b	24	18.17 ± 31.44 ^b	*	*	<0.05
Nursing sow feed	21	26.33 ± 38.59	24	21.25 ± 29.61	20	91.80 ± 205.72	*	*	0.88
Pregnant sow feed	23	57.83 ± 161.75	25	33.84 ± 67.58	18	41.00 ± 115.61	*	*	0.72
Empty sow feed	10	89.00 ± 242.97	30	24.93 ± 36.74	26	49.08 ± 112.65	*	*	0.99

Interestingly, the results indicate that farmers who did not give creep feed but simply allowed piglets to suckle differed from others and sold more pigs on average (Table 5.5). This is possibly because the farmers who sold 780 and 350 pigs over a 12 month period were included amongst those who allowed the piglets to suckle, which could greatly influence the average. It should be noted that overall, most (68.7%) of the farmers made use of commercial creep feed, but the number of pigs sold by these farmers ranged from 0 to 500, resulting in a lower average than that of the farmers who simply allowed their piglets to suckle. Figure 5.3 further shows that TSSP did not risk feeding their piglets anything other than commercial creep feed and/or the sow's milk.

The TSSP did not risk exclusively feeding by-products and waste to their pre-grower phases (Figure 5.3). The piglet and weaning stages are the most sensitive ages of a pig's life and proper

care should be given to ensure that they survive these phases (Visser, 2014). It is thus critically to feed quality feed during this period. The majority of ASSP seemed to understand this as they fed commercial feed to their piglets and weaners (69.1% and 56.4% respectively), however a group of these farmers also fed by-products and waste or mixed their feed during these stages.

When by-products and waste are used for the feeding of pigs, even when mixed with commercial feed, it is difficult to determine what the nutritive value of that feed is as each farmer makes use of different feed and source from different places. By-products and waste are also usually old and stale food which farmers wouldn't themselves consume and, when asked about the preparation of the feed, none of the farmers stated that they cook the feed which contained by-products or waste before feeding it to their pigs. This creates a breeding ground for bacteria and mycotoxins to build up, which could upset a still developing piglet's stomach and cause diarrhoea and other illnesses that could lead to a decrease in production or even death.

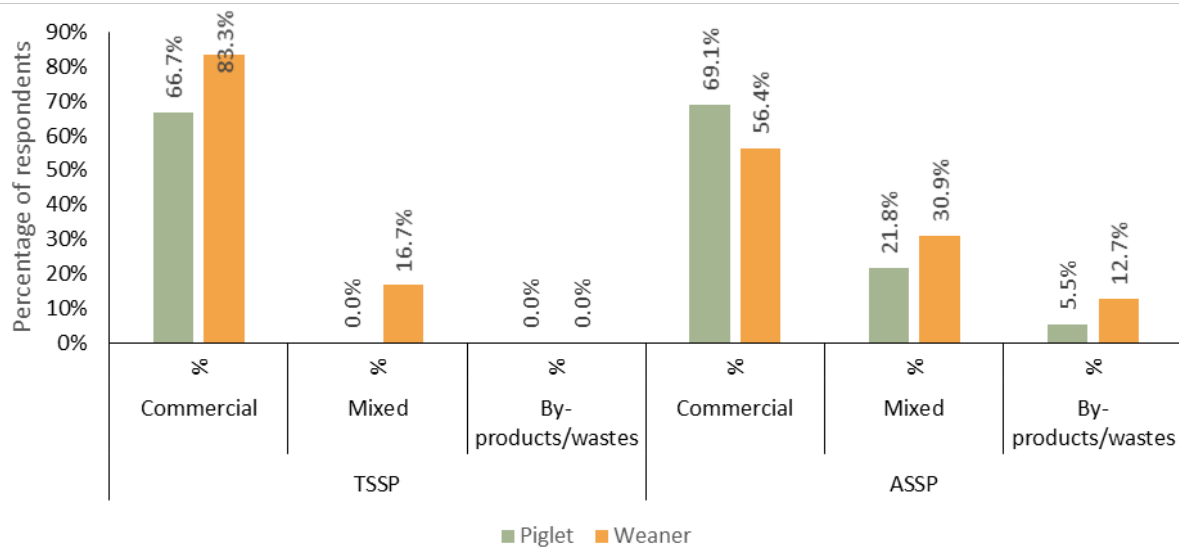


Figure 5.3. A comparison of the piglet and weaner feed given by top small-scale pig producers (TSSP) and average small-scale pig producers (ASSP)

At the grower stage, those who fed commercial feed to their growers sold significantly more pigs on average than those who fed other feed (Table 5.5). This is expected as commercial feed is a more reliable feed source and would result in a healthier pig and more satisfactory carcass. However, when evaluating the different production stages (Figure 5.4), it was interesting to find that an equal number of top producers fed their grower pigs commercial feed as those who fed by-

products and waste. One of the TSSP who fed by-products and waste to their grower pigs stated that they did so because of their market. This led to the discovery that some of the TSSP preferred to sell to the informal/local market rather than to an abattoir. Their reasons were that they could get a better price for their pigs and there was no risk of having their pigs condemned. Farmers stated that the market they were selling to generally prefer the pigs to be a bit fatter than that of the commercial market because the extra fat made the meat tastier. This gave these farmers the freedom to use feed of lower quality such as by-products and waste and/or a mixture of commercial feed as it would result in rapid fattening of pigs due to the high energy and protein content of these diets (Madec *et al.*, 2010). Farmers could then also save money on feed while producing what would be an ideal pig for the informal market. People buying from the informal market would bargain with the farmer and base their price on the conformation of the pig as well as the age. One farmer mentioned that he made use of a cross between pot belly pigs and Large White-Landrace crossings in order to market a pig with satisfactory fat deposition for his customers.

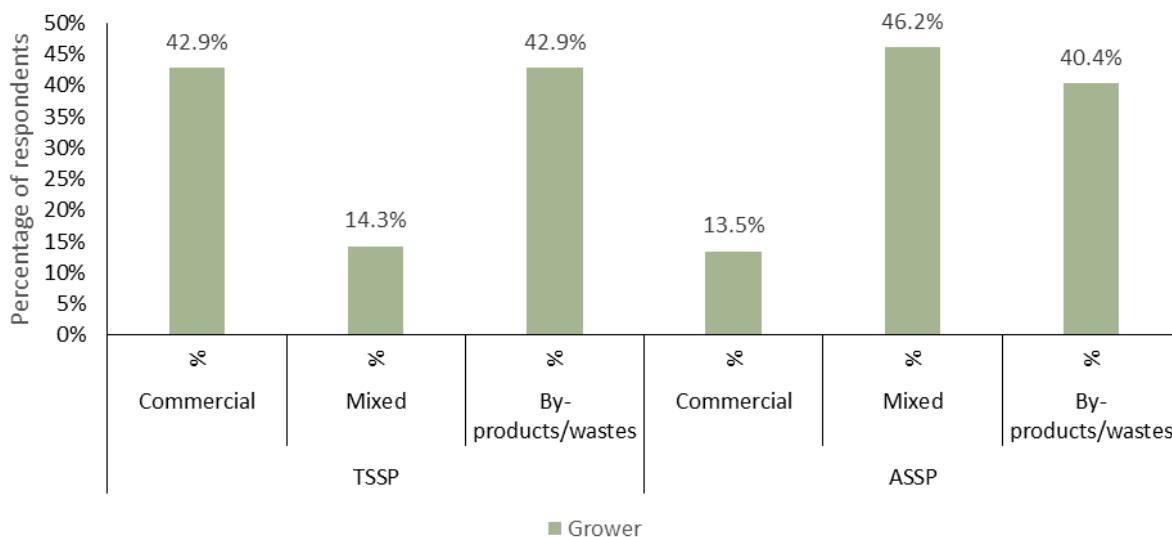


Figure 5.4. A comparison of grower feed given by top producing small-scale (TSSP) pig farmers and average producing small-scale (ASSP) pig farmers.

