Research Article

Veterinary Extension Services in the Integration Program of Cattle Farming and Oil Palm in Target Area Concentration (TAC)

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Abstract | Malaysia's huge ruminant sector drives expansion and livestock self-sufficiency. However, Malaysia struggles to increase meat production to meet rising demand and reduce import dependence. Malaysia has 22.2% self-sufficiency, 5.6kg large ruminant meat consumption per capita, and 78.1% import dependency. Other obstacles include a lack of development, awareness, labour, technology, livestock farm facilities, and incompatibility of some cattle breeds. The study analysed cattle breeders' expectations of veterinary extension services under the Department of Veterinary Services (DVS) Target Area Concentration (TAC) livestock integration program. A cross-sectional study used a self-administered questionnaire, and 200 program breeders responded. Data collected was analysed using the SPSS software version 23.0. The survey found that respondents have positive views and high expectations of veterinary extension services, officers, and the DVS. The respondents agreed that veterinary extension is critical in cattle farming because farmers cannot increase their cattle production without assistance from the DVS. The study recommended that DVS focus more on cattle breeding integration by providing the latest information and knowledge, funds, regulating drug prices, regularly visiting farmers' ranches, and identifying farmers' needs and expectations as a roadmap for developing this sector to make it more appealing to join and a viable investment venture.

Introduction

The livestock industry in Malaysia plays a vital role in the agricultural sector, offering employment opportunities and meeting the protein needs of the population (Abdullah *et al.*, 2021).

The agricultural integration system is a system that combines conventional animal husbandry, aquaculture, horticulture, agro-industry and all agricultural activities (Rahawarin *et al.*, 2020). It has gained popularity in developing nations like Indonesia (Silalahi *et al.*, 2018; Utomo and Widjaja,

2020; Yuhendra *et al.*, 2022) and Malaysia (Ahmad *et al.*, 2018), as well as developed nations such as Australia (Bell *et al.*, 2014) due to its environmental efficiency. Integrating livestock with permanent crops can sustainably enhance land productivity. Besides the direct benefits of animal products (meat, milk, fur, skin and face), this integration provides weed control advantages, reducing reliance on chemical pesticides and promoting biological weed control techniques. Numerous studies indicate increased yields in the main crop due to improved weed control and nutrient recycling or availability of good soil nutrients (Ahmad *et al.*, 2018; Bell *et al.*, 2014; Mosnier *et al.*, 2022). When implemented effectively, livestock production within this system can serve as a primary income source for farmers and enhance overall productivity.

Thorough implementation of integration with permanent crops is crucial, focusing on prioritising the permanent crops as the central component. Factors such as soil, nutrients, water, and light, along with other biological aspects, should be carefully considered to ensure optimal productivity (Craine and Dybzinski, 2013) and profitability in a sustainable and environmentally friendly manner (Gavrilescu, 2021; Tahat *et al.*, 2020). However, it is important to address potential challenges, such as the possibility of livestock causing damage to young trees or the bark of mature trees in the integration system (Grinnell *et al.*, 2022; Mohd Nasir, 2020).

In 2020, Malaysia accounted for 25.8% and 34.3% of the palm oil produced and exported globally (MPOC, 2023), while the total area planted with oil palm is estimated to be 5.74 million hectares in the year 2021 (MPOB, 2021). In this context, limited land would be available for beef production, prompting the government to prioritise integrating cattle farming with oil palm planting. Factors such as topography suitability and the replanting process are considered when selecting suitable farmland. Since 1997, the Malaysian government has encouraged farmers to implement integrated farming (Ahmad and Nasir, 2020). In 1998, it was reported that 1.2 million hectares of oil palm estate in Malaysia were suitable for beef farming, but the responses were not overwhelming (Ahmad and Nasir, 2020; Ibragimov *et al.*, 2019). Nevertheless, the two government-linked companies, FELDA and RISDA, were willing to integrate cattle into their plantation. This integration system received an encouraging response from the estate owners in Terengganu in 1999 (Ahmad and Nasir, 2020). It was also an effort made by DVS to prevent cattle from wandering about on the roadside and promote systematic cattle management (Ahmad and Nasir, 2020; Paterson and Lima, 2018; Suzuki *et al.*, 2017).

