SWINE MARKETING MODEL AND PROFIT MAXIMIZATION IN FREE STATE OF SOUTH AFRICA

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Abstract- This study can be appreciated from the important role marketing models exert in the profit maximization of swine producers world over. This study is motivated by the fact that the previous millennium witnessed the agricultural product market changing from a predominantly producer dominated market approach to a demanding, well informed, consumer dominated market. These call for the validation of similarly studies in order to formulate informed marketing model that will enhance profit maximization for swine producers in the Free State. This study therefore, is set out to examine the swine marketing model and its effect on profit maximization the Free State of South Africa. The primary data was sourced using structured and semi-structured research questionnaire, while the secondary information was generated from existing / available relevant literature journals / periodicals. A judgmental sampling technique was used to determine the sample size of 80 swine producers. For the purpose of this study, Regression analysis and Pearson Product Moment Correlation Co-efficient (PPMC), were used while the Analysis of variance (ANOVA) statistical tool was used to test the hypotheses with the aid of Statistical Packages for Social Sciences (SPSS) version 22.0. The finding showed that the correlation coefficient is very high indicating that a very strong relationship exists between Gross income of Swine Producers in Free State and the determinants. The Coefficient of Determination (R^2) = 0.855. This implies that a 85.5% variation in Gross income of Swine Producers in Free State is explained by variations in Production Cost, Access to Government Agricultural Subsidy, Access to Bank Loan, Membership of Swine Organization. The researcher therefore concludes a good model utility.

Index Terms- Government Agricultural Subsidy, Marketing Model, Profit Maximization, Swine Producers

I. INTRODUCTION

Swine production in the past decades has increased tremendously. The turn of the previous millennium witnessed the agricultural product market changing from a predominantly producer dominated market approach to a demanding, well informed, consumer dominated market. Generally speaking the agricultural industry had become more industrialized and more specialized. This has imposed more pressure on management and business acumen. Irreversible trends in market changes, biotechnology, information technology, globalization and advanced consumerism have contributed to this phenomenon. These trends will play a more important role in the future of agriculture. The changing marketing environment and the problem associated with swine production (including the HINI virus) have necessitated the consideration of developing a marketing model to assist Free State swine producers to maximize profits. Changes in the agri-business sector are caused by changes in distribution channels, the environment (i.e. external environment), agricultural producers and the consumer. The discrepancy between consumer acceptance and consumer rejection, especially of agricultural products like pork meat can be seen as a very thin edge between prejudice and perception. However, the development of a marketing model to assist Free State swine producers will bring relief to the producers and confident back to the business.

Marketing is an important aspect of any livestock system. It provides the mechanism whereby producers exchange their livestock and livestock products for cash. The cash is used for acquiring goods and services which they do not produce themselves, in order to satisfy a variety of needs ranging from food items, clothing, medication and schooling to the purchase of breeding stock and other production inputs and supplies.

Policy and decision makers have to make difficult choices to streamline issues around climate change, food security, energy supply, globalization of markets, population and economic growth, and declining natural resources. Ex-ante impact assessment using integrated models that systematically link development pathways with biophysical and socioeconomic processes and characteristics offers them a decision support tool to help with these decisions. However, these models need to integrate relationships across disciplines, levels of organization and scales [1].This chapter gives an overview of different swine marketing models adopted by different researchers at different time period. We are going to consider the following swine marketing models

including: Rule of Thumb marketing model; The Structure – Conduct – Performance model; and Stochastic model for swine marketing.

Up to now modeling efforts have focused on specific aspects of policy, market and land systems [2] and [1]. Current approaches either use top-down global and continental approaches (e.g. macro-economics and large scale land use modeling [3]-[4] or bottom-up approaches, from farm level upwards (farm household modeling, micro-economics, agent based models and landscape level land use modeling) [5]-[7]. Existing models do not sufficiently capture the complexity of human–environment interactions across different scales, and especially the link between landscape and local market levels, and national and sub-national level policies and markets is missing [1], [8] and [4]. Existing approaches to assess the consequences of global or regional market models on farm household level, take simplistic approaches to represent farmer's diversity and also ignore the diversity in local markets and their effects on price formation. Bottom-up approaches that take into account crop and livestock productivity and analyze food security of farm households take either a landscape approach (e.g. in many multi-agent models or in land use models [6] or in a few cases perform a micro-economic analysis including feedbacks between household choices for production of different commodities and price formation at local markets [7], [9]-[10], but do not go beyond the landscape/local market level.