In terms of what was fed to the breeding sow, the two groups did not differ significantly from one another during any of her production stages (Figure 5.5). What was fed to the pregnant sow did not differ on average in terms of how many pigs farmers sold or between the two producer groups. Interestingly, farmers who fed by-products and waste to their nursing sows sold at least 3.5 times

more on average than those who fed other types of feed. With regards to the two different producer groups, in both cases farmers were nearly evenly divided in terms of what they fed, although more of the TSSP fed by-products and waste (41.7%). Although feed fed to the empty sow did not have a significant impact on the number of pigs sold, those who fed commercial feed sold more on average. However, upon further inspection into what the TSSP fed, only one top producer fed commercial feed to their sow; the highest producer who sells to an abattoir. Other top producers mainly fed mixed feed or by-products and waste to their empty sows.

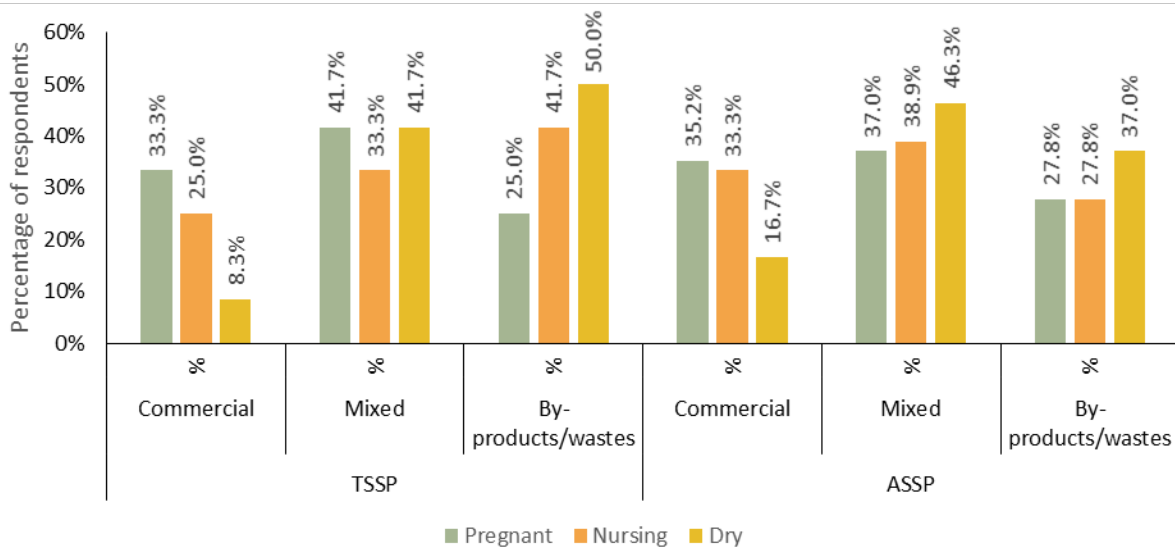


Figure 5.5. A comparison of the breeding sow feed given by top producing small-scale (TSSP) pig farmers and average producing small-scale (ASSP) pig farmers.

The variation observed within the TSSP group in terms of what they feed their breeding sow indicates that certain farmers are able to manipulate the diets of their sows to suit their budgets while still maintaining the sow's health, allowing her to produce and wean more piglets which they could market. Due to the nature of the feed given to pigs, it is uncertain what the nutritive value is as well as what the impact of said feed would have on production. It can only be assumed that commercial feed would have the most positive impact on production as it is specifically formulated feed for pigs while mixed feed and by-products and waste are less predictable. Each farmer has a different feeding strategy and even within the same category, different feed types are found. Therefore, the type of feed given to pigs kept by small-scale farmers and the impact of that feed on their production requires further research.

5.4.6 Housing

The type of system used did not have a significant impact on the number of pigs sold ($P = 0.65$). On average, however, it seemed that farmers who reared pigs on a semi-intensive production system sold slightly more pigs. Semi-intensive farming systems allow pigs to roam freely. This increase in exercise may assist in the ability for the boar to mount sows. Should sows be exposed to boars in this system, it could stimulate the onset of oestrus. The structures included in semi-intensive farming systems also include all the benefits of an intensive system which protect pigs against harsh environments (Matabane *et al.*, 2015).

Table 5.6. A comparison of the production systems pigs were reared in based on the number sold by smallholder pig farmers in the Western Cape.

	N	Average number of pigs sold	Range
Intensive	42	39.86 ± 121.60	0 – 780
Semi-intensive	27	44.37 ± 111.01	0 – 500
Extensive	2	27.00 ± 18.38	14 – 40

The material used did not have a significant impact on the number of pigs sold ($P = 0.34$). However, only three materials could be compared; cement blocks, wood, iron and the combination thereof. This was discussed in detail in Chapter 4. Similarly, there was no significant difference for the type of flooring used by farmers ($P = 0.22$). Only three types of flooring were observed in the pig pens of smallholder pig farmers interviewed for this study; soil, concrete and wood. Those who had concrete flooring (59.55 ± 146.37 pigs) sold more on average than those who had soil (13.05 ± 24.87 pigs) or wood (18.8 ± 16.9 pigs).

Table 5.7 is an overview of how the two groups, TSSP and ASSP, compare with regards to housing their pigs. The two groups did not differ significantly from one another with regards to the housing system ($P = 0.62$), material ($P = 0.16$) or flooring ($P = 0.11$) used. The groups were very similar with the type of systems they used and the materials used. Though there was not a significant difference found, more top producing farmers made use of concrete flooring

Table 5.7. A comparison of the housing structure used by top and average small-scale pig producers in the Western Cape.

	Outliers		Average producers	
	N	%	N	%
Intensive	8	66.7%	34	57.6%
Semi-intensive	4	33.3%	23	39.0%
Extensive	0	0.0%	2	3.4%
Iron and wood	4	33.3%	19	32.2%
Wood	2	16.7%	26	44.1%
Iron	3	25.0%	9	15.3%
Block	2	16.7%	1	1.7%
Other	1	8.3%	4	6.8%
Concrete	10	83.3%	33	55.9%
Soil	1	8.3%	21	35.6%
Wood	1	8.3%	5	8.5%

5.4.7 Knowledge

Number of years farming

A significant difference existed between the number of years farmers had been rearing pigs and their production outputs (Figure 5.6). Knowledge is regarded as an essential factor to the performance of emerging small-scale pig farmers (Mokoele, 2015). Farmers from the three study areas seemed to agree with this statement as knowledge was one of the factors they deemed important to their farming practices. For this study, knowledge was broken up into two components; experience (years farming) and training. Farmers who had less than five years experience in pig farming marketed less pigs than those who had been farming for more than three decades. Those that farmed for more than three decades sold the most pigs on average, indicating that experience does influence production. Interestingly, there is a steady increase in the number of pigs sold as years farming increases, until a sudden decrease (at those who have farmed 11 to

15 years), thereafter the number of pigs sold increases with experience. This impact of farming experience could be further investigated in future studies.