The progress has attracted the interest of government research agencies and universities, who have conducted research in various aspects, including the economy, the impact of palm oil production, and soil ecology. To facilitate this integration, the Department of Veterinary Services (DVS) has allocated approximately 1.44 million hectares, which accounts for 40% of the total oil palm plantation area (Muhamad and Man, 2014). An integrated cattle and oil palm system is promoted to increase local beef production to boost Malaysian local beef's self-sufficiency level (SLF) (Mohd-Nasir, 2020). However, the specific duties and roles of the DVS in developing the integration system of animal husbandry in oil palm plantations have not been widely implemented yet. The slow growth of the cattle industry can be attributed to rapid industrial development, competition from beef imports, insufficient investment, and high disease risk. Consequently, Malaysia's beef production rate is decreasing, leaving the current demand inadequately met (Ahmad *et al.*, 2018; Zayadi, 2021).

Recently, the government has prioritised the transition of small and medium breeders into commercial status through breeder development programs led by the DVS. One such effort is the integration program of cattle with oil palm and rubber cropping under the Target Area Concentration (TAC) initiative (Muhamad and Man, 2014). TAC aims to enhance traditional farm management practices to increase productivity and competitiveness. As part of this initiative, the ruminant livestock integration project with permanent crops (rubber or oil palm), known as Projek Integrasi Ternakan Ruminan dengan tanaman kekal (getah atau kelapa sawit) or PINTAR, has been developed and introduced. This project involves the implementation of a systematic farm management system and the use of electric fence technology. This integration system optimises the grazing fields by utilising low inputs and a suitable number of cattle for grazing. Effective farm management, production systems, animal feeding and nutrition, farming and housing systems, and value-added processing are key elements for the development of large ruminant

farming (Balehegn *et al.*, 2020; Bremer *et al.*, 2022). Employing sound management methods that encompass adequate nutrition, disease prevention and management, and breeding techniques can significantly enhance the productivity of large ruminants.

In order to maximise livestock production in Malaysia, optimising the utilisation of farmland is crucial. One effective approach is integrating ruminant rearing with the cultivation of main permanent crops such as oil palm and rubber plantations. Among these, oil palm plantations prove to be a more suitable option for cattle farming due to several compelling advantages. Integrating livestock with oil palm offers numerous benefits, as compared to rubber trees, including: (1) Reducing the weeding costs by 50%. Therefore the chemical herbicides which are commonly applied every 30 days be extended to 70-90 days; (2) nourishing the oil palm plantations and boost fruit yield due to lack of competition between grasses and palm trees; (3) increase farmers' revenue from selling livestock; (4) cattle grazing in the weed-infested space between the oil palm rows can completely remove weeds, thereby increasing the productivity of the crop; (5) small capital inputs are needed for clearing, planting and fertilising grass pasture; and (6) improving energy efficiency among settlers (Muhamad and Man, 2014).

However, integrating livestock into oil palm plantations with careful planning is crucial. This is because introducing cattle to oil palm plantations less than two years after planting could become due to potential damage to palm fronds caused by grazing. Nevertheless, any damage caused by cattle grazing would not affect the production if the crop plants were more than two (2) years old because cattle could be equated to pruning mature oil palm fronds. Meanwhile, cattle are generally introduced into oil palm fields when the plants have reached maturity to prevent uncontrolled grazing. Integration of livestock during the oil palm replanting phase is recommended to ensure sustainable livestock production and increase production. Consequently, this also helps provide adequate food resources to support the livestock population. In Malaysia, livestock and oil palm crop systems have been integrated since the late 1980s as it is a technique of increasing income from farming and palm oil production, while optimising resource use (Grinnell *et al.*, 2022).

Role of veterinary extension services

In agriculture, the role of extension is to increase the farm production besides improving the living standards of farmers. Therefore, veterinary extension services are important for the development of animal husbandry around the world. In Malaysia, the Department of Veterinary Services (DVS) is the government body responsible for all matters related to the livestock industry. The eight (8) functions of DVS (empowered under Animal ACT 1953) are as follows (DVS, n.d.):

- Control, prevent and eradicate animal and zoonotic diseases.
- Production of livestock, livestock produce and animal feed.
- Inspection of meat, milk, eggs, animal feed, abattoirs, and veterinary product processing plant.
- Control of import and export of livestock, animal produce and quarantine services.
- Training for the livestock and domestic animal industries.
- Expand livestock production and animal health as well as general veterinary health.
- Research on animal diseases and animal genetic sources
- Control of animal's welfare and conservation of animal's genetic materials.

