INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN ECONOMICS & MANAGEMENT SCIENCES

OPEN ACCESS JOURNAL

Vol 12, Issue 2, (2023) E-ISSN: 2226-3624

Connectivity of Sustainability Goals among Beef Cattle Producers in Peninsular Malaysia: Structural Equation Modelling Approach

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To Link this Article: http://dx.doi.org/10.6007/IJAREMS/v12-i2/17873 DOI:10.6007/IJAREMS/v12-i2/17873

Published Online: 16 July 2023

Abstract

The market concentration for live cattle in Malaysia is oligopolistic. The market is controlled by a few firms and is less competitive in price. Despite the challenges in this industry, there is still participation from smallholders and commercial beef cattle producers. The motivation for this study is to support the latest Malaysian National Agrofood Policy (NAP) 2.0, which provides three general principles that should be achieved for a competitive industry. The sustainability goals of the industry are regularly explained in terms of three essential pillars: economic, social, and environmental aspects. This study investigates the connection between each sustainability goal component for beef cattle farm operations. The connectivity of these three sustainability goals was explained using the Structural Equation Modeling (SEM) approach. All three pillars are connected to each other. The finding shows the connectivity of social goals with management and lifestyle constructs is the most vital element in sustaining the beef cattle operation in Malaysia. The structural model gained from this research is suggested to be applied as a framework in policy making and considered when conducting the programs, delivering the financial aid, and providing extension services. The authorities should appreciate the social responsibility shown by the smallholders by providing them with more networking opportunities and protecting them from the cartel pricing that might be practiced by commercial farms and established associations. This research contributes to the outcomes in terms of a general framework and justifies the factors that contribute to the sustainability of the beef cattle industry, which helps the authority and beef cattle producers understand the connection between producers' goals.

Keywords: Sustainability Goals, Beef Cattle Producers, Peninsular Malaysia, Structural Equation Modelling, Beef Cattle Farms

Introduction

Market concentration plays important roles in price setting. Cattle importers consist of the established company who import the cattle for slaughter. Price of beef depends on supply chains management where the producers have the rights to set up the price which is reasonable for them to gained profit (Murphy, 2006). But, the uncompetitive market structure would change the game. Some of producer enjoy the economic of scale and can be a price maker, while some of the smallholder are the price taker where they did not gained the reasonable profit since their operation cost is expensive per unit of cattle.

In Table 1.0, the market concentration of beef cattle importer in Malaysia is dominated by a company, i.e., Tenakan Kamran Sdn Bhd. With the possession of up to 66 percent, the company monopolises the market industry. The advantages of monopoly companies are they can enjoy economic of scales that benefits the consumers where the selling price becomes cheaper. Besides, the sum of the top four companies that possess the overall 82 percent of market concentration makes it a highly concentrated market. Therefore, imported cattle industry in Malaysia is an oligopolistic to monopolistic structure. There are advantages and disadvantages to this market structure. Besides economic of scales, monopolistic market can also benefit producers where they can be price makers. The price of cattle is controlled by the market players which benefits them in gaining profits. Nevertheless, it can be disadvantageous to consumers when the market force is in the hands of producers.

Table 1.0

Market Concentration (CR and HHI) of Cattle Importers based on Import Value, 2018

CATTLE IMPORTER	**Estimated market share based on import value (2018),%**	**CR 2[1] and CR 4[2]**	**HHI[3]**
Ternakan Kamran Sdn Bhd	66	74	4348
TAF Venture Sdn Bhd	8		69
Abdullah Bin Nayan	5	82	26
S.T Ternakan Sdn Bhd	3		9
AR Meats Trading Sdn Bhd	2		6
Top Agro Farm Sdn Bhd	2		3
Others	13		12

[1] CR2 is the sum of concentration ratio for 2 top player in industry. Concentration ratio is of market concentration is calculated as the sum of the percentage shares of usually four, eight or twelve largest companies in an industry.

[2] CR4 is the sum of concentration ratio for 4 top player in industry.

[3] HHI is Herfindahl-Hirschman Index (HHI); the sum of squares of the market shares of all companies in the industry concerned. The value of HHI above 2500 represents a highly concentrated industry, and industry with a very high market power.

Total	**100**		**4473**
		High concentration	High concentration

Source: Malaysian Competition Commission (2019).

Commercial and smallholders farmers are both the beef producers. Both owned the cattle farms and have control over the farming activities and enjoy the farms profit. The term of "producer" referring to the cattle owner either smallholder or commercial farms. The top producer have an advantage to increase and decrease the price which favours their needs. In addition, consumers also gain limited choices in the high concentrated market. Overall, beef and cattle market in Malaysia can be divided into two niches; local beef cattle breeders and live cattle for slaughter importers. For local producers, the market structure is low concentrated, which means a perfect competition amongst the producers (MyCC, 2019). The different structure identifies the cattle importing market where it is highly concentrated and forwarding to monopolistic structure. As local producers and importers can be substitute to each other, oligopolistic to monopolistic structure can be harmful to the perfect competitiveness among local beef cattle producers.

The survival of local beef and cattle producers depends on high demand of products and low productivity of local beef. In the long term, too much dependence on importing beef and cattle can affect the small-scale producers' income as they need to compete with live cattle importers that have advantages on price and quantity. Therefore, high productivity of local beef and cattle could be a solution to local competitive market as the consumers will have various choices and the local producers still gain high profit with low margin per unit head of cattle. It will not burden the consumers and the producers can set up the same price as imported beef cattle. The beef cattle industry could be more competitive when the monopoly power is reduced, and the profit and income are well-distributed to the smallholders.

Motivation of Study

Beef cattle farming in Malaysia seems to experience many challenges to survive. Cattle producers face many challenges to sustain in this industry. Despite of high feed cost, decreasing grazing area due to urbanization, and lack of quality breed, there are still quite a huge number of surviving and sustaining cattle farms (Hashim, 2015). Other than cattle farming, simultaneous subfields of farming such as small ruminant, cash corps, and commodities are exposed to agricultural risk. However, their motivation is high in managing the agricultural risk. Producers are aware of the uncertainties to overcome, such as climate change and other uncontrollable events. However, they are more focused on the main objective of farming, i.e., being successful in managing their businesses (Ali et al., 2019).

Meanwhile, sustainability of beef production requires improved on-farm efficiency, productivity, and efficient value chain that benefit target market specification (Greenwood, 2021). Malaysian latest National Agrofood Policy (NAP) 2.0 provides the three principle to achieve generally; economic, social and environment. Through the principle, it concludes the objectives of NAP 2.0 are to create highly competitive and innovative industry, secure the wellbeing of food producers and inclusivity in industry development and to enhance the paradigm shift towards a sustainable food system. Sustainability of the farm entity would be an important agenda in the latest framework of NAP 2.0.

Sustaining the Beef Cattle Farms

The industry has many challenges. To sustain in industry, the producers need a huge courage and effort. Each of them have their own reasons to stay in industry. Some of the farmer do

for the sake of hobby, whilst other maintain the farms for the monthly income. Each producers have individual indicators to sustain the cattle farming activities. For betterment of resource allocation, the sustainable indicators must be linked to the producers. Sustainable agricultural (SA) approach facilitate the producers in betterment of land, water and overall environment (Sarkar et al., 2021). Do producers aware on the resource scarcity of this industry? If yes, why would they stay doing what they have now (beef cattle farming)?

Focusing on a different perspective, 90 percent of smallholder farms dominate the Malaysian cattle farms. Smaller-sized farms seem reasonably acceptable. They have greater managerial control and flexibility in term of input management and innovation. Cattle farming requires both skills and capital intensive. Besides that, managing small farms' uncertainties in operation is way easier. The adjustment of their inputs is easily to handle. The uncertainties in beef cattle industry include volatile changes in consumer demand, prices of global feed ingredient, and other technological progresses.

The situation is different when the size of farm in business is increasing. They need to provide labour with specialisation, involving employment of workers with special aptitudes and abilities. In addition, more capitalisation involving buildings, lands, and machines for daily operation is needed. Smaller farms experience a different scenario. They may face diseconomies, but fail to appear as family constitutes a significant proportion of labour force. Very few small farms preclude family members in their farms' operation. Most of the farms have unpaid family members such as wife and children to help with the daily operation. Farm workers gain more satisfaction through exercising control over processes and events from many occupations they inherent from the nature of farming (Britton & Hill, 1975).

For example, one-man farm is when the same person chops the forage for cattle, drives a tractor to manage the feed logistic, and handles business administration of the farms. This situation results in the diseconomies of opportunities for specialisation of labour in small businesses. In reality, it is a lie towards utilisation of capacity for specialisation of job scope. This is because of the available capacity of the producers' and their wives' own labour. The component of labour in cattle farms is illuminating due to the involvement of unpaid family labour. The labour of the farmer and his wife will decline when the size of farms is increasing. The participation of family members in beef cattle operation sometimes does not focus solely on profitability aspect, but more to lifestyle and stewardship.