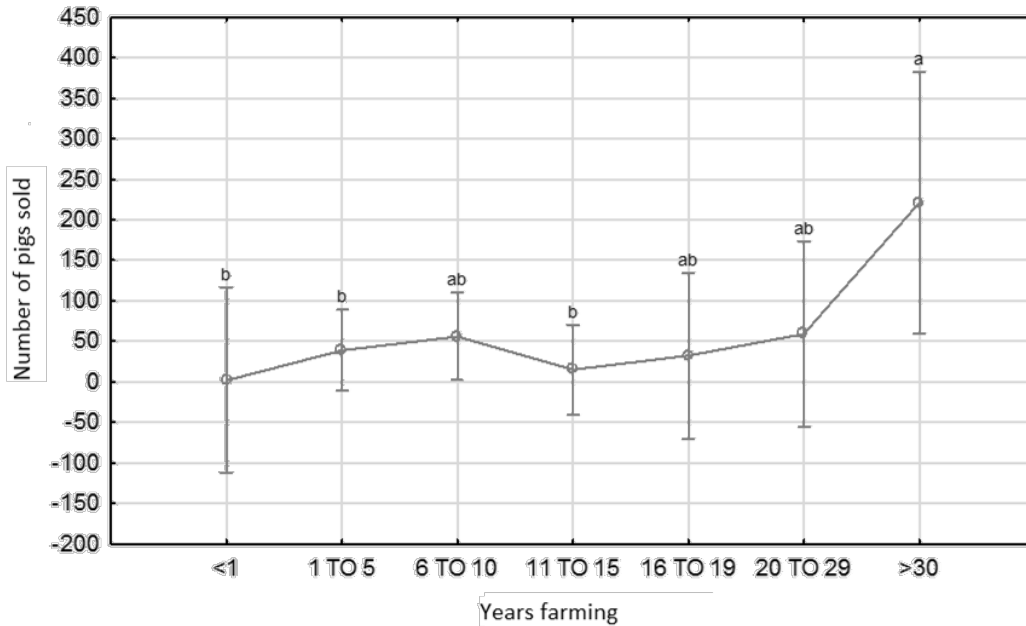


Figure 5.6. A comparison between the number of years small-scale farmers have been farming and the number of pigs sold over a 12 month period. ^{a,b} means with different superscripts differ ($P < 0.05$). The scale of the y-axis is adjusted to ease the interpretation of the graph as, overall, farmers sold from zero pigs to 780.

The difference between the two production groups according to farming experience (years farmers spent farming) is depicted in Figure 5.7. The TSSP differed significantly from the ASSP with regards to how long the groups had been farming with pigs. The top producing farmers had responses that clustered around the 1 to 5 years category (25.0%) and anything over two decades (41.7%). The lower producing farmers (ASSP) mostly had less than 15 years of experience with pig farming (91.5%).

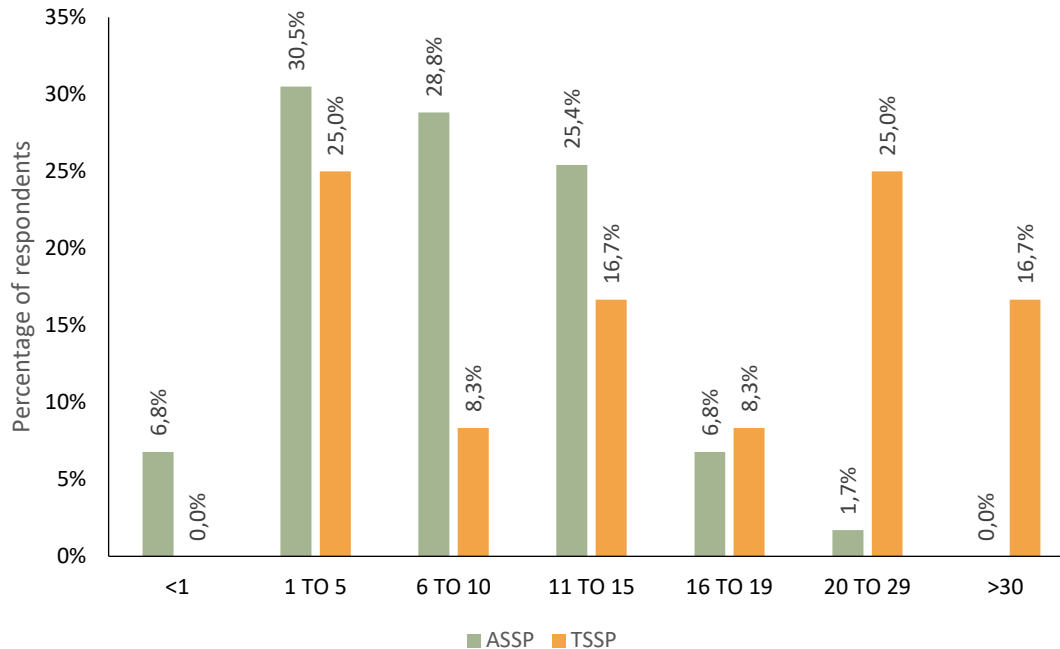


Figure 5.7. A comparison between the top small-scale producers (TSSP) and average small-scale pig producers (ASSP) with regards to pig farming experience.

Training

Training did not have a significant impact on the number of pigs farmers sold ($P = 0.11$). However, farmers who stated they had gone for training on pig rearing sold nearly twice as many pigs on average than those who did not. Sixty-three percent of farmers stated that they had gone for training on pig rearing before and sold a combined average of 49.74 pigs over a 12 month period. Those who had never gone for training sold a combined average of 25.52 pigs over a 12 month period.

The difference between the top producers and the average producers for training can be seen in Table 5.8 below. No significant difference was observed between the two groups in this regard ($P = 0.12$). Although, nearly 40% of ASSP did not have any training while a greater percentage of TSSP had gone for training.

Table 5.8. An overview of the two small-scale producer groups with regards to training received.

	Top producers				Average producers			
	Yes	%	No	%	Yes	%	No	%
Training	10	83.3	2	16.7	36	61.0	23	39.0

The majority of farmers (62.7%) stated that they had received some sort of training on pig rearing. In other developing countries and South African Provinces, it seemed that this was not the case. In Mpumalanga (Munzhelele, 2015) and KwaZulu-Natal (Gcumisa, 2013), few farmers had received any training on pig rearing. Training was also low amongst small-scale pig farmers in Nigeria (Chah *et al.*, 2014; Aminu *et al.*, 2017), Madagascar (Costard *et al.*, 2009) and China (McOrist *et al.*, 2011).

Training on pig rearing is vital for the successful management of a piggery. Mokoale (2015) noted that good animal husbandry and the transfer of knowledge by veterinary officials is central to the productivity of small-scale pig farmers. Aminu *et al.* (2017) stated that trained farmers will be better equipped and thus adapt better as the agricultural sector develops. A study by Gcumisa (2013) on small-scale farmers in KwaZulu Natal found that training improved the performance of sows. Training on pig production should also be offered to extension officers and consultants of small-scale pig farmers as they make direct contact with these small-scale farmers and are most familiar with their struggles. In Nigeria, inadequately trained personal working with small-scale pig farmers has been highlighted as a problem (Ibitoye *et al.*, 2016).

5.4.8 Labourer

The keeping of labourers did not have a significant impact on the about of pigs sold ($P = 0.99$). , however farmers who stated they had labourers sold more pigs on average (75.16 ± 186.11) than those who had none (22.76 ± 33.96) The number of TSSP who managed their farm on their own were similar to the ASSP (Table 5.9) ($P = 0.88$).

Table 5.9. A comparison of the two production groups with regards to labourers employed

	Top producers				Average producers			
	Yes	%	No	%	Yes	%	No	%
Labourer	4	33.3	8	66.7	21	35.6	38	64.4

During the focus group, farmers stated that extra help on the farm was important for the improvement on production output. This is to be expected as an increased number of pigs owned would increase the labour requirement. However, only one third of farmers overall stated that they made use of a labourer. The results show that the top three producers stated that they had employed at least one labourer to assist them with their business. Most farmers were also older than 40 years and would require extra assistance to help with activities that they were possibly not able to do anymore such as mucking out the pens or managing mature boars. Due to the risk of theft, some farmers simply employed someone to watch their pigs at night or when they're not around, this could also be a reason for the fact that those who had labourers sold more pigs as less pigs would be stolen. Some other reasons mention by the focus groups on the advantages of having additional labour include: labourers are useful for monitoring pigs when they farrow, especially during times when the farmer cannot be there. Labourers can be there to ensure that all piglets suckle and get the colostrum that they need to survive. They can also ensure that piglets are not laid on by the sow during the first few hours of being alive.

5.4.9 Record keeping

Those who kept records of their pigs did not differ significantly from those who did not ($P = 0.74$). Based on the average number of pigs sold, results were very similar. Those who kept records sold 41.86 (± 131.04) pigs over a 12 month period on average while those who kept no records sold 42.55 (± 100.65) on average.

A similar pattern was also seen between the two groups ($P = 0.42$). Roughly half of farmers from each production category did not keep records.