Now, the government's focus is to transform small and medium farmers through the farmer development in program DVS to commercial status. Various efforts have been undertaken to improve the beef cattle industry, such as The National Feedlot Program (PFN) in Gemas, Negeri Sembilan, and Integration projects cattle in oil palm and rubber under Target Area Concentration (TAC).

By introducing the Transformation of Livestock Entrepreneur (TRUST) scheme, the Target Area Concentrate (TAC) program transforms traditional operators into more productive and competitive farmers to improve the national meat production level. The main purpose of TAC is to stimulate the country's meat production more economical and viable through the use of existing resources, oil palm and rubber plantations (Zamri-Saad and Azhar, 2015). Under TAC, there are many programs and activities are implemented such as:

- Planning the strategy and implement the development program of ruminants with management permanent crop plantation crops.

- Organising and coordinating the activities of ruminant livestock in the farming areas of government and private agencies.
- Promoting and providing expertise (technical and advisory services through the development of veterinary medicine), particularly in the Planned and Scheduled Visit (LTJ) system
- Providing resource officers and consultants to the parties involved to provide information and guidance on commercial broiler projects (Muhamad and Man, 2014).

Through TAC, farmers are benefited from improved animal health, reduced losses due to diseases, and the adoption of new technologies for enhanced productivity. Meanwhile, TAC also empowered in adopting improved practices, resolve farm issues, enabling in handling hygiene, nutrition, breeding and animal care.

Problem statement and objectives
The livestock industry in Southeast Asia is evolving towards commercialization, transitioning from small breeders to large-scale operations. This trend is attributable to an increase in sources of income and cattle. In Malaysia, large ruminant production is no exception, especially in meat production. Despite the challenges like insufficient production and rising demand, the large ruminant production continues to expand rapidly. As a result, the expansion has created opportunities for farmers to leverage existing production systems and integrate cattle breeding with permanent crops on their fields to generate sustainable income. However, it is critical to highlight and address the challenges faced by the farmers to ensure the successful development of large ruminant farming. Those challenges encompass farm management, low initial costs of agricultural projects, lack of labour incentives, land scarcity, zoning and farm locations, diseases, limited knowledge and information, breed incompatibility, limited access to financial support, the role of DVS roles, breeders' mentality, government subsidies, livestock markets and prices, livestock feed management and cooperation from the private sector. Therefore, addressing these issues is critical to ensure the sustainability of livestock farm management since they could significantly impact beef production and, to a certain extent, the national economy. This might hinder the potential growth of the livestock sector and overall development if the ruminant industry remains small-scale and not commercialised.

The responsibility to promote small-scale farmers and assist them in the transition to commercial status while increasing production lies with the DVS, especially through its livestock extension services. The objectives of this study are: (1) to determine the respondents' perceptions of veterinary extension services in the TAC program; and (2) to evaluate the respondents' expectations of veterinary extension services in the TAC program.

Materials and Methods

This study collaborates with the Faculty of Agriculture, UPM and the Department of Veterinary Services (DVS). Based on the highest number of farmers in those states, the study was conducted in Perak, Johor, Negeri Sembilan, and Pahang. Through the name list provided by the state DVS, 200 breeders were selected among the TAC Program participants as the respondents in this study. Fifty (50) respondents were drawn randomly from the sampling frame provided by DVS authorities from each state. Data was collected via field survey using a questionnaire. The structural design is a questionnaire containing breeder profiles, expectations, and perceptions of veterinary extension services. Data obtained were subjected to descriptive analysis using the Statistical Package for Social Sciences (SPSS) software version 23.0.

Results and Discussion

This section will discuss the research findings, including respondents' socio-demographic profiles, respondents' perception of veterinary extension services, respondents' expectations of the Department of Veterinary Services (DVS), respondents' expectations of the services provided by Veterinary Extension Officers, and respondents' expectations towards the role and policy of the Department of Veterinary Services (DVS) in large ruminant farming.