The government has started an initiative by introducing a scheme for livestock rearing. The main authority that plays the prime role in sustaining beef cattle industry is the Department of Veterinary Services (DVS). The authority provides schemes, financial aids, and technical supports. Apart from that, the integration system (cattle and oil palm plantation) encourages the producers to do cattle farming as a side hustle. Most of the system adopters are smallholders. The system claimed to be systematic and farmer-friendly as it creates harmonious ecological relationship among cattle, undergrowth, and oil palm. The cattle are allowed to move freely among the trees in controlled and specific areas. The conveniences of this system are being promoted to oil palm plantation owners. It is one of the prime strategies to encourage local beef cattle production. However, the adoption of such system depends on capital availability, cost of adoption, bio-physical suitability, labour availability, as well as information know-how (Ahmad & Nasir, 2020). This is because most of the companies do not give solid reasons for not participating in the cattle-oil palm plantation system. The constraints of the system include production and on–farm problem, marketing and economic issues, technology adopted and mechanisation, as well as government support (Ahmad &

Nasir, 2020). Therefore, the sustainability of beef cattle industry does not fully depend on the system being promoted by the authority, but the producers' source availability.

The operation of beef cattle farms possesses more challenges than other livestock. This is due to the size of the animals. Cattles are larger than other livestock, require a permit of movement for interstate transportation, and incur huge operation cost for the intensive system. In contrast, the highest number of registered farms in Malaysia is beef cattle farms. The producers tend to register their farms with the authority because of the advantages that they would get in return, such as technical support from DVS and financial aid from the government. However, do they register the cattle farms just to legalise the operation for entering imported cattle during festival seasons or active operation of the farms for the whole year? This could be an industrial dilemma when a seasonal activity for economic motives could improve the income of producers. However, it would not be long lasting due to cattle availability in the region for the non-seasonal period.

Table 2.0 presents that beef cattle farms and premises are the most registered for operation compared to other commodities of livestock. Meanwhile, layer chicken farms are the least. Throughout the years, the number of beef cattle farms keeps increasing consistently. The number shows progress of additional farms every year and is expected to give a beneficial impact on beef productivity in Malaysia.

Table 2.0

Registered Farms and Premises by Commodities from 2015 to 2018 in Peninsular Malaysia

Year	Beef Cattle	Goat	Broiler Chicken	Sheep	Buffalo	Dairy Cattle	Swine	Layer Chicken
2015	21284	8326	2398	1520	1531	852	539	245
2016	23237	9289	2418	1657	1655	844	525	242
2017	24501	10127	2330	1847	1752	826	509	242
2018	24512	10903	2296	1976	1854	764	722	249

Source: Department of Veterinary Services (2019)

On the operation side, cattle are bigger in size that incur more operational cost compared to other livestock. With the self-sufficiency ratio of less than 30 percent as compared to chicken meat which is more than 90 percent, it is clear that beef cattle farms require multiple effort and hustle to sustain their operations. In addition, registered farms is one of the eligibilities or requirements for farms to apply financial aid and location transfer permit for interstate purchases. As an authorised body, DVS plays its role to facilitate beef cattle farms with all their authorised power, especially in technical aspect.

The participation of Malaysia in the industry has also become one of the dilemmas. Most of the youth have shifted their interest to other promising industries such as oil and gas sector, real estate, finance, and education. Agriculture, especially livestock sector, is not the main choice among Malaysian youth to participate in nowadays. This is due to the below average wage for the young workers. Besides, this sector offers self-employed opportunity and unpaid family labour. Agriculture sector, as a whole, in Malaysia, is known for its lower proportion of managers, professionals and researchers, as well as technicians and associate professionals compared to other sectors (Ashraf & Rafiq, 2020).

High concentrated of live cattle importer market shows the industry controlled by commercial producers whilst the number of smallholder producers involved in this industry up to 90 percent (refer Table 1.0). Increasing SSL, regulated beef price and fair distribution of business

profit would benefit producers and consumers in many ways. The producers are agro food entrepreneur and they are the important person that should be nurture and highlight for the sake of local beef cattle sustainability. As the NAP 2.0 policy crafted based on principle of economics, social and environment, it means to encourage sustainability in consumption and production of agro food in general. Besides, sustainability approach offered in most research more focusing on waste management of the livestock and input (Adawiyah Zayadi, 2021). Perhaps, the intention of producers to survive and sustain in industry should be included from the perspective of economics, social and environment all rounded as suggested in NAP 2.0 instead of focusing on environment sustainability alone. Sustainability goals important for the continuation of beef cattle supply. The problem is market structure of live cattle is high concentrated (not competitive) where the profit shared dominates by leading commercial farms.

As frameworked by NAP 2.0, the three pillar of sustainability from social, economic and environment need to achieve where it will create highly competitive and innovative industry, secure the producers and enhance the paradigm for sustainable food system. Therefore, one of the gap in Malaysian beef cattle industry is;

How much the three pillar of sustainability; social, economic and environment are connected to each other in sustaining the beef cattle farm operation?

Research Objective

To investigate the connection of each sustainability goals component in sustaining beef cattle farms operation in Peninsular Malaysia.

Aim of objective is to find the interconnection of sustainability component in cattle farming where the long term framework can be draft through the findings. Testing the sustainability approach towards the producers would portrays their sole agenda in operates and develop their beef cattle farms. The findings will works on corporation who want to invest in the beef cattle farms business since the blueprint of sustainability can be gained from this research. Besides, government can offer the suitable extension services towards the producers based on producers' sustainability agenda rather than generalize the assistance towards them.

Literature Reviews

Sustainability Pillars

According to Purvis et al (2019) the early conception of sustainability in economic perspective is pioneered by political economists such as Smith, Mill, Ricardo, and Malthus during the era of industrial revolution where there are limits of both economic and demographic growth, and recognised the inherent trade-offs between wealth generation and social justice are been questioned. Economic development during the post war period shows the evolved of notion from exploitation of natural resources to a rise in material well-being indicated by an increase in the flow of goods and services, and growth in per capita income (Arndt, 1981). When the economic development become the major agenda in most of the countries' policy, the rise of modern environment movement take place to increase awareness of the widespread environmental destruction caused by humans. It has also been argued that the environment and the quality of life issues came to the highlight in the West at this point because 'basic economic needs' had been met following the economic growth in the post-war period (Dunlap and Mertig 1991; Martı´nez-Alier 1995). The early conception of sustainable development is motivated by the need for economic development including its social and economic objectives and conservation into account by considering resource limitations and

ecosystem carrying capacity (Purvis et al., 2019). In this current era, the sustainability concept had been specify by United Nation under its Sustainable Development Goals (SDG) based on the idea that economic prosperity, environmental protection and social well-being are interconnected elements that cannot be addressed separately (Andreoni & Miola, 2016). According to the UNAP (2015), the SDG being formulated based on four elements include human well-being is intrinsically linked to the health of the natural ecosystem, global environmental challenges not only affect the development of the poorest but also pose a threat to the long-term prosperity of development, addressing inequalities in the distributive benefits of development is critical for global sustainable development, and sustainable resource management, and maintenance and safeguarding of natural capital are fundamental aspects of long-term development.

In order to achieve the SDG goals, the three main dimensions of sustainability include namely economics ,social and environment for the comprehensive impact. These three dimension called “the three pillar” of sustainability. According to Campbell (1996), these three pillars represented three major goals which have conflicts to balance. There were competition through these three pillars in order to sustain the course. In agricultural field, Altieri (1987) clarify that requirements to develop sustainable agriculture clearly are not just biological or technical, but also social, economic, and political, and illustrate the requirements needed to create a sustainable society. Cocklin (1989); Hancock (1993); Basiago (1995) emphasise integration of the systems and management of trade-offs between the pillars. Hancock (1993); Basiago (1995) agree the pillar works in a systems , but the implication of the individual pillars strengthen and enhance each other. In summary, the pillars works on connecting each other and act individually.

Market concentration and sustainability is a new research agenda (Biely & Passel, 2022). Imported cattle market structure is high concentrated (refer Table 1.0). This means only few firms control the prices and output of imported live cattle in Malaysia. Market power is not limited to the ability to influence prices and outputs. According to Murphy (2006), market power is also the ability to reduce competition. Reduce competition can be the installation of entry barriers, starting off price wars, setting standards, or lobbying (Biely, 2020). The most important parts, market concentration in agricultural field as livestock looks like hourglass where a large number of producers at the base sell to a small number of processors and distributors and supermarkets in the middle, who sell to a very large number of consumers at the top (Murphy, 2006). Since the livestock producers at the base, it is very challenging when we know the facts that they were high concentrated market share for the importer, and the leftover of the market share are local breeder and producers to compete each other and sustain.

As market power and sustainability are connected in various ways, market power does also affect the sustainability transition. Unfortunately , no general statement can be made, whether market power inhibits or supports a transition of sustainability or not. This depends on many unrevealed factors (Biely & Passel, 2022). But, competitiveness of the sustainability element is closely related to the concept of inclusive growth, which looks at how countries can simultaneously achieve economic growth and having balance socio-environmental outcomes (Andreoni & Miola, 2016). The situation shows that interrelation between the sustainability pillar could portrays the competitiveness of the industry.