Table 5.11. A comparison of the two small-scale producer groups with regards to record keeping.

	Top producers				Average producers			
	Yes	%	No	%	Yes	%	No	%
Record keeping	5	41.7	7	58.3	31	54.4	26	45.6

As discussed in Chapter 4, record keeping is poor amongst small-scale pig farmers in many developing countries (Mutua *et al.*, 2010; Gcumisa, 2013; Madzimure *et al.*, 2013; Matabane *et*

al., 2015; Mokoelé, 2015; Munzhelele, 2015; Ibitoye *et al.*, 2016). It is, however, critical that good record keeping be sustained. Good record keeping will not only benefit the farmer by making it possible to design a decent breeding program (Montsho & Moreki, 2012; Gcumisa, 2013) and allowing them to evaluate the financial situation (Mokoelé, 2015) and production on the farm, it also assists veterinarians, extension officers and universities as it provides validation for the farmers' answers (Mokoelé, 2015) it also makes it easier for the veterinarian and extension officers to predict the causes of undetermined mortalities. It would also make it possible to trace back to the cause of a disease breakout. Training should be provided for farmers on proper record keeping and the importance of it should be stressed. Workshops could strengthen the relationship between farmers and extension officers/veterinarians.

5.5 Conclusion

The importance of proper health management was shown in this study as farmers who invested in their pigs' health by medicating pigs when sick, vaccinating pigs, communicating with veterinarians and administering iron injections sold more pigs on average than those who did not. After the piglet and weaner stage, it seems that farmers began to adjust their feeding strategy according to which production stage the pig is at in order to save money on feeding, it also provided a fatter and more desirable carcass for their specific market. Those who had been farming for over three decades sold more pigs than those farming for less. Training did not have a significant impact on the number of pigs sold, however farmers who stated that they had gone for training sold twice as many pigs on average as those who did not.

Should farmers want to sell to a formal market in future, they should do so gradually, starting with the local market. As their piggery grows, so would their income and they would be able to afford more commercial practices, build up their knowledge and experience, and eventually reduce the risk of having their pigs condemned at an abattoir.

Many factors play a role in the success of a piggery. Some of these factors may not have been mentioned by the farmers. Future studies should look at other possible contributors to the success of small-scale pig farmers and the participation of pig farmers for further research should be encouraged.

5.6 References

- Aminu, F.O., Ekiomoado, C. & Ahonkhai, A. 2017. Profitability and Technical Efficiency of Pig Production in Nigeria: the Case of Ekiti State. *Agri. trop. subtrop.* 50, 27–35. doi: 10.1515/ats.
- Beltrán-Alcrudo, D., Labroth, J., Depner, K. & De La Rocque, S. 2008. African swine fever in the Caucasus. *FAO Empres Watch*. Available at: <ftp://ftp.fao.org/docrep./FAO/011/aj214e/aj214e00.pdf>.
- Chah, J. M., Dimelu, M.U. & Ukwuani, S.U. 2014. Institutional and production characteristics among smallholder pig producers in Enugu State, Nigeria. *Trop. Anim. Health Prod.* 46, 1173–1176. doi: 10.1007/s11250-014-0623-4.
- Costard, S., Porphyre, V., Messad, S., Rakotondrahanta, S., Vidon, H. 2009. Multivariate analysis of management and biosecurity practices in smallholder pig farms in Madagascar. *Prev. Vet. Med.* 92, 199–209. doi: 10.1016/j.prevetmed.2009.08.010.
- Department of Agriculture, Forestry and Fisheries. 2012. Integrated Growth and Development Plan 2012. [online] Available at: <<https://www.daff.gov.za/docs/Policy/IGDP121.pdf>> [Accessed 07 August 2019]
- Dione, M.M., Ouma, E.A., Roesel, K., Kungu, J., Lule, P. & Pezo, D. 2014. Participatory assessment of animal health and husbandry practices in smallholder pig production systems in three high poverty districts in Uganda. *Prev. Vet. Med.* 117, 565–576. doi: 10.1016/j.prevetmed.2014.10.012.
- Duniya, K.P., Akpoko, J.G., Oyakhilomen, O. & Nandi, J.A. 2013. Measurement of Pig Production Profitability in Zangon Kataf and Jema'a Local Government Areas of Kaduna State, Nigeria. *Curr. J. Appl. Sci. Technol.* 3, 1455–1463. doi: <https://doi.org/10.9734/BJAST/2014/4137>
- Gcumisa, S.T. 2013. The untold story of the pig farming sector of rural Kwazulu-Natal: A case study of Uthukela District. MSc thesis. Available at: http://uir.unisa.ac.za/bitstream/handle/10500/14146/dissertation_gcumisa_st.pdf?sequence=1.
- Hall, R. & Aliber, M. 2010. The Case for Re-Strategising Spending Priorities to Support Small-

Scale Farmers in South Africa.

- Ibitoye, S.J., Shaibu, U.M., Sanda, M.E. & Oshadare, D. 2016. Economic Analysis of Local Swine Production Among Small Scale Farmers in Kabba/Bunu Local Government Area of Kogi State, Nigeria. *Gashua J. Irrig. Desertif. Stud.* 2, 1–11.
- Kagira, J.M., Kanyari, P.W.N., Maingi, N. & Githigia, S.M. 2010. Characteristics of the smallholder free-range pig production system in western Kenya. *Trop. Anim. Health Prod.* 42, 865–873. doi: 10.1007/s11250-009-9500-y.
- Kambashi, B., Picron, P., Boudry, C., Thewis, A., Kiatoko, H. & Bindelle, J. 2014. Smallholder pig production systems along a periurban-rural gradient in the Western provinces of the Democratic Republic of the Congo. *J. Agric. Rural Dev. Trop. Subtrop.* 115, 9–22.
- Kimbi, E.C., Mlangwa, J., Thamsborg, S. M., Mejer, H., Lekule, F.P. 2016. Smallholder Pig Marketing Systems in the Southern Highlands of Tanzania. *J. Nat. Sci. Res.* 6, 87–98.
- Kyriazakis, I. & Whittemore, C.T. 2006. Whittemore's Science and Practice of Pig Production. doi: 10.1002/9780470995624.
- Madec, F., Hurnik, D., Porphyre, V. & Cardinale, E. 2010. Good practices for biosecurity in the pig sector: issues and options in developing and transition countries. FAO.
- Madzimure, J., Chimonyo, M., Zander, K.K. & Dzama, K. 2012. Potential for using indigenous pigs in subsistence-oriented and market-oriented small-scale farming systems of Southern Africa. *Trop. Anim. Health Prod.* 45, 135–142. doi: 10.1007/s11250-012-0184-3.
- Matabane, M.B., Nethenzheni, P., Thomas, R., Netshirovha, T.R., Norris, D., Nephawe, K.A. & Nedambale, T.L. 2015. Status of the smallholder pig farming sector in Gauteng Province of South Africa. *Appl. Anim. Husb. Rural Develop.* 8, 19–25. Available at: www.sasas.co.za/aahrd/.
- McOrist, S., Khampee, K. & Guo, A. 2011. Modern pig farming in the Peoples's Republic of China: growth and veterinary challenges. *Rev. Sci. Tech. l'OIE.* 30, 961–968. doi: 10.20506/rst.30.3.2091.
- Mokoele, J.M. 2016. Reasons for poor production among the emerging small-scale pig farmers of