Respondents' socio-demographic profiles
Table 1 illustrates the socio-demographic profiles of the respondents. Most of the respondents were between 31 to 40 years old (28.0%), followed by 41 to 50 years old (22.0%), 51 to 60 years old (21.5%), 21 to 30 years old (13.5%), 61 to 70 years old (13.0%), less than or 20 years old (1.5%), and more than 71 years old (0.5%). This study also found that most of the respondents were male (96%), while female only 4%. This indicated that middle-aged male is mostly

involved in handling large ruminant farming. Many of the respondents (83.0%) were married, followed by single (15.0%) and widows (2.0%). Meanwhile, the results suggested that many of the respondents were Muslim (96.5%), followed by Indian respondents (3.5%). This could be due to Muslim in Malaysia will use large ruminants for the ritual, such as Qurban and Akikah due to halal feed concept. For educational status, most of them had completed secondary school (68.5%), followed by primary school (15.5%), higher education (13.5%), and no school (2.5%). Then, over half of the respondents have less than 2 members in family involved (50.5%), followed by 2 to 4 members (40.0%), 4 to 6 members (5.5%) and more than 6 members (4.0%). For years of experience acquired in large ruminant farming, most of the respondents have more than 15 years of experience (33.0%), followed by 5 to 10 years (30.5%), 10 to 15 years (19.0%), and less than 5 years (17.5%).

Respondents' perceptions of veterinary extension services (PPV)

Table 2 illustrates the respondents' perceptions of the vital role played by veterinary services in contributing to the success factors of large ruminant farming. The results revealed a notable mean score of 4.45, indicating strong agreement among many of the respondents regarding Veterinary extension officers are easily accessible for services when needed. Following closely behind were the statements Simple procedures of veterinary services help large ruminant projects (4.42) and Monitoring and control of drug prices is done by DVS (4.39), both of which garnered significant agreement from the respondents. In contrast, the statement pertains to Less bureaucracy

in dealing with veterinary extension services, received the lowest mean score of 4.19, with the majority of the respondents express disagreement with this notion.

Table 1: *Socio-demographic profiles of the respondents (n=200).*

Variables	Categories	Frequency	(%)
Age	≤20 years	3	1.5
	21-30 years	27	13.5
	31-40 years	56	28.0
	41-50 years	44	22.0
	51-60 years	43	21.5
	61-70 years	26	13.0
	≥71 years	1	0.5
Gender	Male	192	96.0
	Female	8	4.0
Religion	Muslim	193	96.5
	Indian	7	3.5
Marital status	Single	30	15.0
	Married	166	83.0
	Widow	4	2.0
Education qualification	Primary	31	15.5
	Secondary	137	68.5
	Higher education	27	13.5
	No school	5	2.5
Number of family involved	<2 members	101	50.5
	2-4 members	80	40.0
	4-6 members	11	5.5
	>6 members	8	4.0
Experiences	<5 years	35	17.5
	5-10 years	61	30.5
	10-15 years	38	19.0
	>15 years	66	33.0

Table 2: *Respondents' perceptions of veterinary extension services (n=200).*

Statement	Score					Mean	S.D.
	1	2	3	4	5		
Simple procedures of veterinary services help large ruminant projects	0 (0.0)	2 (1.0)	1 (0.5)	109 (54.5)	88 (44.0)	4.42	0.56
Veterinary extension officers are easily accessible for services when needed	0 (0.0)	1 (0.5)	1 (0.5)	106 (53.0)	92 (46.0)	4.45	0.54
Less bureaucracy in dealing with veterinary extension services	0 (0.0)	1 (0.5)	17 (8.5)	125 (62.5)	57 (28.5)	4.19	0.60
Cheap equipment and free advice assistance in project implementation	0 (0.0)	4 (2.0)	17 (8.5)	94 (47.0)	85 (42.5)	4.30	0.71
Veterinary extension officers have high expertise in the field of animal husbandry	0 (0.0)	0 (0.0)	6 (3.0)	116 (58.0)	78 (39.0)	4.36	0.54
DVS visit and treatment schedule is consistent	0 (0.0)	0 (0.0)	2 (1.0)	120 (60.0)	78 (39.0)	4.38	0.51
Monitoring and control of drug prices is done by DVS	0 (0.0)	2 (1.0)	7 (3.5)	102 (51.0)	89 (44.5)	4.39	0.61
Total average mean						4.36	

Score: *1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly agree.*
Note: *Figures in parentheses indicate percentages (%).*

Links Researchers

Ahmad *et al.* (2018) hold the same view of Muhamad and Man (2014), who also revealed that the TAC program has improved the integrating farming system of oil palm-cattle farming in Malaysia effectively. Abdullah *et al.* (2021) and Yuhendra *et al.* (2022) concluded that there are many factors that influence the decision of farmers to adopt oil palm-cattle integration and one of them is extension service. In this regard, the positive perception of the respondents to veterinary extension services could be attributed to the quality of extension services provided by the extension officers.