Many studies suggest the item for constructing the variables in each of the sustainability pillars (De Otálora et al., 2021; Lebacq et al., 2013; Maulidah, et al., 2021; Gaviglio et al., 2016). There are also the research whose using the specific theory such as Theory of Planned

Behaviour for constructing the variable item which end up clustering the factor into the three pillar of sustainability (Greiner, 1967; Greiner & Gregg, 2011).

In the context of producers' motivational factor, Sok et al (2021) explained the compatibility of this theory to be applied to producers' intention and motivation assessment. There are 32 percent out of 124 articles related to TPB addressing farmer behaviour in a livestock management that focused on biosecurity and diseases control, animal welfare, and management of grassland. Through motivation and intention, it exerts a psychological driving force that enables action in the pursuit of goals and expectations for joining the activity.

Abdulla et al (2016) suggesting the idea for sustaining the Malaysian beef cattle industry through the importation of animal for breeding, minimized rate of beef cattle mortality, increased fertility and the conduct of training in feed efficiency management. The idea of sustaining this industry should be start at the operation level. Sustaining the beef cattle farms facing a lot of challenges, not only the farms but most of the agricultural field as a whole.

Purvis et al (2019) promoting "the three-pillar" of sustainability that works for the operationalising the sustainability. This include social, economic and environment aspect. Lebacq et al., (2013) suggesting the livestock sustainability indicator which include the three-pillar conception. In detail, the research classified each pillar starting with economic pillar, profitability, autonomy, diversification and durability of the farms are the indicators. For environment, the sustainability indicators include input management and quality of natural resources. It takes the wellbeing of community with value and concerns of society for the farms to sustainable socially (Lebacq et al., 2013). However, the indicator can be different from region to region (Sarkar et al., 2021).

According to Segerkvist et al (2021), there are overlap item which connected the three pillar. For example, producers income and labour are the interconnected item for social and economic pillar, while ecosystem services in between social and environment pillar. This connection between the pillar should be an advantages since the producers or producers can be focusing on the same item in sustaining their activities. Maulidah et al (2021) found the different outcome where social factors have a positive and significant effect on beef cattle sustainability, while economic and environmental factors have a negative and significant effect. These three pillars also being tested for agriculture sustainability in general and found that there is a positive and significant interconnection among the environmental and economic indicators, economic and social too. While environmental and social indicators have possessed positive relationships.

Despite of the framework of three-pillar sustainability conception, the detail of item in constructing of the pillar should being study closely. Greiner (2015) succeed to used the Theory of Planned Behaviour by Ajzen (1991) and the items on the research are able to being cluster into three group namely stewardship and lifestyle motivation, economic motivation and social motivation for three-factoral motivation model. The items of this factors help this research to build comprehensive sustainability item.

Evaluating the sustainability by using three pillar conception have a few approach. Most of the study use quantitative approach so the framework can improve the three pillar. De Otálora et al (2021) evaluate the sustainability three pillar by using modelling approach which is works for dairy production. This method seems accurate but need more literature in the context of beef cattle production. Structural Equation Model (SEM) approach had been used to create a structural model to link social, economic, and environmental variables to the sustainability of the beef cattle business (Maulidah et al., 2021). According to Rohaeni et al (2014), SEM method helps the research to suggest the improvement of resource;

environmental, economic, physical, technological and human for sustaining the beef cattle farming. For structuring the model as in these two literature, suitable items need to be analysze as in Greiner (2015) where the Theory of Planned Behaviour are able to cluster the item into three main factor of farmer motivation.

Producers' and Farming Activities

Motivation of producers to sustain in cattle farming originates from producers' intention that are influenced by three constructs; attitude, subjective norm, and perceived behavioural control. Attitude is a positive or negative evaluation of performing a given behaviour. According to Daxini et al (2019), the intention of producers towards their activities will increase if they perceive that using the practice is useful and beneficial, and will lead to positive results for them. Meanwhile, subjective norm is the expression of social pressure level or expectation felt by an individual from their significant reference persons to engage or not to engage in the particular behaviour. The producers will consider people's opinion regarding their value which will confirm a given behaviour. Then, their own intention to perform the behaviour will increase (Rezaei et al., 2018). Meanwhile, perceived behaviour control is an individual's perception of the ease or difficulty related to their performing of a given behaviour that is also related to the presence of facilitating conditions or situational constrains.

The influence of TPB construct on intention or motivation varies depending on behaviour and context of study (Ajzen, 1991). In the context of the livestock producers, some studies applied standard TPB model, meanwhile others would extend the model with additional predictors according to their research objectives (Sok et al., 2021). The construct of TPB might work positively towards their intention to comply. As in Senger et al (2017), the basic three constructs of TPB were positively correlated with the farmer intention. Among the three constructs, one might show a strong impact on the other two. Borges et al (2016) found that attitude had the strongest impact on intention, which is different from Winkel et al (2020) where the construct of TPB such as perceived behavioural control had no significant influence on producers' behaviours.

Besides, extended model of TPB may work better to determine farmer intention as compared to basic model. Maleksaeidi & Keshavarz (2019) found that the constructs of basic TPB model of an extended model, identified variables of producers' knowledge, perceived threat, social norms, and moral norms as the most relevant factors to explain farmer intention. Therefore, the basic model of TPB might not totally work in all situations.

Another approach in which the researcher found could reveal the motivation of producers in sustaining their activities is by clustering the TPB traits according to factor loading weight. Greiner & Gregg (2011) used a three-factor model to explain farmer goals and motivations. The factors are clustered into economic and financial motivation, conservation and lifestyle motivation, and social motivation. This approach was applied by Greiner (2015) where the three factorial motivation model is based on the importance of rating motivation items. The 3-factorial motivations model provides a good fit with the results of other studies. Chouinard et al (2008) identified three types of farmer motivations in Washington State (USA): pure profit-maximising, ego-utility (valuing environment only to the extent that it provides direct personal benefits), and sense of obligation to others. Maybery, Crase, & Gullifer (2005) identified three sets of values for landholders in the NSW Murray region (Australia): economic, conservation, and lifestyle motivations. They noted that there was 'conceptual overlap' of lifestyle and conservation values.

Han et al (2021) briefly explained personal value and farmer goal into their current activities of farming. These include the positioning of farming activities into three major goals that are linked to economic condition, biophysical situation, and social interaction. These three groupings of goals are long term goals that are competing, but not mutually exclusive. Henceforth, individuals can hold all three simultaneously, but prioritise differently (McGuire et al., 2015). Similar to three goal orientations, producers also have three goal driven management styles called production maximiser, environmental stewards, and networking entrepreneur. Motivation and goals can be distinguished where goal orientation refers to producers' long-term goals rooted in their values while motivation is an immediate factor that triggers behavioural change (Brodt et al., 2006). Additionally, long-term goals exist prior to market evaluation by beef cattle farms, which are not influenced by an immediate consideration.

Therefore, the TPB is suitable for constructing the items in the sustainable framework as it will portrays the outcome from producers. To connect the conception of three-pillar with the TPB as the items would be workable for constructing the new framework of beef cattle sustainability goals in Malaysia.

As this research known the beef cattle industry in Malaysia is a high concentrated, the sustainability of the remaining producers are being questionable. Previous study suggesting the " the three-pillar" of sustainability conception in order to evaluate sustainability goals among the producers. The lack of this assessment in Malaysian context should be filled to complete the assessment at the micro level (farms). A better understanding of interrelations and interactions would be an important piece of the puzzle in the work on determining how to improve individual aspects of sustainability but also how the entire farm-level sustainability can develop in a positive way (Segerkvist et al., 2021).

Methodology

Samples were taken from random cattle farms around Malaysia that would represent the real scenario of beef cattle farms. The selected farms consisted of registered and non-registered farms, from full-time producers and part-timers. This include both fattening and breeding farms where both have the business transaction in selling their cattle for beef source. There is no separation of farms categories since there were breeding farms who sell fattening cattle during festival too, and there are fattening farms who keeps the breeds too. Most of the farms have the bi-function operation; breeding and fattening. As long as the farms sell their cattle for the beef purpose, it be counted as sample. The wide range of these criteria would help this research to present the industry in the most accurate evaluation.

The data obtained through questionnaire where the Likert Scale questions provided for the beef cattle producers to answer. All the questions have been adopt and adapt from Greiner (2015) where the question turn out valid to be implement in this research since it able to cluster the items from Theory of Planned Behaviour (TPB) into three group of construct; economic,social, management and lifestyle in farms. From the questions, pre-testing by using Exploratory Factor Analysis (EFA) done purposely for selecting the best items before constructing the measurement model and structural model by using Structural Equation Model (SEM) analysis (Amin & Chin, 2019). Based on Greiner (2015), the items include clustered each of the factor loading. Some of it have redundant score between two factors. The interconnection between these three factors or pillars (economic, social, management and lifestyle) important to evaluate in order to facilitating the betterment of this high concentrated market structure industry.