- the Limpopo province of the Republic of South Africa. MMed Vet., University of Pretoria.
- Montsho, T. & Moreki, J.C. 2012. Challenges in commercial pig production in Botswana. *J. Agric. Technol.* 8, 1161–1170.
- Munzhelele, P. 2015. Evaluation of the production systems and constraints of smallholder pig farming in three agro-ecological zones of Mpumalanga province, South Africa. MSc (Agric) thesis, University of South Africa.
- Mutua, F.K., Arimi, S., Oraga, W., Dewey, C., Schelling, E. 2010. Farmer Perceptions on Indigenous Pig Farming in Kakamega District, Western Kenya. *Nord. J. African Stud.* 23, 43-57. Available at: <http://www.lrrd.org/lrrd23/7/mutu23144.htm%5Cnhttp://hdl.handle.net/10568/5369>.
- Nantima, N., Ocaido, M., Ouma, E., Davies, J., Dione, M., Okoth, E., Mugisha, A. & Bishop, R. 2015. Risk factors associated with occurrence of African swine fever outbreaks in smallholder pig farms in four districts along the Uganda-Kenya border. *Trop. Anim. Health Prod.* 47, 589–595. doi: 10.1007/s11250-015-0768-9.
- Nath, B.G., Pathak., P.K., Ngachan, S.V., Tripathi, A.K., Mohanty, A.K. 2013. Characterization of smallholder pig production system : productive and reproductive performances of local and crossbred pigs in Sikkim Himalayan region. *Trop. Anim. Health Prod.* 45, 1513–1518. doi: 10.1007/s11250-013-0391-6.
- Roelofse, J.J. 2013. Economic feasibility study of the establishment of smallholder pig farmers for the commercial market : Empolweni case study. MSc (Engineering management) thesis, University of Stellenbosch, South Africa. Available at: <http://hdl.handle.net/10019.1/85703>.
- Strom G, Djurfeldt, A. A., Boqvist S., Albihn A, Sokerya S, San S, Davun H, Magnusson, U. 2017. Urban and peri-urban family-based pig- keeping in Cambodia: Characteristics, management and perceived benefits and constraints. *PLoS ONE.* 12, 1–13. Available at: <https://doi.org/10.1371/journal.pone.0182247>.
- Thamaga-Chitja, J.M. & Morojele, P. 2017. The Context of Smallholder Farming in South Africa: Towards a Livelihood Asset Building Framework. *J. Hum. Ecol.* 45, 147–155. doi: 10.1080/09709274.2014.11906688.

Umeh, J.C., Ogbanje, C. & Adejo, M.A. 2015. Technical Efficiency Analysis of Pig Production : A Sustainable Animal Protein Augmentation for Nigerians. J. Adv. Agric. Technol. 2. doi: 10.12720/joaat.2.1.19-24.

Visser, D. 2014. Modern Pig Production. Available at:
<https://books.google.co.za/books?id=mpXorQEACAAJ>.

Chapter 6

Conclusions and Recommendations

This study set out to determine the structure of small-scale pig farmers' production systems in three municipal areas of the Western Cape; Mamre, Malmesbury, and Khayelitsha. The study further aimed to uncover the nature of the small-scale pig farming practices across three study areas and how they compared to one another. Lastly, it aimed to identify factors which play a significant role in the production outputs of small-scale pig production.

The findings of this study show that pig farming contributes financially to the livelihood of small-scale farmers in the Western Cape. Besides making a financial contribution to the farmers and their families, pig farming is also beneficial to the community as it provides a source of more affordable protein to those living in rural settlements, opens up a platform for the community to develop certain skills, and possibly provide odd jobs for those without income. Attention should be given to the involvement of youth and women in pig farming since the majority of farmers were male and over the age of 40. The youth in South Africa are especially vulnerable in the labor market as it is estimated that roughly half of those aged between 15 and 24 are unemployed in South Africa. The development of small-scale farmers in communal farming areas could provide a place where the youth can develop certain farming skills, especially because 56.0% farmers interviewed for this study did not only rear pigs but kept other animals as well. Agricultural days and workshops where learners can be in direct contact with livestock, crops and other agricultural components should be encouraged at schools to stimulate the interest of the youth. The involvement of women in agriculture should also be encouraged

This study has, however, shown that overall biosecurity is low amongst small-scale pig farmers in the Western Cape. Farmers are not able to segregate their pigs due to the close proximity in which they farm to one another in communal farming areas and the little space they have to do so, this makes it easy for diseases to spread and, without regular and proper cleaning and disinfecting of facilities, pigs are more vulnerable to infections. This is worsened by the relatively low veterinarian involvement. Roughly one third of farmers stated that they do not contact a veterinarian at all; this did not differ across the three areas. The use of a veterinarian did not have a significant impact on the number of pigs sold, and did not differ between the top producers (those who sold more than 50 pigs over a 12 month period) and the average producers (those who sold

fewer than 50 pigs over a 12 month period). However, those farmers who did contact a veterinarian when they deemed necessary sold roughly 1.7 times more pigs on average than those who did not. Farmers should be encouraged to clean and disinfect their pens regularly by extension officers and through training. Workshops and farmer days should be organized on health management to provide a platform where farmers can become familiar with state veterinarians, extension officers, and organizations that could provide proper health care such as SAPPO (South African Pig Producers Organization) and the SPCA (Society for the Prevention of Cruelty to Animals).

Other biosecurity risks extended to the feed certain farmers fed, their breeding strategies, and record keeping. The number of farmers who fed commercial feed to their pigs declined as the pigs became older. More farmers fed commercial feed before the grower phase. This meant that many farmers would increase the number of by-products and waste fed in the diet of their breeding boars, breeding sows and grower pigs. The concern lies in the fact that when asked if they prepared the feed in any way, none of the farmers who fed by-products and waste to their pigs mentioned cooking the feed beforehand. This is a health risk and unacceptable in many countries, including South Africa. With regards to breeding, most of the sows and boars farmers used for breeding were obtained from the same area, either selecting from the herd and/or borrowing from a neighbor. This not only puts the farmer at risk of having highly inbred litters, it is also an easy way for diseases to transfer from farmer to farmer. In addition to all this, roughly half of the farmers interviewed do not keep any sort of records of their pigs, even though farmers considered record keeping to be one of the key factors to a successful piggery. This would make it difficult to trace back the origin of a disease breakout, should one occur.

Despite all the biosecurity breaches, very few farmers stated that they had lost pigs due to disease. Seventy-six percent of farmers stated that their pigs rarely died once weaned and of those who had experienced piglet mortalities, very few farmers had experience with losing a piglet due to disease. This suggests that some farmers were possibly unable to identify certain diseases and that farmers concluded that it was due to the sow or the cold because it was what they were familiar with. Farmers may have missed symptoms of diseases or malnutrition that result in piglets being more prone to cold and/or make them unable to respond quickly enough to get away from the sow when she is laying down. In addition, farmers did not have electricity where they farmed and were unable to protect their pigs against the cold with heaters, resulting in more piglets being crushed by sows

in the winter as they huddle close to the sow for warmth. Providing farmers with electricity for heaters and heat lamps could, however, be potentially dangerous as many of these farmers have pens made of wood and lay bedding which could easily catch fire and spread through the farming site. Thus, alternative ways to provide piglets with warmth should be developed such as specialized heating pads which make use of water or other substances which would not pose a fire hazard. The economic feasibility of this would need to be evaluated considering that most of the farmers did not have ready cash nor electricity and running potable water. Farmers are also unable to afford farrowing crates for their sows, but certain farmers found means to get around this by placing a plank or a rod in the corner of the pen. This effectively ensures that the sow cannot pass to that area, providing a safe space for piglets to lie down and prevents the sow from crushing them in the corners.

Farmers generally sold to anyone who would be willing to buy their pigs, which suggests that many did not have a specific market. This indicates that most farmers did not have a stable income source from selling their pigs. Most farmers from Mamre sold to personal buyers. It was later discovered that many of the Mamre farmers sold to the same buyer who bought their weaner stock. This encouraged Mamre farmers to rear more pigs and motivated them to produce healthier weaners as this would ensure their income. This may have been the reason why nine of the 12 top producing farmers discussed in Chapter 5 were from Mamre, three were from Khayelitsha and none from Malmesbury, meaning none of the farmers from Malmesbury sold more than 50 pigs. During a focus group, farmers, especially those from Khayelitsha, stated that the main market is usually those living in the informal settlements surrounding their farming areas. This market generally bought grower and finisher pigs which they could slaughter upon purchase. Certain farmers mentioned that they prefer to sell to this market since there is no risk of having their pigs condemned as they might be at the abattoir. Farmers also stated that they could sometimes get a better price for their pigs than if they sold to an abattoir. This came along with the interesting discovery that pigs reared for people living in informal settlements tend to be fatter than those reared for the commercial market. This is because the people generally buying from the farmers interviewed prefer their pork with more fat as they believe it improves the taste of the meat. This drives farmers to produce fatter pigs as it is a more desirable carcass to their specific market. This also means that farmers can get away with manipulating the diet of their grower pigs by not exclusively feeding commercial feed. Feeding commercial feed would result in a leaner carcass,

which would lower the value of their pigs to the market they are rearing for. Farmers would thus feed pigs by-products and/or waste, or mix the by-products/waste with commercial feed in order to get the desired carcass and save on input costs.