Table 3 shows the mean level of the respondents' perceptions toward veterinary extension services. Overall, the level of perception toward Veterinary services is high (4.35). This could be explained that the veterinary extension officers are highly trained,

knowledgeable and professional in providing the services to the ranches, which instil confidence in the respondents and contribute to a positive perception. Meanwhile, veterinary extension services that are easily accessible and responsive to the needs of the respondents also contribute to a positive perception as respondents would find easy communication with the extension services provider.

Table 3: *Mean level of the respondents perceptions toward veterinary extension services (n=200).*

Level	Frequency	Percentage (%)	Mean	Std. Deviation
High (3.67-5.0)	196	98.0	4.36	0.39
Moderate (2.34-3.66)	4	2.0		
Low (1-2.33)	0	0.0		
Total	200	100		

Table 4: *Respondents' expectations towards the department of veterinary services (DVS) (n=200).*

Expectation	Score					Mean	S.D.
	1	2	3	4	5		
DVS meets the needs of farmers	0 (0.0)	4 (2.0)	19 (9.5)	114 (70.5)	36 (18.0)	4.04	0.60
DVS helps raise breeders' interest	0 (0.0)	1 (0.5)	11 (5.5)	143 (71.5)	45 (22.5)	4.16	0.53
DVS helps increase farm income	0 (0.0)	2 (1.0)	21 (10.5)	141 (70.5)	36 (18.0)	4.06	0.57
DVS helps farmers maintain farm records	0 (0.0)	5 (2.5)	26 (13.0)	143 (71.5)	26 (13.0)	3.95	0.60
DVS helps farmers the proper way in managing large ruminant farming	0 (0.0)	1 (0.5)	8 (4.0)	155 (77.5)	36 (18.0)	4.13	0.47
DVS helps farmers the proper way in labour management	0 (0.0)	9 (4.5)	23 (11.5)	137 (68.5)	31 (15.5)	4.00	0.67
DVS provides new information on cattle prices	0 (0.0)	9 (4.5)	18 (9.0)	135 (67.5)	38 (19.0)	4.01	0.68
DVS provides information about specific government policies	0 (0.0)	4 (2.0)	22 (11.0)	134 (67.0)	40 (20.0)	4.05	0.62
DVS provides information about new livestock technology	0 (0.0)	5 (2.5)	16 (8.0)	139 (69.5)	40 (20.0)	4.07	0.61
DVS helps farmers build networks with other farmers	0 (0.0)	6 (3.0)	12 (6.0)	137 (68.5)	45 (22.5)	4.10	0.63
DVS helps farmers make decisions related to livestock	0 (0.0)	4 (2.0)	15 (7.5)	141 (70.5)	40 (20.0)	4.09	0.59
DVS increases the level of knowledge in information technology	1 (0.5)	21 (10.5)	30 (15.0)	109 (54.5)	39 (19.5)	3.82	0.88
DVS provides information about the training program	2 (1.0)	13 (6.5)	22 (11.0)	129 (64.5)	34 (17.0)	3.90	0.79
DVS provides up-to-date information on input prices	0 (0.0)	9 (4.5)	32 (16.0)	131 (65.5)	28 (14.0)	3.89	0.69
DVS informs livestock policy	0 (0.0)	1 (0.5)	16 (8.0)	140 (70.0)	43 (21.5)	4.12	0.55
DVS helps breeders in reducing the risk of new cattle breeds	0 (0.0)	1 (0.5)	22 (11.0)	136 (68.0)	42 (20.5)	4.09	0.58
DVS helps in the marketing of cattle products	0 (0.0)	11 (5.5)	31 (15.5)	127 (63.5)	31 (15.5)	3.86	0.72
DVS helps in agricultural technology transfer	0 (0.0)	10 (5.0)	17 (8.5)	144 (72.0)	29 (14.5)	3.96	0.66
DVS improves coordination with stakeholders in cattle	0 (0.0)	9 (4.5)	21 (10.5)	135 (67.5)	35 (17.5)	3.98	0.68
DVS helps in livestock chain	0 (0.0)	9 (4.5)	13 (6.5)	137 (68.5)	41 (20.5)	4.03	0.67
DVS helps in identifying dangerous diseases	0 (0.0)	1 (0.5)	4 (2.0)	123 (61.5)	72 (36.0)	4.33	0.54
DVS helps in sharing information with other breeders	0 (0.0)	1 (0.5)	10 (5.0)	138 (69.0)	51 (25.5)	4.19	0.54
DVS helps farmers who are in a critical state of livestock management	0 (0.0)	1 (0.5)	16 (8.0)	135 (67.5)	48 (24.0)	4.15	0.56
DVS provides a network between breeders	0 (0.0)	4 (2.0)	15 (7.5)	151 (75.5)	30 (15.0)	4.02	0.55
DVS builds self-confidence and breeders' spirit	0 (0.0)	0 (0.0)	9 (4.5)	144 (72.0)	47 (23.5)	4.20	0.50
DVS motivates young breeders	0 (0.0)	0 (0.0)	8 (4.0)	136 (68.0)	56 (28.0)	4.24	0.51
DVS facilitates new breeders on management techniques and reduces risk	0 (0.0)	0 (0.0)	8 (4.0)	137 (68.5)	55 (27.5)	4.23	0.52
DVS facilitates in water resource management	5 (2.5)	42 (21.0)	33 (16.5)	94 (47.0)	26 (13.0)	3.47	1.04
Total average mean						4.04	