SEM is the suitable method to analyse the interconnection of sustainability goals among producers because it is the integration between two statistical concepts; the concept of factor analysis belonging to measurement model and the concept of regression through structural model. The measurement model explains the relationship between variables and their indicators and the structural model explains the relationship among variables. The measurement model is a study of psychometrics, and the structural model is a study of statistics. SEM is an evolution of multiple equation models (regression) developed from the principle of econometrics and combined with the principle of settings (factor analysis) of psychology and sociology (Hair et al., 1995; Rohaeni et al., 2014). Based on Sarkar et al (2021) and adaptation of motivation factor from Greiner (2015) implementation of sustainability goals towards the beef cattle producers can be hypothesized as below:

H1: Management and Lifestyle and Economic indicators are significantly interconnected for facilitating producers sustainable goals.

H2: Management and Lifestyle and Social indicators are significantly interconnected for facilitating producers sustainable goals.

H3: Economic and Social indicators are significantly interconnected for facilitating producers sustainable goals.

Questionnaire have been set in two language; Malay and English. Malays version is the one that distribute to the survey participant and English version for the record purpose . The questionaire have been revised two times before distributed. Field visit have been conducted on the year 2018 in order to gain real experiences of the beef cattle farming operation so the questionnaire are well adapt with the real situation of beef cattle farming in Malaysia.

Survey Technique

Cluster sampling is the technique used to find the adequate sample for the research. Cluster sampling is advantageous for those researchers whose subjects are fragmented over large geographical areas as it saves time and money (Davis, 2005). Since the population is all over Peninsular Malaysia, this research clustered the sample frame into smallholder and commercial producers. For the smallholder, the amount of sample must be at least 90 percent from the total collected sample, and the rest from commercial producers. For the smallholders, amount of cattle must be more than 4 heads and both size of the business must be operate at least for two years. Stratified sampling is used because there is a great deal of variation within beef cattle farms population overall Peninsular Malaysia (Taherdoost, 2016). The purpose is to ensure that every stratum is adequately represented (Ackoff, 1953).

A pilot test was conducted on an online platform in social media and communication applications such as Facebook specific group of beef cattle businesses, email and Whatsapp application. The outcome is frustrating as there were IT illiterate amongst the cattle producers. There are only 30 farmer respond on the pilot test using the Google Form application for respond. The pilot study done on July 2020 and field data collection starting on August 2020 until February 2021.

Sampling Implementation

The sampling unit of this research was beef cattle farms around Peninsular Malaysia. As published by the Department of Veterinary Services (2021), the number of registered cattle farms in Peninsular Malaysia were 24512 units for the year 2018. According to Israel (2012), using published table for determining sample size is one of the strategies to determine the sampling size. The table suggested for the size of population up to 25000, with the precision of 7 percent; 204 sample is sufficient. With 334 data collected, the number also fulfil the Cochran's (1963) requirement where 270 samples met 90 percent of the desired confidence level and five percent precision. Because of the samples collected show almost the same input (lack of variety), especially for smallholder farms, confidence level of 90 percent was sufficient in this case. From the 334 of data, the ratio of the smallholder farm respondents was 90 percent as compared to commercial farms which only represented ten percent of the ruminant Malaysian population; consistent ratio as mentioned in (Zainalabidin et al., 2013).

Sustainability – Three Pillar Conception

Sustainable Development Goals (SDG) by United Nation have evolved an 'integrated' approach adopting 17 broad goals over a smaller number of categorisations (Purvis et al., 2019). The conceptional of sustainability had become common in many literature and being represent into three component; economic, social and environment. Figure 1.0 shows a few representation of sustainability interconnection. This graphic is found in various forms as a descriptor of 'sustainability' within academic literature, policy documentation, business literature, and online.

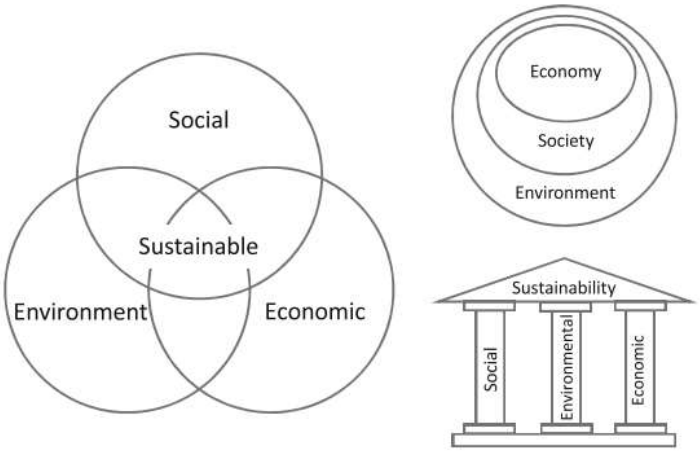

Figure 1.0 Sustainability Representation
Source: Purvis et al (2019)

Sustainability assessment is a key step in supporting the development of sustainable farming systems (Sadok et al., 2008). Since the market structure of live beef cattle is not competitive (oligopoly), sustainability goals of remaining industry player should be considered. Sarkar et al (2021) use the SEM analysis to evaluating all the associated indicators of sustainable agricultural with a structured model. The SEM approach is proven to justify the influence of environmental, economic, technological, physical, human, and institutional resources influence towards the beef cattle farming (Rohaeni et al., 2014). Plus, the interdependency of identified indicators confirmed and linked to each other and give advantages towards the policy recommendation (Maulidah et al., 2021).

Theory of Planned Behaviour

The theory is an extension of the theory of reasoned action (TRA). It upgrades the facts that most behaviours of interest to social and behavioural scientists are under complete self-control. Therefore, once an intention is formed, it is expected to initiate the behaviour under appropriate circumstances. However, it soon becomes clear that the assumption of perfect volitional control places a severe limitation on the theory's ability to deal with behaviours that are difficult to execute, which may prevent people from acting on their intentions. Besides, many behaviours require certain skills, knowledge, or cooperation by other people. In fact, this may demand the ability to overcome such barriers like lack of money, time, or other resources. To summarise the proxy in TPB, the equation was explained as follows

$$B = f(I, AC\tilde{}\ P\ BC) \quad (1)$$
$$I = f(A, SN, PBC) \quad (2)$$

Equations (5) and (6) presented the TPB in a symbolic form, where B was a given behaviour, I was the intention to perform the behaviour, AC was actual control, PBC was perceived behavioural control, A was the attitude toward the behaviour, and SN represented subjective norm. Both equations were estimated in an additive manner without the recently postulated moderation effects of PBC on A and SN.

$$SN \propto \sum_{j=1}^{t} n_j\ m_j \quad (3)$$

Equation (7) showed the representation of subjective norm, where SN represented subjective norm, n was the strength of an accessible normative belief concerning the expectation of an important social referent, and m was the motivation to comply with the referent in question. Motivation was the component in subjective norm. For the expectancy-value model of attitude toward a behaviour (A), the equation was shown below

$$A \propto \sum_{i=1}^{s} b_i\ e_i \quad (4)$$

Consistent with subjective expected utility theory (Feather, 1959,1982), the subjective probability or strength of the behavioural belief *(b)* indicated that a behaviour would produce a certain outcome or experience which was multiplied by the person's evaluation *(e)* of the outcome or experience. the products were summed across all accessible behavioural beliefs *(i = 1, . . ., s).*

Meanwhile, perceived behavioural control was determined by the total set of accessible control beliefs, which were beliefs about the presence of factors that might facilitate or impede performance of the behaviour. Specifically, the strength of each control belief *(c)* was multiplied by the perceived power *(p)* of the control factor, and the products were aggregated across all accessible control beliefs *(k = 1, . . .,v).* The equation as follows

$$PBC \propto \sum_{k=1}^{v} c_k\ p_k \quad (5)$$

The Pre-Testing, Pilot Study and Exploratory Factor Analysis (EFA) Procedure

The measuring instruments were adapted from literature and customized to suit this study. The pre-testing procedure was conducted after the customization process has been completed. After the pre-testing procedure, the items in the questionnaire rearraged ,

according to the topic and locality suitability. The questionnaire was then ready for pilot testing and Exploratory Factor Analysis (EFA). The revised questionnaires were sent by email and online posting in social media . Selected beef cattle producers in different locations was invited to join the online survey. 30 were collected out of 80 questionnaire distributed to beef cattle producers on July 2020. The data from the pilot study were used to analyze the Exploratory Factor Analysis (EFA). EFA procedure was used to determine the dimensionality of item in the questionnaire. The EFA procedure need to be done because the dimensionality of items used in this research study might have changed from the previous research due to different industry, geography and sociocultural factors from the adapted questionnaire of (Greiner, 2015; Amin & Chin, 2019).