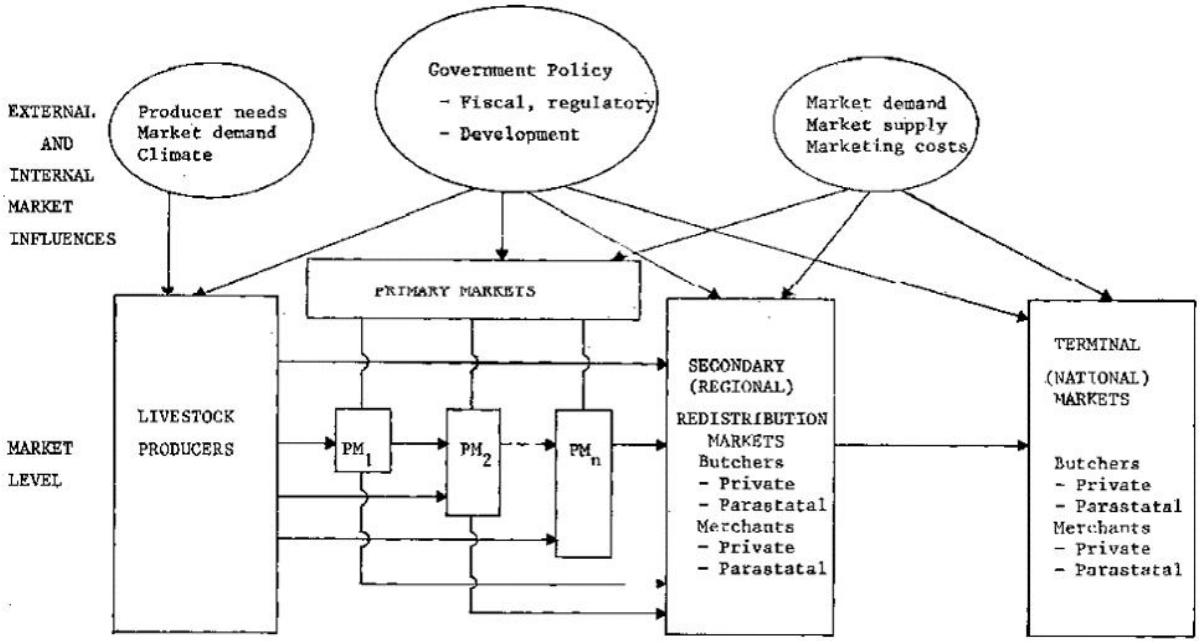


Fig.1 Livestock Marketing System Model adapted from Solomon, B. and Negussie, T (1983) Livestock Marketing Studies (Eastern and Southern Africa) Program, ILCA Kenya, pp. 327-332 in Pastoral System Research in Sub-Saharan Africa: Proceedings of the (IDRC) workshop held at ILCA, Addis Ababa Ethiopia 21-24 March, 1983

II. LITERATURE REVIEW

A. Existing Marketing Model for Livestock Distribution

A schematic representation of a livestock marketing system is shown below. The bottom part shows the flow of livestock from producers to secondary (regional) and terminal (national) markets through one or more primary collection markets.

The figure above shows the external and internal factors that influence the livestock marketing system. First on the supply side the cash needs of producers, the strength of demand for their livestock, and pastoralists' expectation of the nature and length of the dry and wet seasons influence the volume of the different species of livestock on offer at any time. The higher the cash needs of the pastoralists the greater the volume of livestock on offer. Their response to market demand has been a subject of controversy in the literature [12]-[16]. However, there is growing evidence that pastoralists in fact dispose of their marketable animals in a manner consistent with sound economic behavior [17]. In other words the stronger the effective market demand as expressed by high prices, the greater the volume of livestock supplied. Finally, pastoralists' perception of the climate influences supply and hence the price of livestock. Anticipation and occurrence of prolonged dry seasons induce more sales. The poor condition of the animals plus the greater numbers supplied during such times depress livestock prices. On the other hand the anticipation and occurrence of good raids causes pastoralists to withhold animals from the market so that they can put more weight and fetch better prices later on.

Second, government policy through fiscal, regulatory and development intervention affects the volume, flow and prices of livestock in the marketing system.

Favorable fiscal policies that encourage livestock production and reduce costs to producers increase the supply of livestock, e.g. subsidies, and price stabilization policies. On the other hand taxes and levies of all kinds tend to restrict the volume supplied. The control of epidemic diseases, the proper development of range areas and the development of trek routes and livestock market facilities tend to increase the volume supplied and reduce marketing costs. In general government monopolistic tendencies and the fixing of artificially low prices stifle market supply and demand.

Finally, market demand as expressed by the volume and prices buyers are willing to pay for livestock influences the behavior of the markets at all links in the system. The efficiency of the market as reflected by the marketing costs of the system and to what extent price changes are transmitted through the marketing system strongly influences the operation of the markets. The less efficient the market the less responsive will supply be to changes in market demand.

Livestock markets can easily be differentiated by the type of sellers and buyers operating in the market and the purpose for which livestock are purchased. Table 1 summarizes these attributes for three types of livestock markets [17].

B. Rule of Thumb Marketing Model

Rule of Thumb is seen as a guideline that provides simplified advice regarding a particular subject. A rule of thumb is a general principle that provides practical instructions for accomplishing or approaching a certain task. Typically, rules of thumb develop as a result of practice and experience rather than scientific research or theory.