The benefit of these small-scale pig farmers is that they personally sell to their customers and customers can specifically request the type of pig/carcass they want to have reared. As the farmers are in direct contact with their market, they are able to breed pigs that suit the preference of their market. This makes the buyers a direct part of the rearing process. One of the top small-scale producers from Khayelitsha stated that when they produced a pig that met the preference of their market, they could bargain for a better price than they would receive at an abattoir where the same pig might be condemned for being too fat. This shows how integral small-scale pig farming is in local communities as they can produce a product that is unique and otherwise impossible to get in the formal market. It is recommended that further research be done on the specific markets small-scale farmers sell to and how these markets impact the pig rearing practices of farmers. More value should be placed on indigenous knowledge and the assumption should not be made that western knowledge would always benefit small-scale piggeries as they do commercial piggeries. Future research should make use of both western and indigenous knowledge when trying to develop solutions to the challenges small-scale farmers meet.

The goal for authorities/Government towards these farmers should thus rather be to equip them through training and workshops on good pig rearing practices than to push farmers into commercial pig farming. Farmers should be encouraged to first establish a sustainable market before expanding their farm; this will also allow them to gain experience as most of the large producers interviewed had over ten years of pig farming experience. Extension officers should also regularly inspect pigs, especially before farmers plan to sell them to ensure that the pigs being sold are fit to be slaughtered and consumed. The goal should thus be to help farmers grow their piggery and produce healthy pigs which in turn would increase the number of pigs they sell, provide a safe and affordable source of protein to impoverished communities, and improve the livelihood of small-scale pig farmers. Only once a stable market is established can small-scale pig farmers build their piggery and possibly adopt more commercial farming practices; this would increase their chances of eventually selling to the formal market should they choose to.

From the results, it is clear that farmers in Malmesbury are less developed in their pig farming practices than the other two areas. None of the farmers in Malmesbury qualified as a top small-scale pig producer. The highest number of pigs sold by a farmer in Malmesbury was 40, and the farmers sold a combined average of 12.2 pigs per year, much less than farmers in Mamre or Khayelitsha. As stated before, roughly half of farmers from Malmesbury did not medicate their pigs when they became ill or disinfect their pens. Therefore, should training be provided, more attention should be given on the basics of pig rearing to those farming in Malmesbury while training in other areas can be slightly more advanced.

Training is especially needed on proper feeding and preparation of feed, safe breeding practices, biosecurity measures, and record keeping.

Before any possible solutions to the problems faced by small-scale farmers in the Western Cape are developed, it should be taken into consideration that these farmers differ greatly from farmers in the commercial sector. They are often poor with lower education levels, farm on governmental land that they do not own, have a low monthly income as well as other sources of income besides livestock, make use of lower quality breeding material, have no electricity and often have to travel for water because they have no taps on site.

This study has shown that small-scale pig farmers in the Western Cape benefit from pig farming financially and have a desire to expand on their piggeries, but they often face various challenges which prohibit them from doing so. These challenges should not be addressed in the same way as done in the commercial sector. In many ways, small-scale farmers differ from commercial farmers; thus factors that benefit commercial farmers will not necessarily benefit small-scale farmers. The needs of small-scale farmers should be identified by making contact directly with farmers instead of speculating. Workshops and farmer days should be organized where information and knowledge can be shared between small-scale farmers from different areas, governmental officials, animal scientists, veterinarians, extension officers and other organizations which offer services to pig farmers. Small-scale pig farmers should also be encouraged to first build up their piggeries as far as they are financially able to and to establish themselves in the informal market instead of attempting to leap into commercial pig rearing. By obtaining knowledge and growing their piggeries at a pace each individual farmer is comfortable with, farmers can gradually adopt

commercial practices and eventually sell to abattoirs if they chose to do so. An expansion of land should also only be provided to small-scale farmers who have shown promise as pig producers.

Therefore, future research should focus on developing solutions which would enable farmers to build and manage profitable piggeries where safe and affordable pork is produced for those living in rural areas.

During this study, a need for training was identified and four workshops were hosted by Stellenbosch University in collaboration with NOVA feeds and SAPPO. Funding for these workshops was provided by the Social Impact division of the University of Stellenbosch and SAPPO. The first two workshops covered aspects of water management and pig health, specifically on disease identification and prevention (Images 6.1 – 2). The second two workshops involved practical training where a select group of farmers were taken on a visit to Mariendahl experimental farm and were supplied with overalls, hair nets, masks and boots (Images 6.3 – 4).



Image 6.1 Mamre and Malmesbury farmers training at Cloof wine estate



Image 6.2 Khayelitsha farmers training day at Stellenbosch University



Image 6.3 Practical workshop with Mamre and Malmesbury farmers



Image 6.4 Practical workshop with Khayelitsha farmers

Addendum A

An insight into the livelihood of small-scale pig farmers in the Western Cape, South Africa

University of Stellenbosch
 Department of Animal Sciences
 Private Bag XI, Matieland, 7600
 Tel: 021 808 3148

Questionnaire

Ethical clearance number: ANI-2018-6868

Questionnaire number:

Interviewer:

Date of interview:

Demography

1. General information

Municipality	
--------------	--

2. Pig Farmer

GENDER	MALE [] FEMALE []
HOME LANGUAGE	
OTHER LANGUAGES	
HIGHEST LEVEL OF EDUCATION	[] NO FORMAL EDUCATION [] PRIMARY EDUCATION [] SECONDARY EDUCATION [] COLLEGE EDUCATION [] UNIVERSITY EDUCATION
AGE	
RACE	

3. Income: How much is derived from the following sources

(tick all appropriate options and arrange by rank with 1 being the highest source)

	RANK	PERSON/S RECEIVING SAID INCOME
SALARIES		
PENSION (OLD AGE)		
CHILD SUPPORT GRANT		
DISABILITY GRANT		
HOME INDUSTRIES		
LIVESTOCK SALES		

CROP SALES		
CONTRIBUTIONS FROM FAMILY MEMBERS/BOARDERS		
OTHER (SPECIFY)		

Social and Economic Contribution of Pigs

4. Which of the following do you farm with?
 (Tick all appropriate options and rank with 1 being highest farming practice)

	RANK
<input type="checkbox"/> BEEF CATTLE	
<input type="checkbox"/> DAIRY CATTLE	
<input type="checkbox"/> GOATS	
<input type="checkbox"/> SHEEP	
<input type="checkbox"/> PIGS	
<input type="checkbox"/> CHICKENS	
<input type="checkbox"/> RABBITS	
<input type="checkbox"/> CRAFT PLANTS	
<input type="checkbox"/> MAIZE	
<input type="checkbox"/> SORGHUM	
<input type="checkbox"/> MEDICINAL PLANTS	
FRUIT (IF YES, SPECIFY)	
VEGETABLES (IF YES, SPECIFY)	
OTHER (SPECIFY)	

5. Why do you keep pigs?
 (Tick all appropriate answers and rank from highest to lowest where applicable, with 1 being the highest)

	RANK
<input type="checkbox"/> SELLING TO RAISE INCOME	
<input type="checkbox"/> HOUSEHOLD CONSUMPTION	
<input type="checkbox"/> MANURE	
<input type="checkbox"/> INVESTMENT	
<input type="checkbox"/> YOU ENJOY IT	
<input type="checkbox"/> FUNDING WAS GIVEN TO FARM WITH PIGS	
<input type="checkbox"/> OTHER (SPECIFY)	

6. What plans do you have with your pig farm? (Choose one)

<input type="checkbox"/> CONTINUE AS IS
<input type="checkbox"/> EXPAND YOUR HERD
<input type="checkbox"/> STOP FARMING AND SELL OFF PIGS – WHY?