The Exploratory Factor Analysis using extraction method of Principal Component with Varimax (Variation Maximization) Rotation was performed on the 10 items measuring Management and Lifestyle (ML) construct, 10 items measuring Economics (E) construct and 11 items measuring Social (S) construct. The results in Figure 2.0 indicated that the Bartletts' Test of Sphericity was signif- icant (P-Value < 0.05) for all constructs. Furthermore, the measure of sampling adequacy by Kaiser- Meyer-Olkin (KMO) was excellent where all exceeded the required value of 0.6 (Awang, 2010, 2014). The Bartlett's Test is significant and KMO > 0.6, indicate that the data is adequate to proceed further with the data reduction procedure (Awang, 2010, 2014). This analysis conducted with real data of 334 collected from August 2020 to February 2021.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.943
Bartlett's Test of Sphericity	Approx. Chi-Square	7401.857
	df	465
	Sig.	.000

Figure 2.0. KMO and Bartlett's Test

Most of the components and their respective items were excellent in measuring the ML, E and S construct since their total variance explained exceeded 60% (Awang, 2010, 2014). Some factor loading for every item in ML, E and S are less than 0.6. Thus, the item should be deleted since they not achieved the minimum requirement for factor loading of 0.6 (Awang, 2010, 2014, 2016). In other words, most items are useful to measure the latent construct. However four item needs to be deleted. All of the items in all three components have achieved the required Internal Reliability since the Cronbach's value which is greater than 0.7 (Awang, 2010).

Pre-Structural Equation Modelling Analysis: Exploratory Factor Analysis (EFA)

Every variable involved in this third objective was screened and analyzed at the EFA stage. Thirty-one questions were set as the item (latent variables) to find reliable variables to use in the next stage of analysis, SEM. Four of the item are withdrawn due to the low factor loading. EFA is a pre-determined stage that involves finding reliable factors before structuring the model.

Table 3.0 shows that the variables could be grouped into three categories, according to the factor loading. The groups were classified as management and lifestyle, social motives, and economic motives. The EFA results revealed three grouped sets of variables, according to their factor loading. Some variables were excluded from the analysis due to the low loading

factor. For the measurement model analysis, variables with factor loading of 0.500 and above were selected.

Since the Cronbach's Alpha scores for each category were around 0.8 to 0.99, the internal consistency of the variables was considered good or excellent.

Table 3.0

Exploratory Factor Analysis

Labelled item	Factor Loading			Cronbach's Alpha
	Management and lifestyle	**Economics**	**Social**	
MTVT-1.4 : Enjoy life and work on the cattle farms	**0.820**			
MTVT-1.5: Improve farms resource and land condition	**0.789**			
MTVT-1.8: Get satisfaction from living and working on the land and farms	**0.748**		0.111	
MTVT-1.7: Look after cattle as a job satisfaction	**0.741**			
MTVT-1.3: Safeguard the properties of farm assets	**0.715**			0.919
MTVT-1.2: Pass on cattle farms in good condition	**0.619**			
MTVT-1.9: Produce high-quality cattle	**0.609**			
MTVT-1.10: Cattle farming is one way to a healthy lifestyle and routine	**0.593**			
MTVT-1.6: Protect the cattle farms from risky environment	**0.592**	0.151		
MTVT-1.1: Look after the cattle farms as assets of the property	**0.560**	-0.111		
MTVT-3.9: Control the local beef supplies to the food businesses		**0.916**		
MTVT-3.10: To reduce the beef importation monopoly in market		**0.815**		
MTVT-3.6: Be among the best in the industry	0.127	**0.722**		0.869
MTVT-3.7: Run a profitable business		**0.688**		
MTVT-3.5: Build up land, wealth and assets	-0.112	**0.547**	0.146	
MTVT-3.3: Maximise cattle production from owned land		**0.533**		

MTVT-3.4: Avoid years with very little or negative income		**0.451**	0.169	
MTVT-3.1:To earn high income		**.293**		
MTVT-3.2: Maximize farm profit		**.459**		
MTVT-2.1: Raise family at the farms property			**0.810**	
MTVT-2.2: Life goal of retired in the farm house			**0.779**	
MTVT-2.7:Species availability for the local consumption		0.185	**0.741**	
MTVT-2.9:Provide free organic fertilizer (cattle waste product) to the community	0.127		**0.730**	0.935
MTVT-2.3: Ability to organize event and serve beef dishes to closest relatives and friends		-0.140	**0.724**	
MTVT-2.6:Ability to feed the needy during emergency		0.193	**0.672**	
MTVT-2.10:Produce beef to feed world population	0.115	0.215	**0.562**	
MTVT-2.4: To provide children with high education		-0.203	**0.545**	

Structural Equation Modelling by IBM® SPSS® Amos Software

Structural equation modelling (SEM) was imposed to find the interconnection of sustainability goals of producers in sustaining at the beef cattle industry. SEM was used to achieve the objective because it was the most frequent method employed in analysing theory of planned behaviour (Sok et al., 2021). Before conducting the SEM method, Exploratory Factor Analysis (EFA) was conducted in order to compress a group of items into a smaller set of combination factors with a minimum loss of information, and could be interpreted more easily and meaningfully which became the foundation for the SEM analysis.

Measurement Model

In this research, the questionnaire was adopted and adapted from Greiner (2015) research. The items suitable to implement in this research because it focuses on the motivation of farmer in accepting conservation contract, where conservation incentive will lead to sustainable livelihood (Karki, 2013). Therefore, the SEM procedure started from validating the measurement model with Confirmatory Factor Analysis (CFA). At this stage, CFA had the ability to assess the unidimensionality, validity, and reliability of the latent construct. These three pre-analysis and Normality Test were conducted so that items with a low factor loading could be deleted, identified the redundant item, evaluated the model fitness, and solved all the issues between the relationship item and latent.

Unidimesionality Test requirement was the item-deletion procedure for low factor loading item. Item deletion process was repeated until the fitness indexes achieved the required level; 0.5 for newly developed model and 0.6 for establish item (Zainudin, 2015).

Validity Test was required to measure the construction of latent. There were three type of validity namely convergent validity, construct validity and discriminant validity. The table explained requirement for the model fit cited by (Zainudin, 2015).

Table 4.0
Construct Validity Model Fitness Index

Name of category	Index full name	Name of index	Level of acceptance	Literature
Absolute fit	Discrepancy Chi Square	Chi-Square	P-value > 0.05 Not application for large sample size (>200)	Wheaton et al. (1977)
	Root Mean Square of Error Approximation	RMSEA	RMSEA<0.08	Browne and Cudeck (1993)
	Goodness of Fit Index	GFI	GFI > 0.90	Joreskog and Sorbom (1984)
Incremental fit	Adjusted Goodness of Fit	AGFI	AGFI > 0.90	Tanaka and Huba (1985)
	Comparative Fit Index	CFI	CFI > 0.90	Bentler (1990)
	Tucker-Lewis Index	TLI	TLI > 0.90	Bentler and Bonett (1980)
Parsimonious fit	Normed Fit Index	NFI	NFI > 0.90	Bollen (1989b)
	Chi Square/Degrees of Freedom	Chisq/df	Chi-Square/df < 3.0	Marsh and Hocevar (1985)

Source : (Awang, 2015)

Reliability Test was fulfilled by two requirements as follows
Table 5.0
Reliability Index

Average Variance Extracted (AVE):	The AVE values exceeding 0.50 indicate the reliability of the measurement model in measuring the construct.
Composite Reliability (CR) :	The Composite Reliability is achieved when all CR values exceed 0.60.

Normality Test was confirmed after fitness indexes were achieved. By using the finalised measurement model, test of normality and outlier was selected to assess the distribution for every variable in a dataset. The assessment focused on skewness for every item. The absolute value of skewness was 1.0 or lower, which indicated that the data were normally distributed. When the SEM used the Maximum Likelihood Estimator (MLE) like in Amos software, it was robust to skewness greater than 1.0 in absolute value if the sample size was large and the

Critical Region (CR) for the skewness did not exceed 8.0. Normally, the sample size of 200 or more was considered large enough in MLE even though the data distribution was slightly non-normal. Thus, the researcher proceeded into further analysis even though the value of skewness was up to 1.5. SEM, using Maximum Likelihood Estimator (MLE), was also robust to kurtosis violations of multivariate normality as long as the sample size was large and the Critical Region (CR) for the kurtosis did not exceed 7.0.

A few studies have been suggest the suitable measurement model variable for testing the farms and agricultural sustainability items. Rohaeni et al., (2014) suggest the quantity of cattle and quality of cattle are the indicators for sustainability of beef cattle farming but the model are not reliable since its AGFI and GFI are less than 0.9 (0.784 and 0.862). Maulidah et al (2021) have suggest the indicators (item) for the three endogenous variables in measuring beef cattle sustainability. For social indicators; role of farmer group,role of farmer group head,role of extension agents,role of husbandry office, and role of university academic staff. Economic indicators suggested are income, business feasibility and production. Environment indicators is manure processed. Indicators for the sustainability of beef cattle farming are social viable,economic viable,environment sound,low risk and productivity. The problem with this research is the researcher not providing the interconnection between the sustainability constructs (endogenous variables). Therefore, the item as in Table 4.0 is tested for measurement model of SEM analysis in this research.