Investors may be familiar with a variety of "financial rules of thumb" that are intended to help individuals learn, remember and apply financial guidelines, including those that address methods and procedures for saving, investing and retirement. Although a rule of thumb may be appropriate for a wide audience, it may not apply universally to every individual and unique set of circumstances.

According to Wikipedia free encyclopedia “A rule of thumb is a principle with broad application that is not intended to be strictly accurate or reliable for every situation. It is an easily learned and easily applied procedure for approximately calculating or recalling some value or for making some determination”. Compare this to heuristic, a similar concept used in mathematical discourse, psychology, and computer science, particularly in algorithm design.

The exact origin of the phrase is uncertain. The earliest citation comes from J. Durham’s Heaven upon Earth, (1685, ii. 217) "Many profess Christians are like to foolish builders, who build by guess, and by rule of thumb."[1] The phrase also exists in other languages, for example Swedish tumregel, Norwegian and Danish tommelfingerregel, sometimes in the variant "rule of fist", for example Finnish nyrkkisääntö, Estonian rusikareegel, German Faustregel, Hungarian ökölszabály or Dutch vuistregel, as well as in Turkish parmak hesabı (rule of finger) and in Persian "ی,"قاعدهسرانگشـــــت which is translated as finger's tip rule. This suggests that it has some antiquity, and does not originate in specifically Germanic language culture” (Wikipedia, the free encyclopedia)

The term is thought to originate with carpenters who used the width of their thumbs (i.e., inches) rather than rulers for measuring things, cementing its modern use as an imprecise yet reliable and convenient standard. This sense of thumb as a unit of measure also appears in Dutch, in which the word for thumb, duim, also means inch. The use of a single word or cognate for "inch" and "thumb" is common in many other Indo-European languages, for example, French: pouce inch/thumb; Italian: pollice inch/thumb; Spanish: pulgada inch, pulgar thumb; Portuguese: polegada inch, polegar thumb; Swedish: tum inch, tumme thumb; Sanskrit: angulam inch, anguli finger; Slovak: palec, Slovene: palec inch/thumb, Czech: palec inch/thumb (Wikipedia, the free encyclopedia).

Another possible origin of the phrase comes from measurement, in particular in agricultural fields. The plants need a fairly precise depth to seed properly, whether planted from seed or being replanted, but the depth can sometimes be estimated using the thumb. That is, a rule "(measurement) of thumb". According to Gary Martin, "The origin of the phrase remains unknown. It is likely that it refers to one of the numerous ways that thumbs have been used to estimate things—judging the alignment or distance of an object by holding the thumb in one's eye-line, the temperature of brews of beer, measurement of an inch from the joint to the nail to the tip, or across the thumb, etc. The phrase joins the whole nine yards as one that probably derives from some form of measurement but which is unlikely ever to be definitively pinned down"(Wikipedia, the free encyclopedia).

Pork producers must determine when to sell pigs, which and how many pigs to sell, and to which packer(s) to sell them. We model the decision-making problem as a linear mixed-integer program that determines the marketing strategy that maximizes expected annual profit. By discretizing the barn population into appropriate weight and growth categories, we formulate a mixed-integer program that captures the effect of stocking space and shipping disruption on pig growth. We consider marketing to multiple packers via shipping policies reflecting operational sorting constraints. Utilizing data from Cargill Animal Nutrition, we implement the model to

obtain solutions that characterize significant strategic departures from commonly-implemented industry rules-of-thumb and that possess the potential to increase profitability in an industry characterized by narrow profit margins.

C. The Structure – Conduct – Performance (SCP) Model

A large number of agricultural marketing studies rely on the theoretical foundations laid by the "perfect competition" model. This is particularly true in studies based on the structure-conduct-performance paradigm. The SCP paradigm originated from the work of [18]. The SCP approach postulates that as market structure deviates from the paradigm of a perfect competition, the degree of competitive conduct will decline and there will be a consequent decrease in output (supply) and allocative efficiency, and an increase in prices. This implies that the performance of markets can be assessed based on the level of competition and efficiency in those markets [19].

The market conditions are influenced by the social, economic, technological, factor prices and tastes. These factors influence the method of analysis of markets among them the Structure, Conduct ad Performance (S-C-P) model, a standard tool for the analysis of markets. It is a framework for explaining how markets behave and the differences between them. This paradigm postulates that the market structure determines the market conduct, which then sets the performance of the market. It envisages that the number of sellers and buyers determines the behavior of economic agents and thereby determine how close the industry comes to meeting the standard of reference of social welfare.