Score: *1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly agree.* **Note:** *Figures in parentheses indicate percentage (%).*

Links
Researchers

Respondents' expectations towards the department of veterinary services (DVS)

Table 4 reveals the respondents expectations towards the Department of Veterinary Services (DVS) in safeguarding the triumph of large ruminant farming in Malaysia. Topping the list with a remarkable mean score of 4.33 is help breeders identify severe diseases, followed by DVS stimulates young breeders. (4.24), and DVS helps simplify management approaches and reduce risks for new breeders. (4.23). Notably, the expectation with the lowest mean score is DVS helps in the management of water resources. scoring 3.47 on average.

Animal diseases impose direct costs on the livestock sector in terms of animal mortality, reduced productivity and the cost of disease control. Meanwhile, animal diseases such as zoonoses are diseases that can be transmitted from animals to humans (World Organisation for Animal Health, 2023). Therefore, the expectations of the respondents regarding the management of serious animal diseases tend to be higher. Study by Wulandari (2021) concluded that there are three (3) strategies in a smallholder support system. This includes strengthening the farmer group, optimising production, and productivity, and developing market links to build their capabilities and resources to sustain the palm cattle integration. In this context, the present study shows that respondents would expect more in strategies to optimise production and productivity from the veterinary department.

Table 5 displays the mean level of the respondents' expectations towards the Department of Veterinary Services (DVS). Overall, the respondents had high expectation towards the DVS (4.04). The respondents held positive and optimistic views on the services and facilities offered by the veterinary services department. This could be attribute to the DVS plays an important role in the ranching industry in Malaysia. Many of the ranches would have depend on DVS for extension services to improve their production, besides ensuring the livestock health and welfare.

Table 5: *Mean Level of The Respondents' Expectations Towards the Department of Veterinary Services (DVS) (n=200).*

Level	Frequency	Percentage (%)	Mean	Std. deviation
High (3.67-5.0)	174	87.0	4.04	0.384
Moderate (2.34-3.66)	26	13.0		
Low (1-2.33)	0	0.0		
Total	200	100		

Respondents' expectations towards the services provided by veterinary extension officers

Table 6 presents a comprehensive overview of the respondents' expectations of the services provided by veterinary extension officers in the realm of large ruminant farming. The statement Giving information about the risk and management of diseases in cattle, stands out with the highest mean score of 4.32.

Table 6: *Respondents' perceived of expectation towards veterinary extension officers (n=200).*

Services	Score					Mean	S.D.
	1	2	3	4	5		
Help farmers in assessing risks in cattle farming	0 (0.0)	1 (0.5)	18 (9.0)	127 (63.5)	54 (27.0)	4.17	0.59
Improve the feedback mechanism for cattle extension services	0 (0.0)	0 (0.0)	19 (9.5)	136 (68.0)	45 (22.5)	4.13	0.55
Provide information on disease risk and management in cattle	0 (0.0)	0 (0.0)	6 (3.0)	125 (62.5)	69 (34.5)	4.32	0.53
Create awareness about the risks expected in cattle farming	0 (0.0)	0 (0.0)	13 (6.5)	122 (61.0)	65 (32.5)	4.26	0.57
Increase breeders' awareness of the basics of cattle breeding	0 (0.0)	0 (0.0)	14 (7.0)	128 (64.0)	58 (29.0)	4.22	0.56
Identify new breeds of cattle to reduce risk and reduce cattle diseases	0 (0.0)	3 (1.5)	8 (4.0)	123 (61.5)	66 (33.0)	4.27	0.60
Provide solutions to farmers for cattle risk management and managing disease outbreaks	0 (0.0)	0 (0.0)	5 (2.5)	131 (65.5)	64 (32.0)	4.30	0.51
Help farmers to understand new technologies in cattle breeding	0 (0.0)	4 (2.0)	20 (10.0)	132 (66.0)	44 (22.0)	4.08	0.63
Assist farmers in using new technology in cattle breeding to increase production	0 (0.0)	5 (2.5)	23 (11.5)	123 (61.5)	49 (24.5)	4.09	0.68
Provide information on good husbandry practices in cattle breeding and disease management to farmers	2 (1.0)	3 (1.5)	23 (11.5)	105 (52.5)	67 (33.5)	4.16	0.76
Total average mean						4.20	