7. Do/did you receive any support from organisations, municipalities, universities and/or vets with regards to your pig farming practices (this excludes training)?

- YES
- NO

If yes, explain

.....

.....

.....

8. Labour

DO YOU MANAGE YOUR FARM ON YOUR OWN?	<input type="checkbox"/> YES <input type="checkbox"/> NO
IF NO ABOVE, HOW MANY LABOURERS DO YOU HAVE?	
WHAT ARE YOUR LABOURERS' DUTIES AND GENDER/S?	

9. Marketing

(Tick all appropriate options and **RANK**, with 1 being the highest used)

WHICH MARKETING CHANNELS DO YOU USE?	<input type="checkbox"/> PERSONAL USE <input type="checkbox"/> PENSION POINTS <input type="checkbox"/> ABATTOIRS <input type="checkbox"/> BUTCHERIES <input type="checkbox"/> NEIGHBOURS <input type="checkbox"/> ANYONE WHO WANTS <input type="checkbox"/> OTHER (SPECIFY)
--------------------------------------	---

HOW DO YOU SELL YOUR PIGS?	<input type="checkbox"/> AS BREEDING STOCK <input type="checkbox"/> LIVE AS WEANERS <input type="checkbox"/> LIVE AS GROWERS <input type="checkbox"/> FRESH MEAT <input type="checkbox"/> OTHER (EXPLAIN)
WHAT AGE DO YOU USUALLY SELL YOUR PIGS AT?	
WHAT WEIGHT (IN KG) DO YOU USUALLY SELL YOUR PIGS AT?	

10. What time of the year do you usually sell your pigs and why?

SEASON:

WHY:

11. Do you face any religious or cultural challenges with regard to keeping pigs and marketing pigs? (underline)

YES/NO

If yes, explain.

.....

.....

.....

.....

Production Systems

12. Experience and pig training

HOW LONG HAVE YOU BEEN FARMING WITH PIGS (IN YEARS AND MONTHS, IF POSSIBLE)?	
DID YOUR PARENTS KEEP PIGS	<input type="checkbox"/> YES <input type="checkbox"/> NO
IF YES ABOVE, DESCRIBE WHAT TYPE OF PIGS THEY FARMED WITH	
DID YOU ATTEND ANY PIG TRAINING COURSE ON PIG REARING?	<input type="checkbox"/> YES <input type="checkbox"/> NO

IF YES ABOVE, NAME THE INSTITUTION THAT GAVE THE COURSE AND/OR WHAT THEY OFFERED	
HOW LONG WAS THE COURSE?	

13. Breeding stock

<p>WHICH TYPE OF PIGS DO YOU MOSTLY FARM WITH?</p> <p>DESCRIBE THE TYPE OF PIG IF NOT KNOWN</p>	<p><input type="checkbox"/> INDIGENOUS (KOLBROEK/WYNDNER)</p> <p><input type="checkbox"/> LARGE WHITE</p> <p><input type="checkbox"/> LANDRACE</p> <p><input type="checkbox"/> DUROC</p> <p><input type="checkbox"/> CROSSED (DESCRIBE)</p> <p><input type="checkbox"/> OTHER (SPECIFY)</p>	
<p>WHERE DO YOU BUY YOUR BOARS AND SOWS FROM (BREEDING STOCK)? (Specify which source fits boars and which fits sows)</p>	<p>BOARS</p> <p><input type="checkbox"/> NEIGHBOURS</p> <p><input type="checkbox"/> STOCK SALE</p> <p><input type="checkbox"/> BREEDERS</p> <p><input type="checkbox"/> SELECTION WITHIN THE HERD</p> <p><input type="checkbox"/> OTHER (SPECIFY)</p>	<p>SOWS</p> <p><input type="checkbox"/> NEIGHBOURS</p> <p><input type="checkbox"/> STOCK SALE</p> <p><input type="checkbox"/> BREEDERS</p> <p><input type="checkbox"/> SELECTION WITHIN THE HERD</p> <p><input type="checkbox"/> OTHER (SPECIFY)</p>
<p>IF BREEDER, GIVE NAME OF THE BREEDER</p>		
<p>WHAT ARE YOUR REASONS FOR USING THE BREED/S YOU USE?</p>		

14. Reproduction management

<p>DO YOU PRACTICE CONTROLLED BREEDING (MATING)?</p>	<p><input type="checkbox"/> NO – UNCONTROLLED MATING</p> <p><input type="checkbox"/> YES – FARMER DECIDES WHICH ANIMAL MATES WITH WHICH</p>	
<p>AT WHICH AGE DO YOUR GILTS FIRST GET SERVED?</p>		
<p>HOW OFTEN DO YOUR SOWS GIVE BIRTH A YEAR?</p>	<p><input type="checkbox"/> ONCE</p> <p><input type="checkbox"/> TWICE</p>	
<p>HOW SOON AFTER WEANING DO YOU RE-MATE YOUR SOWS?</p>		
<p>HOW MANY PIGLETS ARE BORN PER LITTER? (Choose one)</p>	<p><input type="checkbox"/> < 8</p> <p><input type="checkbox"/> 8 – 10</p>	

	<input type="checkbox"/> > 10
DO YOU/A LABORER OBSERVE THE SOWS DURING FARROWING (BIRTH)?	<input type="checkbox"/> YES <input type="checkbox"/> NO

15. Weaning

DO YOU WEAN YOUR PIGLETS (STOP THEM FROM SUCKLING)?	<input type="checkbox"/> YES <input type="checkbox"/> NO
IF NO, DO THEY	<input type="checkbox"/> STAY IN THE SAME PEN AS THEY AGE If above is ticked, at which age do you separate them and why? <input type="checkbox"/> STAY WITH THEIR MOTHER AS THEY AGE If above is ticked, at which age do you separate them and why?
IF YES, AT WHICH AGE DO YOU WEAN? (Choose one)	<input type="checkbox"/> 3 WEEKS <input type="checkbox"/> 4 WEEKS <input type="checkbox"/> 5 WEEKS <input type="checkbox"/> OTHER (SPECIFY)

16. Do your pigs often get stolen?

If yes, how often, how many and when last did it happen?

.....

17. Do your pigs ever escape or run away?

If yes, how often, how many, and when last did it happen?

.....

18. Do you have problems with animals (such as dogs, wild animals, rats, etc.) that pose a danger to your pigs (attacks, disease carriers, etc.).

If yes, explain what type of animals, what type of threat they are and how often this occurs.

.....

19. Mortalities

(Tick all appropriate options and rank, 1 being the highest cause)

	NO. OF MORTALITIES/ LITTER	CAUSES (AS WELL AS EST. NO. OF DEATHS CAUSED)	RANK
PIGLETS		<input type="checkbox"/> DISEASE (DESCRIBE)	
		<input type="checkbox"/> SQUASHED BY MOTHER	
		<input type="checkbox"/> COLD	
		<input type="checkbox"/> ABORTED/STILL BIRTHS	
		<input type="checkbox"/> OTHER (SPECIFY)	
WEANERS		<input type="checkbox"/> DISEASE (DESCRIBE)	
		<input type="checkbox"/> FIGHTING	
		<input type="checkbox"/> OTHER (SPECIFY)	

POST WEANING		<input type="checkbox"/> DISEASE (DESCRIBE)	
		<input type="checkbox"/> OTHER (SPECIFY)	

20. Breeding stock mortalities

	NO. OF MORTALITIES/YEAR	CAUSES (DESCRIBE)
SOWS		
BOARS		

21. Do you involve state veterinarians or animal health technicians to investigate mortalities?

Yes

No

If not, why?

.....

.....

.....