According to the structure-conduct-performance approach, an industry's performance (the success of an industry in producing benefits for the consumer) depends on the conduct of its firms, which then depends on the structure (factors that determine the competitiveness of the market). The structure of the industry then depends on basic conditions, such as technology and demand for a product. For example: in an industry with technology that the average cost of production falls as output increases, the industry tends to have one firm, or possibly a small number of firms. According to [20], the Structure-Conduct-Performance (S-C-P) paradigm of strategy assumes market structure would determine firm conduct which would determine performance. This is a paradigm that is foundational to industrial organization economics, consistent with the positional view of strategy, as opposed to the resource-based view of strategy.

To actually understand the meaning of structure conduct performance (s-c-p), we need to analyze the three major elements of the model namely: structure, conduct, and performance.

1. Structure: This refers to market structure. Market structure refers the organizational characteristics that establish interrelationships between the buyers and sellers of a particular market. Its elements include the number and size distribution of buyers and sellers, the degree of product differentiation, the ease of entry of new firms into an industry, vertical integration and cost structure. These characteristics influence the nature of competition and pricing within that market. The variables that are used to describe market structure include seller concentration, degree of product differentiation and barriers of entry. These variables can be further classified into two classes, namely:

(a) Intrinsic structural variables - those determined by the nature of products and available production and marketing technologies.

(b) Derived structural variables - those determined by firms and government such as barriers of entry, seller and buyer concentration and product differentiation [21]. This distinction may be important if intrinsic structural variables are exogenously determined, thus making them suitable candidates as instrumental variables.

2. Conduct: This refers to a firm's behavior. The market conduct is the pattern of commercial behavior that firms follow in adjusting to the markets in which they sell or buy. These commercial behaviors arise from the existing market structure and include price determination behavior, product behavior, research and development, innovation, advertising, sales promotion policies, financial policy and collusion and Conduct Elements.

The market structure determines the kinds of price determination strategies, advertising, product and price displays, sales promotion strategies, mode of payment/ terms of sales (deposit before delivery, cash terms and credit terms). The variables used to capture firm behavior include pricing strategies, collusion, advertising, research and development and capacity investment. Some have interpreted conduct as whether firms collude or compete.

3. Performance: This refers to outcome or equilibrium assessed in terms of allocative efficiency. The variables mostly used to measure performance are profitability and price-cost margin. This is the end result of which is essentially brought about the nature of market structure and how firms conduct themselves. It includes:

- The price relative to the average cost of production. A price that just covers the cost is ideal. This price assumes fair returns to the inputs used in production but allow no excess profits. This ideal would be reached under conditions of pure competition.
- The relative efficiency this far is influenced by the scale or size of the plant and firm relative to the most efficient and by extent, if any excess capacity. Efficiency can be viewed as operational efficiency, pricing efficiency and technical efficiency.

Operational efficiency aims at cutting costs, pricing efficiency helps in the allocation of marketing resources and marketing efficiency is based on the input output ratio.

• The size of sales promotion costs relative to the costs of production. Are promotion costs excessively high? What percent are advertising costs of the total production?

• The character of the product, including the choice of design, level of quality and variety of product within any market. Is the quality of the product within the industry high? Is there any variety available to the consumer? Are products excessively improved to the extent buyers would prefer a lower quality at a lower cost?

• The growth rate of the firm and the industry in developing both products and techniques of production. Are firms attempting to find cost reducing techniques? One scope might be the scope of their research activity. Do firms try to discover what the consumer wants? Does the firm have a good public image?

The SCP paradigm posits specific causal relationships between market structure, conduct and performance. In particular, market structure determines conduct and conduct in turn determines performance.

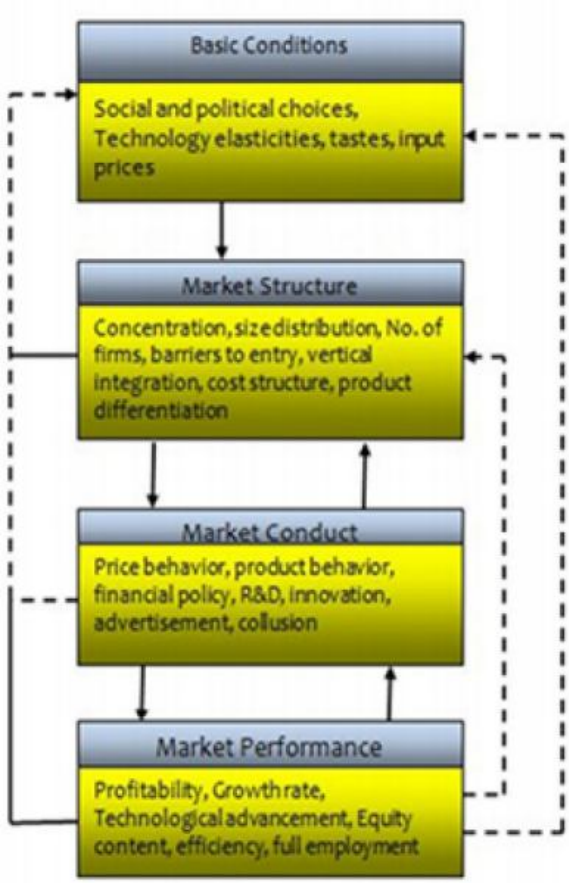
Structure ⇒ Conduct ⇒ Performance

Structural Parameters of the S-C-P Model

Limitation: The theory has been criticized on the following grounds: (1) its price integration and price performance analyses are static and suffers from spatial arbitrariness; (2) its market segmentation concepts with respect to margins and transfer costs are faulty; (3) it does not explain how competition among traders may affect consumers' welfare. Thus the approach fails to explain the causal links between structure, conduct and performance and is therefore unable to predict performance from structures and vice versa [23].