Structural Model

Structural model was conducted after unidimensionality, validity, and reliability of all the constructs involved in the study were being reported. In the structural model, there were two stages of CFA; first order and second order. The steps in the first order of CFA was when the deletion of sub-constructs that did not fulfil the model fitness. For the second order, it was confirmed that the theorised construct in a study loaded into a certain number of underlying sub-constructs or components.

For the second stage, the estimation of causal effects was analysed from the main construct to all its sub-constructs. The objective here was to estimate the factor loading of main construct on its sub-constructs in order to confirm that the theorised second order construct loaded into the respective sub-constructs. As usual, the CFA procedure also estimated the factor loading for every item. The outputs of this analysis were the factor loading for every sub-construct, factor loading for items of the sub-constructs, and the correlation between constructs. All the pre-analysis and normality tests were repeated as in the measurement model stage. The important part in this stage was the regression path analysis whether it supported the theory applied for the research or not. For structural model, the framework of Sarkar et al (2021) applied as it is sufficient to answering the objective . The frameworks as follows:

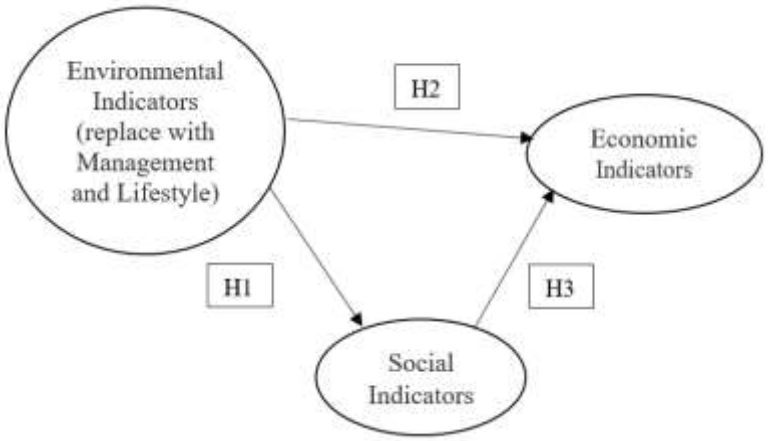

Figure 3.0 Conceptual Model of Indicators of Sustainable Agriculture
Source: Sarkar et al (2021)

where
H1: Management and Lifestyle and Social indicators are significantly interconnected for facilitating producers sustainable goals.
H2: Management and Lifestyle and Economic indicators are significantly interconnected for facilitating producers sustainable goals.
H3: Economic and Social indicators are significantly interconnected for facilitating producers sustainable goals.

Results and Discussions

Measurement Model

A measurement model demonstrates the relationship between the measuring items and their underlying latent construct. For this study, the measurement model had to be assessed for uni-dimensionality, validity, and reliability prior to modeling the structural model.

Unidimensionality Test

Unidimensionality was achieved since all the measuring items had acceptable factor loadings for the respective latent constructs. To ensure the unidimensionality of a measurement model, any item with a low factor loading is deleted.

Table 6.0
Measurement Model: Unidimensionality Test

Respond Items	Factor Loading
MTVT -1.3	0.70
MTVT-1.4	0.83
MTVT-1.5	0.77
MTVT-1.6	0.72
MTVT-1.8	0.81
MTVT-1.10	0.68
MTVT-2.2	0.81
MTVT-2.3	0.70
MTVT-2.6	0.73
MTVT-2.7	0.85

MTVT-2.9	0.74
MTVT-2.10	0.79
MTVT-3.2	0.72
MTVT-3.5	0.73
MTVT-3.6	0.84
MTVT-3.7	0.75
MTVT-3.10	0.80

The deleted items in this analysis were response items with factor loading scores below 0.6. The consideration to delete the items with low factor loading was based on the suggestion that the established items should have a factor loading of 0.6 or more. All the response items listed in Table 6.0 have factor loading weights greater than 0.6.

Validity Test

Three types of validity are required for a measurement model and each validity test can be fulfilled through convergent validity, construct validity, and discriminant validity.

Convergent Validity by Average Variance Extract (AVE)

AVE tests are important for justifying the reliability of the latent constructs used in a model.

Table 7.0

Measurement Model: Convergent Validity by AVE

Latent construct	Average Variance Extracted	Composite Reliability
Management and Lifestyle	0.568	0.887
Social Motives	0.596	0.898
Economic Motives	0.592	0.878

The AVE verified the convergent validity for every construct. An AVE value should be 0.5 or higher. Therefore, the latent constructs in this measurement model were convergent validated.

Construct Validity-Fitness Index

This form of validity is achieved when the Fitness Indices for a construct achieve the required level. Each of the Fitness Indices is reported below

Table 8.0
Measurement Model: Construct Validity of Fitness Index

Name of category	Name of index	Index	Level of acceptance
Absolute fit	Chi-Square	0.000	Not applicable since sample size more than 200
	RMSEA	0.058	RMSEA <0.08 ; Required index is accepted
	GFI	0.920	GFI > 0.90; Required index is accepted
	AGFI	0.895	AGFI > 0.90; Required index is not accepted
Incremental fit	CFI	0.961	CFI > 0.90; Required index is accepted
	TLI	0.955	TLI > 0.90; Required index is accepted
	NFI	0.929	NFI > 0.90; Required index is accepted
Parsimonious fit	Chisq/df	2.117	Chisq/df < 3.0; Required index is accepted

As Table 8.0 shows, the AGFI index did not fulfill the requirement. Therefore, adjustments had to be made in the next step.

Discriminant Validity by Modification Index (MI)
This form of validity indicates the measurement model of a construct is free from redundant items. AMOS identified the item redundancy in the model through a discrepancy measure called Modification Indices (MI). An item is deemed redundant if the MI is greater than 15.

Table 9.0
Measurement Model: Modification Indices for Covariance; Indication of Redundancies

			M.I.	Par Change
E12	<-->	social	4.451	-.031
E17	<-->	social	4.167	.026
E17	<-->	E12	6.717	.037
E15	<-->	social	4.894	-.024
E15	<-->	E16	5.844	.022
E14	<-->	E17	9.820	-.037
E14	<-->	E15	5.304	.023
E13	<-->	E17	8.843	.036
E13	<-->	E16	4.105	-.021
E13	<-->	E15	4.497	-.022
E11	<-->	eco	9.276	-.037
E11	<-->	E16	5.038	-.032
E8	<-->	E12	5.208	-.039
E8	<-->	E17	9.264	-.045
E8	<-->	E14	10.275	.046
E7	<-->	E9	5.138	-.036
E7	<-->	E8	11.934	.057
E6	<-->	eco	4.398	.017
E6	<-->	E13	5.623	.026
E6	<-->	E8	4.283	.027

E5	<-->	E12	5.052	.031
E5	<-->	E6	7.450	.028
E4	<-->	E16	6.343	.023
E4	<-->	E15	5.497	-.021
E4	<-->	E14	5.328	.023
E4	<-->	E11	5.200	-.031
E3	<-->	E14	4.827	-.024
E2	<-->	eco	4.224	-.016
E2	<-->	E16	4.592	-.020
E1	<-->	E5	8.397	-.031
E1	<-->	E3	4.404	.022
E1	<-->	E2	6.475	.025

As Table 9.0 shows, the MI showed no redundancies among the items in the measurement model.

Another requirement when checking for discriminant validity is that the correlation between exogenous constructs should not exceed 0.85. A value exceeding 0.85 indicates two exogenous constructs are redundant and a serious multicollinearity problem. The correlation of the exogenous constructs was simplified and is reported in Table 10.0 as follows:

Table 10.0

Measurement Model: Correlation Between Latent Construct

LATENT CONSTRUCT	CORRELATION
Management and Lifestyle ⟷ Social	0.73
Management and Lifestyle ⟷ Economic	0.71
Social ⟷ Economics	0.72

Based on the latent construct correlations, there were no serious multicollinearity problems as the correlations recorded were below 0.85. Therefore, the latent constructs were deemed valid for proceeding to the next stage.

Reliability Test

The reliability test is an important assessment of a measurement model and is required prior to modeling the structural model. The two requirements of a reliability test are the Average Variance Extracted (AVE) and Composite Reliability (CR) tests. AVE values exceeding 0.50 and CR values exceeding 0.60 are considered to have met the test requirements.

Table 11.0
Measurement Model: Reliability Test

Construct	Respond Items	Factor Loading	Composite Reliability (CR) (Minimum 0.6)	Average Variance Extracted (AVE) (Minimum 0.5)
Management and Lifestyle	MTVT -1.3	0.70	0.887	0.568
	MTVT-1.4	0.83		
	MTVT-1.5	0.77		
	MTVT-1.6	0.72		
	MTVT-1.8	0.81		
	MTVT-1.10	0.68		
Social	MTVT-2.2	0.81	0.898	0.596
	MTVT-2.3	0.70		
	MTVT-2.6	0.73		
	MTVT-2.7	0.85		
	MTVT-2.9	0.74		
	MTVT-2.10	0.79		
Economics	MTVT-3.2	0.72	0.878	0.592
	MTVT-3.5	0.73		
	MTVT-3.6	0.84		
	MTVT-3.7	0.75		
	MTVT-3.10	0.80		

Table 11.0 shows that the AVE values exceed 0.50, indicating the reliability of the measurement model in measuring the construct. Composite Reliability was achieved since all the CR values exceed 0.60 (Awang, 2015).