Score: *1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly agree.* **Note:** *Figures in parentheses indicate percentages (%).*

Followed by Providing solutions for cattle risk management and managing disease outbreaks. (4.30), and Identifying a new breed of cattle to reduce the risk and reduce cattle disease (4.27). Conversely, the least expected service from the veterinary extension officer is help understand new technology in cattle breeding with the lowest mean score of 4.08.

Ayob and Hj Kabul (2009) suggested that integrating cattle into oil palm plantations is sustainable through systematic management. This practice not only could save the maintenance cost and labour requirement (Ayob and Hj Kabul, 2009), it also improve productivity and environment performance (Mosnier et al., 2022), promote nitrogen balance and improve profitability and variability of the farm (Bell et al., 2014). However, without proper skills in managing the integration system, especially among those with a lower educational background, it could lead to problems for the oil palm such as damage to crops, resulting in a loss for farmers. Therefore, livestock farmers would expect much from the extension agents to disseminate information to them in order to manage their farms systematically.

Table 7: *Mean level of the respondents' expectations towards the services provided by veterinary extension officers.*

Level	Frequency	Percentage (%)	Mean	Std. Deviation
High (3.67-5.0)	187	93.5	4.20	0.410
Moderate (2.34-3.66)	13	6.5		
Low (1-2.33)	0	0.0		
Total	200	100		

Table 7 shows the mean level of the respondents' expectations towards the services provided by veterinary extension officers. Overall, the respondents had high expectations towards the services provided by veterinary extension officers (4.20). This favourable opinion could be attribute respondents believe

the veterinary extension officers are likely trained professionals with specialised knowledge in animal health, husbandry and agricultural practices. They are competent in communicating with the ranchers to establish trustful relationship between ranchers. This reflects the significant impact of veterinary extension officers on the ranches' community.

Respondents expectations towards department of veterinary services (DVS) role and policy in large ruminant farming

Table 8 illustrates respondents expectations regarding the role and policy of the Department of Veterinary Services (DVS) in large ruminant farming. The table highlights four key roles and policies of DVS in relation to this domain. The highest mean score is 4.36 represents by the statement of DVS has played an important role in improving cattle breeding, followed by DVS always listens to the problems of cattle breeders, (4.35), DVS is always committed to cattle breeding in the area, (4.31), and DVS always helps to solve the problems of cattle farmers (4.29). In Africa, livestock production appears to be given low priority in agricultural extension interventions, therefore, extension activities for livestock are fewer as compared to crop production (Pousga et al., 2022). Currently, the self-sufficiency ratio (SSR) of livestock products in Malaysia over the past five years shows that the proportion of beef and mutton is below 30 %, which means Malaysia still needs to import animal products to meet demand (Zayadi, 2021). This could be attributed to many factors, one of which could be due to less attention being provided to increasing production in this sector. Therefore, the respondents roughly have positive expectations towards the role and policy of the DVS. While current policies related to the livestock industry in Malaysia are moving towards sustainable practices, agricultural extension officers need to equip themselves with sufficient knowledge and skills when transferring technology to the livestock farmers.