D. Commodity Chain Model

A commodity chain is a series of interlinked exchanges through which a commodity and its constituents pass: extraction or harvesting, production, transformation, transport, distribution, wholesale, retail and end use. As such, commodity chains serve as conduits through which commercialized natural resources—such as forest products—are ushered from the land to their final users, whether rural, urban or 'international' [24]. A commodity chain could also be seen as a process used by firms to gather resources, transform them into goods or commodities, and finally, distribute them to consumers. It is a series of links connecting the many places of production and distribution and resulting in a commodity that is then exchanged on the world market. In short, it is the connected path from which a good travels from producers to consumers. Commodity chains can be unique depending on the product types or the types of markets. Different stages of a commodity chain can also involve different economic sectors or be handled by the same business.



[22] Adapted from: CAEE 5131 - Agricultural Marketing and Price Analysis: Economic Role of Prices and Approaches to the study of Agricultural Market Organization and Performance, Moi University, Department of Economics and Agricultural Resource Management with support from OER Africa and Bill & Mellinda Gates Foundation.

Commodity-chain analysis is a method for analyzing how and for whom such market conduits operate. It is a tool for understanding that benefits from natural resources, how they benefit, and how those patterns of benefit distribution might be changed. According to [25], Commodity chain analysis is the identification of the actors and processes that contribute to the origination of a product that is consumed by a market, such as raw materials, food or consumption goods. Thus, a commodity chain includes a sequence of operations ranging from the extraction of raw materials, the assembly of intermediate goods, to the distribution to consumption markets. Commodity chain analysis can also consider only a specific

segment related to a single product (or group of products).

The analysis of such a complex chain of agents and processes considers several perspectives:

• Transactional perspective: Identification of the flows and of the transactions that create them. This particularly concerns the decision making process in the establishment and management of commodity chains.

• Comparative perspective: Assess the relative competitiveness of the elements of the commodity chains in terms of added value.

• Functional perspective: Identify the physical processes involved in the circulation of goods, including the capacity constraints in distribution, namely modal, intermodal and terminal effectiveness.

The analysis of commodity chains, depending on the perspective, can consider several factors:

• Origin and destination. This is a basic issue of supply and demand which reveals comparative advantages, locational preferences and market size. A commodity chain is commonly organized as a sequence of origin / destination pairs until a destination is considered to be the location of final consumption. For complex products, a multitude of origins, intermediary stages and destinations imply the concept of global commodity chains, Intermediary locations where activities such as warehousing need also to be considered.

• Cost function. Evaluates the costs incurred to the set of activities taking place along the commodity chain such as procurement costs, manufacturing costs, distribution costs and retailing costs.

• Load unit. Considers how the material flows in the commodity chain are circulating, often related to how fragile, perishable (see the Cold Chain) or valuable a product is. It is more than simply an issue of containerization, but also in which way the containerized load unit is used.

• Modal and intermodal use. A matter of the nature of the transport chains used to accommodate the commodity chains in terms of modes, terminals and freight forwarders.

• Regulation and ownership. The set of rules and regulations related to the circulation of goods within the commodity chain, including compliance. Also considers the nature and the level of control shipping companies have over the commodity chains they use through agreements, mergers and alliances.

• Distribution channel. This involves the relationships with logistical service providers, particularly with manufacturers and retailers. In many cases, distribution activities are subcontracted.

• Added value. This is the consideration of which parts of the commodity chain contributes the most to added value. This is an important strategic goal as added value is linked with profit margins. The organization of commodity chain thus seeks to increase added value through locational and organizational strategies.

[26] outline the distinctive features of commodity-chain analyses. First is an empirical, as well as theoretical focus on markets, in lieu of formal abstract neoclassical economic modeling [27]-[37]. Second is attention to power: its sources, uses and effects in a socially differentiated environment. Third is an approach to politics and political institutions as endogenous to the existence and functioning of markets, with attention to differentiated market agents engaging in competitive as well as collective or collusive action.