Table 12.0
Measurement Model: Discriminant Validity Index Summary of the Constructs

Construct	**Management and Lifestyle**	**Social**	**Economics**
Management and Lifestyle	**0.754**		
Social	0.73	**0.772**	
Economics	0.71	0.72	**0.769**

Table 12.0 shows the diagonal values (in bold) is the square root of AVE of the construct while other values are the correlation between the respective constructs. The discriminant validity for all constructs is achieved when a diagonal value (in bold) is the highest values in its row and column.

Normality Test

Table 13.0

Measurement Model: Assessment of Normality

Variable	min	max	skew	c.r.	kurtosis	c.r.
2.10 -Produce beef to feed world population.	2.000	5.000	-.881	-6.572	.080	.297
3.10- To reduce the beef importation monopoly in market.	1.000	5.000	-1.108	-8.270	1.588	5.924
3.7- Run a profitable business.	2.000	5.000	-.710	-5.300	.042	.157
3.6- Be among the best in the industry.	2.000	5.000	-.945	-7.051	.497	1.853
3.5- Build up land, wealth and assets.	2.000	5.000	-.880	-6.564	.405	1.511
3.2- Maximize farm profit.	2.000	5.000	-.721	-5.380	.156	.583
2.9- Provide free organic fertilizer (cattle waste product) to the community.	1.000	5.000	-.969	-7.233	.760	2.836
2.7- Species availability for the local usage.	1.000	5.000	-1.008	-7.524	.542	2.023
2.6- Ability to feed the needy during emergency.	1.000	5.000	-1.056	-7.880	1.014	3.782
2.3- Ability to organize event and treat beef dishes to closest relatives and friends.	1.000	5.000	-.932	-6.957	.963	3.592
2.2 -Life goal of retired in the farm house.	1.000	5.000	-.791	-5.901	.258	.964
1.8- Get satisfaction from living and working on the land and farms.	2.000	5.000	-.924	-6.896	.001	.004
1.6- Protect the cattle farms from risky environment.	3.000	5.000	-.603	-4.500	-.738	-2.754
1.5- Improve farms resource and land condition.	2.000	5.000	-.883	-6.584	.067	.250
1.4- Enjoy life and work on the cattle farms.	2.000	5.000	-.871	-6.497	-.040	-.149
1.3- Safeguard the properties of farm assets.	2.000	5.000	-.738	-5.505	.052	.192
Multivariate					92.703	35.296

The absolute value of skewness of 1.0 or lower indicates the data were normally distributed. However, SEM using a Maximum Likelihood Estimator (MLE) in Amos software is fairly robust for skewness greater than 1.0 in absolute value if the sample size is large and the Critical Region (CR) for the skewness does not exceed 8.0. Normally, a sample size of 200 or more is considered large enough in an MLE, even if the data distribution is slightly non-normal. Thus,

this study could proceed with further analysis even though the value of skewness was up to 1.5.

Another normality assessment method is to utilize the multivariate kurtosis statistic. However, SEM using a Maximum Likelihood Estimator (MLE) is also robust in finding kurtosis violations of multivariate normality as long as the sample size is large and the Critical Region (CR) for the kurtosis does not exceed 7.0 (Awang, 2015).

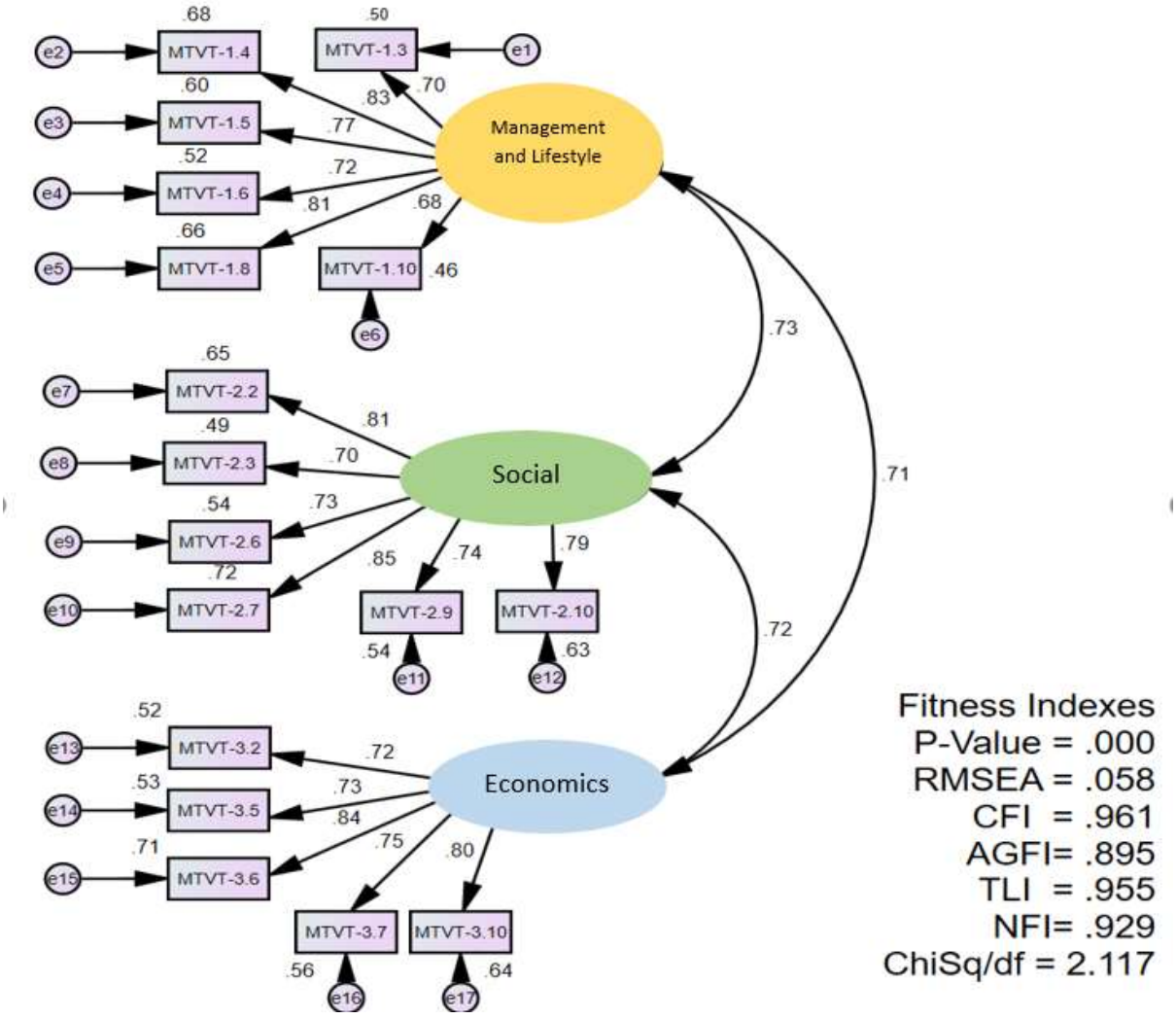

Figure 4.0 Measurement Model

Figure 4.0 shows the full image of the CFA used for the measurement model development. The tests refined the validity of the variables in the model. The measurement model is overall fit based on the fitness indexes. AGFI is not achieved the minimum score fitness ; more than 0.900. The remedy of this model is to withdrawn the low factor loading item as it will increased the AGFI score and fit the model . Based on the figure above, the item label MTVT-1.10 is the lowest factor loading indicator. Action taken for proceed to the next step; structural modelling.

Structural Model

Any structural model needs an assessment of the significance of the path analysis. A diagram output records the results and answers the research hypotheses. The residual term is required for every endogenous construct. The assembly of the constructs into the structural

model for path analysis is presented in Table 14.0 . The test of Uni-Dimensionality, Validity Test, Construct Validity –Fitness Index are repeated and result recorded as below:

Uni-Dimensionality Test

Table 14.0

Structural Model: Unidimensionality Test

Respond Items	**Factor Loading**
MTVT -1.3	0.71
MTVT-1.4	0.84
MTVT-1.5	0.79
MTVT-1.6	0.72
MTVT-1.8	0.80
MTVT-1.10	**Item deleted**
MTVT-2.2	0.81
MTVT-2.3	0.70
MTVT-2.6	0.73
MTVT-2.7	0.85
MTVT-2.9	0.74
MTVT-2.10	0.79
MTVT-3.2	0.72
MTVT-3.5	0.73
MTVT-3.6	0.84
MTVT-3.7	0.75
MTVT-3.10	0.80

The structural model was adjusted by deleting the response item with the lowest factor loading to modify the AGFI reading. All the response items listed in Table 14.0 have a factor loading weight greater than 0.6.