Table 8: *Respondents' expectations towards the role and policy of the department of veterinary services (DVS) (n=200).*

Roles and policies	Score					Mean	S.D.
	1	2	3	4	5		
DVS has played an important role in improving cattle breeding	0 (0.0)	2 (1.0)	3 (1.5)	117 (58.5)	78 (39.0)	4.36	0.57
DVS is always committed to cattle breeding in the area	0 (0.0)	0 (0.0)	13 (6.5)	113 (56.5)	74 (37.0)	4.31	0.60
DVS always listens to the problems of cattle farmers	1 (0.5)	0 (0.0)	0 (0.0)	127 (63.5)	72 (36.0)	4.35	0.55
DVS always helps solve the problems of cattle farmers	1 (0.5)	1 (0.5)	7 (3.5)	127 (60.5)	70 (35.0)	4.30	0.62
Total average mean						4.32	

Score: *1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly agree.* **Note:** *Figures in parentheses indicate percentages (%).*

Table 9 showed the mean level of respondents' expectations towards the role and policy of the Department of Veterinary Services (DVS). Overall, the respondents had high expectations towards the role and policy of the DVS (4.32). The respondents had positive and favourable opinion towards the role and policy of the DVS reflecting that they expect the important role and policy of DVS in ensuring the well-being of animals and the success of agricultural operations. The respondents are likely to view DVS as valuable partner in achieving their goals for animal health, productivity and sustainable farming practices.

Table 9: *Mean level of respondents' expectations towards the role and policy of the department of veterinary services (DVS) (n=200).*

Level	Frequency	Percentage (%)	Mean	Std. Deviation
High (3.67-5.0)	190	95.0	4.32	0.472
Moderate (2.34-3.66)	9	4.5		
Low (1-2.33)	0	0.0		
Total	200	100		

Conclusions and Recommendations

Large ruminant farming in Malaysia holds immense potential to improve people's lives and meet their needs. The study reveals that the respondents hold a positive perception of veterinary extension services and the Department of Veterinary Services (DVS). It emphasises the significant responsibilities of the DVS in fostering the large ruminant industry of the nation. These responsibilities include promoting sustainable livestock production, enhancing industry value, advocating for animal welfare, motivating young breeders, ensuring animal health, controlling zoonotic diseases, and producing healthy forage. Through these efforts, the DVS contributes to the industry's development, sustainability, and public health.

In general, most respondents agreed on the vital role of veterinary extension services in cattle farming. They recognise that these services are essential for increasing their cattle production, disease detection, expanding livestock operations, and benefiting from valuable veterinary advice. Respondents expectations according to the highest mean level is related to cattle disease risk management. Consequently, the DVS should prioritise problem-solving initiatives to address issues such as livestock loss and the threat of unhealthy animals, which can hamper farmers'

productivity.

Competent veterinary extension officers emerge as a critical success factor in Malaysian cattle farming. Therefore, veterinary extension officers should always be ready to provide their services to farmers, especially in terms of channelling the latest information about the world of livestock. To foster industry development, the DVS should impart knowledge and skills to cattle breeders, enabling them to raise large ruminants effectively and access affordable and suitable feed sources. These address existing challenges in cattle breeding, ensuring breeders competitiveness and survival in the industry. Additionally, breeders would benefit from exposure to marketing skills, strategic development, and effective forage management practices. These measures collectively contribute to the overall progress and sustainability of the cattle farming sector.

Government involvement and effective policies are also crucial in the large ruminant farming industry. In collaboration with the DVS and other relevant agencies, the government must empower and support the industry to boost income generation and enhance the country's self-sufficiency. It is essential for the government to maintain consistent regulations and policies that are conducive to the industry's growth. Allocating more funds, particularly for research and development (R and D) activities, is imperative to drive improvements in the large ruminant farming sector. Furthermore, addressing land issues, deforestation, and land ownership challenges for livestock purposes should be a priority for the government. The DVS should prioritise monitoring the effectiveness of ongoing breeding projects, providing adequate funding, regulating drug prices, conducting regular farm visits, and actively considering the needs and opinions of breeders. DVS should also plan, implement and evaluate the livestock extension programs to increase breeders' knowledge and skill in technical and management of cattle farming. Besides that, improving the competencies of livestock extension officers is compulsory. These measures are crucial for the industry's development and to enhance its attractiveness and advancement.

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Novelty Statement

This study addresses a gap in research by focusing on this specific combination of agricultural sectors, providing unique practical solutions with proven benefits, focusing on a region or community where this integration has not been studied before, demonstrating significant sustainability impacts, using an innovative methodology for better resource management.

Author's Contribution

Norsida Man: Conceptualization, Methodology, Supervision, Writing - original draft.
Shin Yee Siaw and Munifah Siti Amira Yusuf: Writing review and editing.
Siti Azizah: Investigation, validation.

Conflict of interest
The authors have declared no conflict of interest.

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