Fourth, and last, is the view that regulation (by which they mean both state and non-state forms of control) too is an endogenous feature of markets, hence shifting debates from their current focus on ‘more vs. less’ regulation to the study of ‘better vs. worse’ forms of regulation. This method of analysis also broadens predominant focus on individual mechanisms of control and accumulation—such as prices or property—to include in the analysis of markets the whole repertoire of interacting mechanisms shaping their operation [38]. Further, it locates production and exchange as embedded within social relations and hierarchies [39]-[41] writing on the ‘market-order’ problem). It does so in a multi-local manner, spanning the geographic extent of production, distribution, exchange and use.

Different methodologies have been developed for analysis of commodity chains. Commodity Chain Analysis according to [42] in what they called “l’approche filière”, is a value-free technique applied to analyzing existing marketing chains for agricultural commodities assessing how public policies, investments and institutions affect local production systems. It consists of quantitative analysis of inputs and outputs, prices and value added along a commodity chain through accounts by agent. The dominant idea behind the economic analysis of commodity chains is to lay out the overall activities of all the participants, or agents, who contribute to the production and/or transformation of a given commodity. This process involves:

(a) Identifying the outline of the chain and the position of the various agents within it,

(b) Developing the economic accounts corresponding to the activities of the agents involved in the chain.

This reduction of activities and operations to their monetary value makes this economic technique a powerful tool of analysis. It allows using commodity chain analysis to produce properly quantified and significant results, calculations at new levels of aggregation, sensitivity and simulation analyses, and to interpret these results at the macroeconomic level.

The commodity chain model builds on the SCP framework. It assumes vertical as well as horizontal

relationships between livestock producers in evaluating market performance and is more dynamic in following the entire commodity flow from producer to the ultimate consumer. At each stage along the commodity chain, the model permits three types of analysis namely: (i) costs and margins, (ii) spatial flows (involving places, volumes and directions), and (iii) the social relations of trade [43]-[44].

Limitation: This phenomenon increases transaction costs and, consequently, increases the amount paid by the final consumers (sales price). For instance, a more distant market may be influenced by the desire to avoid transactions costs. On the other hand, the same pig farmer may decide to go all the way to a distant market because of excessive profits made by intermediary traders – a situation, which lowers return to producers.

E. Stochastic Model for Swine Marketing

A stochastic model is a tool for estimating probability distributions of potential outcomes by allowing for random variation in one or more inputs over time. The random variation is usually based on fluctuations observed in historical data for a selected period using standard time - series techniques. Distributions of potential outcomes are derived from a large number of simulations (i.e. Stochastic projections) which reflect the random variation in the input(s).

Pork processors have the objective to produce uniformly sized lean products. Most pork processors have developed marketing systems to discount carcasses with weights less or greater than the desired optimal range. Swine producers must evaluate alternative marketing strategies that reduce sort loss. Researchers have sought for a way to assist swine producers to maximize their profit by employing the stochastic model in various aspect of swine production. Among the various stochastic models employed for swine farmers, two will be considered namely:

1. Use of stochastic model to evaluate alternate marketing strategies
2. Using a stochastic model to evaluate swine production management with paylean: split – weight management.

Use of Stochastic Model to Evaluate Alternate Marketing Strategies

The research on the use of stochastic model to evaluate alternative marketing strategies was carried out by [45] at Purdue University Indianna U.S.A. In this research four alternative marketing strategies were evaluated as to their impact to reduce variation for carcass component mass and carcass measurements. The following assumption that the objective of the producer was to market swine with an average fat-free lean mass close to 102.1 lb. was made. For multiple day marketings, a sort weight was pre-defined. Any swine with a live weight exceeding that sort weight was marketed. The only exception was on the final marketing day, when all residual swine were marketed. The target sort weight for each multi-day marketing strategy was found by setting the sort weights at 242, 248 and 254 lb and predicting the mean fat-free lean mass at these weights.

The first marketing strategy was to market all swine at 160 d of age. The second strategy was to market all swine above 250.9 lb body weight at 146 d (21.2%; mean = 261.5 lb) and 160 d of age (53.5%; mean = 264.3 lb), and all remaining pigs at 174 d of age (25.3%; mean = 262 lb). The third strategy was to market swine above 247.6 lb at 146 d (25.8%; mean = 259.3 lb) and 160 d (53.0%; mean = 262.2 lb) of age, and all remaining pigs at 181 d of age (21.2%; mean = 270.4 lb). The fourth strategy resulted in swine above 256.6 lb marketed on a weekly basis (12.0, 21.9, 28.8, 19.6, and 9.6%; with mean body weights of 266.6, 264.2, 263.7, 264.7, and 264.6 lbs at 146, 153, 160, 167, and 174 d of age) and the remaining pigs (7.1%; mean = 250.7 lbs) marketed at 181 d of age.

Using the stochastic model, the researchers concluded that the best compromise for pork producers is to carefully sort swine three times from a facility with swine of the same sex. The stochastic model can be used to evaluate alternative marketing strategies that compromise between the pork producer's labor and transportation costs and the pork processors' reduced returns associated with excessive variations in carcass weight and composition.