22. Housing

(Tick the most appropriate option)

WHICH OF THESE BEST DESCRIBES THE WAY YOU REAR PIGS?	<input type="checkbox"/> EXTENSIVE – PIGS KEPT OUTDOORS <input type="checkbox"/> INTENSIVE – PIGS KEPT INDOORS <input type="checkbox"/> SEMI-INTENSIVE (A MIXTURE OF THE ABOVE)
WHICH OF THESE BEST DESCRIBES THE WAY YOU HOUSE PIGS?	<input type="checkbox"/> BLOCK HOUSES <input type="checkbox"/> WOODEN HOUSES <input type="checkbox"/> CORRUGATED IRON HOUSES <input type="checkbox"/> OPEN ENCLOSURES <input type="checkbox"/> MUD/SOIL <input type="checkbox"/> OTHER (SPECIFY)
FLOOR TYPES INSIDE PENS	<input type="checkbox"/> CONCRETE <input type="checkbox"/> WOODEN (SLATED OR NOT SLATED?) <input type="checkbox"/> SOIL <input type="checkbox"/> OTHER (SPECIFY)
DO YOU LAY DOWN ANY BEDDING?	<input type="checkbox"/> NO <input type="checkbox"/> YES – SPECIFY

--	--

23. Nutrition

The following question is split into five parts; type of pig, type of feed, origin of feed, preparation of feed, and an estimation of the amount of feed fed per day.

- Type of feed – e.g. commercial feed (specify, e.g. meadow, epol, agfri, ect.), vegetables, bread, kitchen swill (describe), other (specify)
- Origin of feed – where did the feed come from?
- Preparation – describe how the feed is prepared (e.g. mixed with water and/or other types of feed) before being presented to the pigs (in kg)

	TYPE OF FEED	ORIGIN OF FEED	PREPERATION	AMOUNT FED PER DAY
PIGLET				
WEANER				
GROWING PIG				
PREGNANT SOW				
NURSING SOW				
EMPTY/DRY SOW				

BOAR				
------	--	--	--	--

24. Do you make use of a feeding trough?

- Yes
- No

If yes, is it anchored?

- Yes
- No

If yes, describe trough used:

.....

.....

25. Water

Explain where water is gathered from and transported to pigs

.....

.....

How much water do you provide for your pigs per day?

.....

.....

<p>WHICH BEST DESCRIBES THE PROVISION OF WATER?</p>	<p><input type="checkbox"/> PIGS DRINK FROM WATER TROUGH PROVIDED IN STY (DESCRIBE WATER TROUGH)</p> <p><input type="checkbox"/> PIGS DRINK FROM NEARBY WATER SOURCE (EXPLAIN)</p> <p><input type="checkbox"/> OTHER (SPECIFY)</p>
<p>HOW MANY TIMES A DAY IS WATER GIVEN?</p>	<p><input type="checkbox"/> WATER IS AVAILABLE ALL THE TIME</p> <p><input type="checkbox"/> WATER IS GIVEN DURING FEEDING TIME</p> <p><input type="checkbox"/> OTHER (SPECIFY)</p>

26. Pigs owned

TOTAL NO. OF PIGS	
NO. OF SUCKLING PIGS	
NO. OF WEANERS	
NO. OF BOARS	
NO. OF SOWS AND GILTS	
HOW MANY PIGS DID YOU SLAUGHTER FOR HOME CONSUMPTION DURING THE PAST 12 MONTHS?	
HOW MANY PIGS DID YOU SELL DURING THE PAST 12 MONTHS?	

27. Health and Biosecurity

DO YOU	<input type="checkbox"/> CLEAN OUTSIDE YOUR PIG HOUSING (REMOVING DEBRIS AND BUILD UP OF FILTH?) <input type="checkbox"/> CLEAN INSIDE THE PENS (WASTE REMOVAL) <input type="checkbox"/> DISINFECT THE PEN WHEN PIGS ARE REMOVED <input type="checkbox"/> CLEAN WATER TROUGHS
--------	--

If any of the above is ticked, describe the procedure/s as well as how often they are practiced

.....

.....

.....

.....

WHAT DO YOU DO WITH THE COLLECTED MANURE AFTER CLEANING?	<input type="checkbox"/> MAKE COMPOST FOR OWN USE <input type="checkbox"/> MAKE COMPOST TO SELL <input type="checkbox"/> DUMP IT OFF-SITE <input type="checkbox"/> MANURE IS NOT REMOVED <input type="checkbox"/> OTHER (SPECIFY)
--	---

DO YOU HAVE ANY MEASURES TO PREVENT DISEASES ENTERING YOUR PIGGERY?	<input type="checkbox"/> YES (DESCRIBE) <input type="checkbox"/> NO
DO YOU HAVE A VACCINATION PROGRAM FOR YOUR PIGS?	<input type="checkbox"/> YES (DESCRIBE VACCINES USED AND AT WHAT AGE) <input type="checkbox"/> NO
DO YOU SEND DEAD PIGS (NOT SLAUGHTERED) FOR POST MORTEM?	<input type="checkbox"/> YES <input type="checkbox"/> NO
IF NO ABOVE, WHAT DO YOU DO WITH DEAD PIGS?	<input type="checkbox"/> EAT THEM <input type="checkbox"/> BURY THEM <input type="checkbox"/> FEED TO DOGS <input type="checkbox"/> OTHER (SPECIFY)
WHAT ARE THE REASONS FOR NOT SENDING FOR POST MORTEM?	
DO YOU CASTRATE YOUR BOARS?	<input type="checkbox"/> YES (EXPLAIN METHOD AND PROVIDE AGE) <input type="checkbox"/> NO
DO YOU CLIP THE TEETH OF THE PIGS?	<input type="checkbox"/> YES (EXPLAIN METHOD AND PROVIDE AGE) <input type="checkbox"/> NO
DO YOU ADMISTER IRON INJECTIONS?	<input type="checkbox"/> YES (EXPLAIN METHOD AND PROVIDE AGE) <input type="checkbox"/> NO
DO YOU CLIP THE TAILS OF THE PIGS?	<input type="checkbox"/> YES (EXPLAIN METHOD AND PROVIDE AGE) <input type="checkbox"/> NO
WHAT DO YOU DO WITH SICK PIGS?	<input type="checkbox"/> REMOVE THEM TO SEPARATE HOUSING <input type="checkbox"/> CULL OR KILL THEM

	<input type="checkbox"/> LEAVE THEM IN THE PEN WHERE THEY WERE <input type="checkbox"/> OTHER (SPECIFY)
DO YOU MAKE USE OF A VETERINARIAN? IF YES, PROVIDE HER/HIS NAME.	
DO YOU MAKE USE OF ANY MEDICATION WHEN YOUR PIGS BECOME ILL? IF YES, DESCRIBE MEDICATION AND HOW YOU GET IT AS WELL AS THE PRODUCTION STAGE OF THE PIG MEDICINE IS ADMINISTERED TO.	

28. Abattoir slaughtering (*n/a if farmer does not sell to abattoirs*)

AT WHAT LIVE WEIGHT DO YOU SELL YOUR ANIMALS (KG)?	
AT WHAT AGE DO YOU SELL YOUR ANIMALS (MONTHS)?	
HOW MANY PIGS HAVE YOU SOLD OVER THE LAST YEAR?	
WERE ANY PIGS REJECTED BECAUSE OF DISEASE OR ANYTHING ELSE?	<input type="checkbox"/> YES (EXPLAIN) <input type="checkbox"/> NO

29. Record keeping

DO YOU KEEP FORMAL RECORDS OF YOUR PIGS?	<input type="checkbox"/> YES (EXPLAIN) <input type="checkbox"/> NO
HOW DO YOU ENSURE TRACABILITY	<input type="checkbox"/> TATTOOS <input type="checkbox"/> EAR TAGS <input type="checkbox"/> OTHER (SPECIFY)

30. Comments from the farmer (challenges faced, constraints, suggestions, etc.)

A large, empty rectangular box with a thin black border, intended for the farmer to provide comments, challenges, constraints, or suggestions.