Validity Test

Latent construct	Average Variance Extracted	Composite Reliability
Management and Lifestyle	0.589	0.881
Social Motives	0.596	0.898
Economic Motives	0.592	0.878

The convergent validity was verified by AVE for every construct. The AVE value should be 0.5 or higher. Therefore, the latent constructs in this measurement model were convergent validated.

Construct Validity-Fitness Index

This form of validity is achieved when the Fitness Indices for a construct achieve the required level. The Fitness Indices are reported below.

Table 15.0
Structural Model: Construct Validity of Fitness Index

Name of category	Name of index	Index	Level of acceptance
Absolute fit	Chi-Square	0.000	Not applicable since sample size more than 200
	RMSEA	0.059	RMSEA <0.08 ; Required index is accepted
	GFI	0.925	GFI > 0.90; Required index is accepted
	AGFI	0.900	AGFI > 0.90; Required index is accepted
Incremental fit	CFI	0.964	CFI > 0.90; Required index is accepted
	TLI	0.957	TLI > 0.90; Required index is accepted
	NFI	0.934	NFI > 0.90; Required index is accepted
Parsimonious fit	Chisq/df	2.123	Chisq/df < 3.0; Required index is accepted

Table 15.0 shows the validity of the structural model. All the indexes passed the minimum requirement value and the model construct was valid. Since the fitness indices meet all the criteria, the model was valid for hypothesis testing.

First and Second Order of Confirmatory Factor Analysis (CFA)

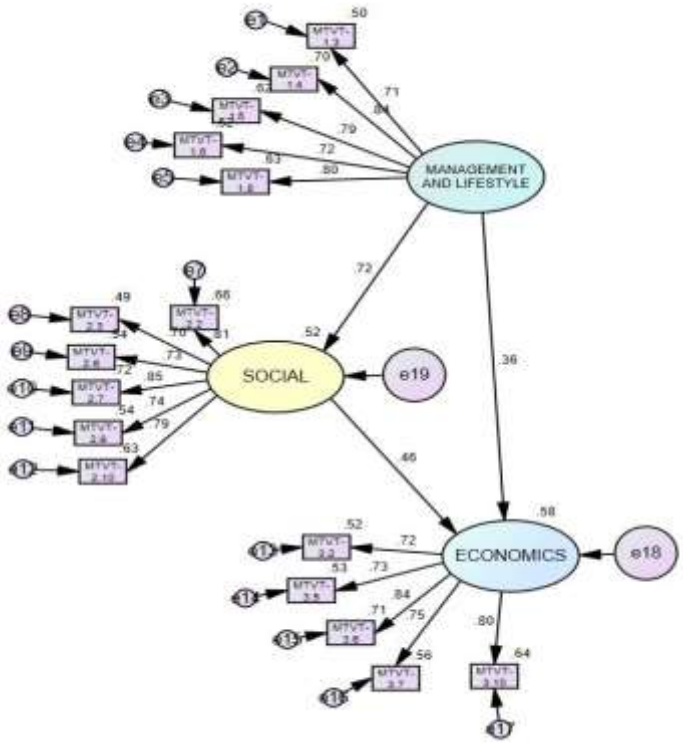

Figure 5.0. Structural Model of Sustainability Goals of Beef Cattle Producer

Figure 5.0 shows the full diagram path of the structural model used to analyze the sustainability goals of the beef cattle producers in Peninsular Malaysia. In short, the model

was considered fit and reliable, based on the output. The detail of each test is clarified in the next section.

Testing Hypothesis

The structural model provides a regression analysis of the variables involved in the hypothesis testing. The main hypothesis of this research objective is as follows:

H1: Management and Lifestyle and Social indicators are significantly interconnected for facilitating producers sustainable goals.

H2: Management and Lifestyle and Economic indicators are significantly interconnected for facilitating producers sustainable goals.

H3: Economic and Social indicators are significantly interconnected for facilitating producers sustainable goals.

The results for the hypothesis testing of each factor are recorded in Table 16.0.

Table 16.0

Structural Model: Regression Path Coefficient and its Significant

Component	Path	Construct	R^2	Estimate	S.E.	C.R.	P
Social	←	Management and Lifestyle	.723	1.171	.109	10.714	***
Economics	←	Management and Lifestyle	.363	.401	.085	4.735	***
Economics	←	Social	.460	.314	.053	5.979	***
Safeguard the properties of farm assets	←	Management and Lifestyle	.708	1.000			
Enjoy life and work on the cattle farms	←	Management and Lifestyle	.837	1.307	.092	14.155	***
Improve farms resource and land condition	←	Management and Lifestyle	.786	1.193	.089	13.360	***
Protect the cattle farms from risky environment	←	Management and Lifestyle	.723	.956	.077	12.339	***
Get satisfaction from living and working on the land and farms	←	Management and Lifestyle	.795	1.331	.098	13.515	***
Life goal of retired in the farm house	←	Social	.809	1.000			
Ability to organized community event and feed the closest relatives and friends.	←	Social	.698	.789	.058	13.703	***

Have the ability to do ad hoc welfare	←	Social	.735	.846	.058	14.629	***
Species availability for local usage	←	Social	.848	1.074	.061	17.723	***
Provide free organic fertilizer (cattle waste product) to community	←	Social	.737	.965	.066	14.685	***
Produce beef to feed population	←	Social	.791	.988	.061	16.121	***
Maximise farm profit	←	Economics	.721	1.000			
Build up land, wealth and assets.	←	Economics	.729	1.000	.079	12.678	***
Be among the best in the industry	←	Economics	.843	1.220	.084	14.597	***
Run a profitable business	←	Economics	.746	.936	.072	12.962	***
To reduce the beef importation monopoly in market	←	Economics	.803	1.250	.090	13.938	***

Table 16.0 shows the hypothesis is supported by the regression analysis as all three components - management and lifestyle goals, social goals, and economic goals - were found to have a significant and interconnection for facilitating the sustainability goals of beef cattle producers in Peninsular Malaysia. When the indicators appear strongly associated and interrelated with each other, they consider reflective, and the precision, as well as the relevance of those indicators, must be carefully assessed (Haenlein and Kaplan, 2004; Hair et al., 2012). The strongest interconnection is between management and lifestyle construct with social goals. This work has proven the importance of social aspect in upholding the sustainable agenda of food policy of the country. The strongest component in social construct is species availability for local usage. It is undenied facts as the beef cattle producers are willing to sustain in industry due to the social obligation and food security responsibility to the local consumers.

Social obligation amongst Muslim in Malaysia is one of the crucial part that need the present of the live beef cattle in Malaysia. The availability of beef cattle would help Muslim from the Halal status fraud when there were local slaughter men that in-charge of this social responsibility (Riza et al., 2022).

The interconnection between three pillar of sustainability goals shows the structured framework established a statistically viable and significant interaction that has also been found among all the indicators. Moreover, the frameworks shows the beef cattle producers main concern in Malaysia is social aspect, which most of them bound with the religion responsibility; halal status and live cattle for Edul-adha celebration. This objective have quantifying both theoretical and empirical validation. As the framework and hypothesis have

been tested according to the real-time estimation, it could be helpful for both the producers and concerned authorities to understand the extent of those indicators.

The most important component in management and lifestyle construct is enjoyment of the producers to having life and works in cattle farms. This element shows most of the producers in Malaysia are volunteering to do the beef cattle farming, that why they can sustain in this challenging industry. For the economics construct, being the best in the industry is the most important element for producers and beef cattle entrepreneur.

Conclusion

All the three pillar of sustainability are interconnected to each other. Interconnection of sustainability goals helps beef cattle industry in many ways. One of it is to framework the guideline for producer in order to achieve the successful beef cattle farming. The structural model can become the framework for training the young producers where we know the nature of producer through the framework. Prime finding shows the interconnection between social with management and lifestyle proves that beef cattle farmers in Malaysia are very responsible on the requirement of local people above economics purpose. This is important knowledge to create a competitive producer. In the high concentrated market, competitiveness of producer will encourage more productivity in operating the beef cattle farms starting from small scale to commercial size since beef cattle industry in Malaysia are "alive" because of responsibility of producers in providing the local with fresh beef rather than economic motives alone.

The sustainability goals appear to be dominated by social responsibility, advancing the entrepreneurial skills of beef cattle producers must focus more on younger producers. Smallholders need to be coached on how to conduct a beef cattle farming business from a small herd until they progress to a commercial-sized farm.

The authorities should be appreciated of the social responsibility shown by the smallholders by providing them with more networking opportunities and protecting them from the cartel pricing that might be practiced by commercial farms and established associations. The market rivalry between commercial and smallholder farms should be studied for the betterment of consumers and producers.

Acknowledgments

I would like to thank to my doctoral study supervisor; Dr Hanny Zurina binti Hamzah for guiding the research gracefully. This research also supported by IPS grant from Universiti Putra Malaysia. Many thanks to my advisor committee; Prof Dr Anjas Asmara bin Samsudin and Prof Dr Shaufique Fahmi bin Ahmad Sidique.

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