Using a Stochastic Model to Evaluate Swine Production Management with Paylean: Split – Weight Management

The second stochastic model under consideration was carried out by [46] at Purdue University Indianna, U. S. A. The concept of split-weight feeding management for swine production has existed for a long time. However, because of the high cost of separating pigs by hand, and the labor involved, split-weight management is not widely adopted by swine producers. With the introduction of the Automatic Sorting Technology (known as AST) into the hog industry, split-weight management is made easier and cheaper to accomplish once the AST barn is invested. To help producers implementing split-weight management, it is necessary to evaluate the benefit of split-weight feeding and to investigate the optimal dietary nutrition management for different weight groups of swine.

Assumptions: The model assumed swine were split by weight into two groups when swine were 100 days of age: a heavier group versus lighter group, at the late finishing stage when they average 146 lbs. The model also assumed that Paylean (ractopamine, RAC) was used in the swine production and it could be fed at different concentrations and durations for each group. Different dietary lysine concentrations were allowed to be fed with Paylean.

Furthermore, the model assumed that three diets were fed to each split weight group, one diet before Paylean onset and two diets containing Paylean. The same dietary lysine concentration was fed to both groups before Paylean. It was also assumed that diet 2 must be fed for exactly 2 weeks, and then switched to the diet 3.

How much does it cost to raise 100kg body weight?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	R100-R200	8	10.0	10.0	10.0
	R200-R300	32	40.0	40.0	50.0
	R300-R400	26	32.5	32.5	82.5
	R400-R500	5	6.3	6.3	88.8
	R500 and above	9	11.3	11.3	100.0
	Total	80	100.0	100.0	

The optimal management was derived for four payment schemes: (1) carcass payment with discounts on underweight and overweight carcasses; (2) carcass merit payment system adopted from Hormel's Carcass Lean Value Program; (3) lean to fat price ratio of 2:1, with discounts on underweight and overweight carcasses; and (4) lean to fat price ratio of 4:1, with discounts on underweight and overweight carcasses. The carcass weight discount grid for payment schemes 1, 3 and 4 were also adopted from Hormel's Carcass Lean Value Program, which was the standardized grid for 0.51-0.90 inch last rib backfat. Payment schemes 1 and 2 reflected the marketing approaches by independent producers. Payment scheme 3 simulated the producers under limited coordination with packers, while payment scheme 4 reflected vertically integrated producers, because the lean to fat ratio of 4:1 allowed producers to capture the full benefit of the increase in carcass value.

The barn size of 1,000 head was used; thus, each weight group consisted of 500 head. Swine were marketed together regardless of weight groups. It was assumed that as long as the number of swine heavier than the sort weight exceeded 170 head, the heaviest 170 pigs were marketed on a semi-truck. For a group size of 1,000 head, six truckloads were needed to market all the swine. To sum up, the model optimized 14 variables: two Paylean concentrations, two optimal Paylean onset ages, two dietary lysine concentrations for diet 2, two dietary lysine concentration for diet 3, and six marketing days.

The model results showed that split-weight management for swine production with Paylean did not increase the returns to a large degree. Although the lighter half of swine were optimally fed with a higher Paylean and dietary lysine concentrations, the optimal marketing ages would be the same as for the non-split-weight management. Because producers usually market their swine to a targeted weight range, the growth rate of the lighter swine has to be increased to speed up the barn turnover, and thus increase the production return. The predicted return from the model simulation would be helpful for producers to assess if split-weight management was economically optimal to implement.

III. METHODOLOGY

The study adopted the exploratory research method. The population of the study consists of 1304 swine producers within the Free State province of South Africa. Three local municipalities were chosen for the study. The local municipalities chosen includes: Maluti a Phofung with 215 pig farmers; Mangaung with 138 pig farmers; and Moghaka with 116 pig farmers. The estimated total number of pig farmers in the selected Local Municipalities is 469. The sample size of 80 for the study was arrived by employing [47] Tara Yamani formula.

Structured and semi-structured research questionnaire, observatory and interview were used in primary data collection, while relevant and accessible secondary data were also generated. Reliability and validity was achieved through the adoption of a pilot or pre-test study which was carried out in Port Harcourt cosmopolitan city, because the three ethnic groups under study reside in the city.

The generated data were presentation through the use of simple table frequencies and percentages; pie chart and bar chart. The data were analyzed and the formulated hypotheses tested by using the analysis of variance (ANOVA) statistical tool in Statistic Package for Social Sciences (SPSS) version 22.0.

IV. DATA PRESENTATION, ANALYSIS AND INTERPRETATION

In this study the acquired data were presented, analyzed and tested the formulated hypotheses using the analysis of variance (ANOVA) statistical tool.

Cost to Raise 100kg Body Weight

The information above showed that 40.0% (32) of the respondents raise their swine to body weight of 100kg at the cost of between R200-R300. Furthermore, the result showed that 32.5%(26), 11.35(9), 10.0%(8), and 6.3%(5) raise their swine body weight to 100kg at the cost of between R300-R400, R500 and above, R100-R200 and R400-R500 respectively

(a) Organizational Affliation

Do you belong to any swine organisation?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	11	13.8	13.8	13.8
	No	69	86.3	86.3	100.0
	Total	80	100.0	100.0	

(b) Organizational Affliation

I yes name the swine organisation?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Itshokolele	2	2.5	18.2	18.2
	Metsi-matsho pegge	2	2.5	18.2	36.4
	NERPO;RMPO	2	2.5	18.2	54.5
	Motebog piggery	3	3.8	27.3	81.8
	Makware	2	2.5	18.2	100.0
	Total	11	13.8	100.0	
Missing	System	69	86.3		
Total		80	100.0		

› you have access to government agricultural subsidie:

		Frequency	Percent	Valid Percen	Cumulative Percent
Valid	Yes	4	5.0	5.0	5.0
	No	76	95.0	95.0	100.0
	Total	80	100.0	100.0	

The table above indicated that 86.3% (69) do not belong to any swine association while 13.8% (11) of the respondents belong to an organization. Table (b) shows the names of swine association they are affliated to.

Access to Government Subsidies

The result above showed that 95.0(76) of the farmers do not have access to government agricultural subsidies, while only 5.0(4) of the farmers has access to the subsidies.

Access to Government Bank Loan

Regression Analysis showing the Effects of Production Cost, Access to Government Agricultural Subsidy, Access to Bank Loan, and Membership of Swine Organization, on Gross income of Swine Producers in Free State.

r = 0.925 R^2 = 0.855 F-cal =110 F-tab $_{(0.05, 4, 75)}$ = t-tab $_{(0, 05, 79)}$ =1.98

Dependent Variable; Gross income of Swine Producers in Free State

Source: SPSS 20.0 Output, detail in Appendix 3.

GI = αo+ α1 CP + α AGAS + α1 ABL + α1 MSO + U1

Where GI = Gross Income

CP = Cost of Production

AGAS = Access to Government Agricultural Subsidy

ABL = Access to Bank Loan

MSO = Membership of Swine Organization

GI = 0.22 – 1.69CP + 0.69GAS + 0.05ABL + 0.16MSO

t- values (0.28) (-18.72) (1.33) (0.17) (0.49) in bracket

The result shows that the Pearson's correlation coefficient is 0.925. This correlation coefficient is very high indicating that a very strong relationship exists between Gross income of Swine Producers in Free State and the determinants. The Coefficient of Determination (R^2) = 0.855. This implies that a 85.5% variation in Gross income of Swine Producers in Free State is explained by variations in Production Cost, Access to Government Agricultural Subsidy, Access to Bank Loan, Membership of Swine Organization. The remaining 14.5% is explained by other variables not included in the model. The F-calculated of 110.96 had a corresponding significant F-value of 0.000 < 0.05 (level of significance); the researcher therefore concludes a good model utility. Conventionally F-cal = 110.96 > F-tab $_{(0.05, 4, 75)}$ = 3.842 hence the above conclusion of a good model utility is upheld. (See Appendix 3)

CONCLUSION AND RECOMMENDATIONS

The need for this study was anchored on the fact that many Swine producers typically market their pigs to several distributors, and this has reduced their profit maximization. On the relationship that exist between distance to abattoir and transport cost, it was proved that a positive, moderate, and significant relationship exist between distance to market/abattoir and transport cost. It was concluded that Production cost significantly affect Gross income of Swine Producers in Free State. We concluded from the result that Access to government agricultural subsidy does not significantly affect Gross income of Swine Producers in Free State

Considering the access to bank loans, the researcher accepted the null hypothesis and concluded that Access to bank loan does not significantly affect Gross income of Swine Producers in Free State. On the membership to swine organizations, the researcher accepted the null hypothesis and conclude that membership of swine organization does not significantly affect Gross income of Swine Producers in Free State.

Going through the results, findings, and conclusions reached based on scientifically and systematically conducted research work, the following recommendations are hereby forwarded.

- More youths should be encouraged to involve in pig farming. The research showed that majority of the farmers are aging if care is not taken swine farmers will go extinct.
- Government policy should encourage funding of the swine producers/ farmers.
- Swine producers should be given periodic training on the new technology available for the industry.
- The department of agriculture in conjunction with the extension officers (EOS) should have regular

workshop to encourage the farmers.

- The farmers should be encouraged to join organizations that will booste their industry.
- Many of the farmers are not educated and so find it difficult to meet up with the modern technology in the industry. On this note, the government should make agricultural study compulsory in the matric level. They should also give grant to students who offer to study agriculture in the university.
- The government should subsidize or reduce tax for swine producers
- Finally access to government loan/bank loan should be made available.

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