

FACTORS INFLUENCING DEVELOPMENT OF DAIRY CATTLE FARMING IN MALAYSIA

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

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April 2019

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

FACTORS INFLUENCING DEVELOPMENT OF DAIRY CATTLE FARMING IN MALAYSIA

By

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April 2019

Chair Faculty : Prof. Zulkornain B Yusop, PhD : Economics and Management

The Malaysian dairy cattle industry does not produce enough quantity of dairy products to satisfy domestic market needs. As a result, Malaysia is one of the highest milk importing countries in the world. The objectives of the thesis are to identify the competitiveness of the factors influencing the dairy cattle industry, investigate and focus into the most important factors affecting the dairy cattle industry development, and determine the most appropriate dairy farm model in terms of initial investment and herd size for the nation. The population of this study covers Peninsular Malaysia's dairy cattle industry. The exploratory mix method is applied to initially identify the competitiveness level of factors and later to focus on the most important factors affecting the industry development in Malaysia.

The qualitative approach is used to identify the competitiveness of the factors influencing the dairy cattle industry. The sample of twelve participants were interviewed and the data are collected from semi-structured open-ended interviews. This study integrates the theory-driven and data-driven codes using Nvivo 10 software. The results show that most of the factors have low competitiveness level and the issues have spread to all aspects of the industry such as factor condition; related and supporting industries; company's structure; rivalry and organization; government's role; accessibility; and costs. There are only a few factors such as demand, natural resources (water), infrastructure (utilities and logistics) have a high and moderate level of competitiveness. Therefore, the contributions of many relevant stakeholders are very vital for any future improvement and development of this industry.



The quantitative is implemented to investigate and focus on the most important factors affecting the dairy cattle industry in Malaysia. In this part, an original research instrument has been developed. The Content Validity Index (CVI) method is applied in the pretesting and the reliability test (Cronbach's alpha technique) is used in the pilot test. The Structural Equation Modelling (SEM) is implemented to analyze the data by using the Smart-PLS 3 software. The findings demonstrate that the factors such as adequate land allocation for dairy farming and animal feed plantation, climate condition, logistic costs, animal feed price and accessibility, poor cow breed, lack of well trained and experienced labors, lack of knowledge on dairy farming, government policies, and the inappropriate environment of the industry are among the most important factors affecting Malaysian dairy cattle industry stakeholders for their future development plan.

Finally, Cost and Benefit Analysis (CBA) is applied on 4 different dairy cattle farms with 100, 250, 500 and 1,000 milking dairy cows' capacity and 8, 20, 40 and 80 ha animal feed ranching. The outcomes show that the most ideal farm size is at least 1,000 heads milking dairy cows for Malaysia because it generates lower average costs and more income. However, bigger size farms need higher investment. Our study indicates that the most viable farm size is 500 cows because it is feasible and efficient enough at a lower investment rate. Additionally, farm with 250 cows is advisable just for the start with the aim to expand in the future. Finally, farms with smaller herds of less than 250 cows are not recommended because of the low income and high risk.

In conclusion, this study identified the competitiveness and level of importance of the factors affecting dairy cattle industry in Malaysia besides the most viable dairy farm size for Malaysia. These findings provide benefits to many dairy cattle industry stakeholders such as farmers, policymakers and researchers. Farmers can use these results to improve their current farm situation or in their future farm design. This information acts as a comprehensive roadmap for the policymakers for their future dairy cattle development plan. Finally, determining the appropriate solution for each of the explored critical factors in this industry can be a topic for future research. Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

FAKTOR-FAKTOR PENENTU BAGI PEMBANGUNAN TERNAKAN LEMBU TENUSU DI MALAYSIA

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Industri lembu tenusu Malaysia tidak menghasilkan jumlah produk tenusu yang cukup untuk memenuhi keperluan pasaran domestik. Akibatnya, Malaysia adalah salah satu negara pengimport susu tertinggi di dunia. Objektif tesis ini adalah untuk mengenal pasti daya saing faktor-faktor yang mempengaruhi industri lembu tenusu, menyiasat dan menumpukan kepada faktor-faktor yang paling penting yang mempengaruhi pembangunan industri lembu tenusu dan menentukan model ladang tenusu yang paling sesuai dari segi pelaburan awal dan saiz ternakan untuk negara. Populasi kajian ini meliputi industri lembu tenusu Semenanjung Malaysia. Kaedah campuran penerokaan digunakan untuk mengenalpasti tahap daya saing faktor awal dan kemudian memberi tumpuan kepada faktor-faktor yang paling penting yang mempengaruhi pembangunan industri di Malaysia.

Kaedah kualitatif digunakan untuk mengenal pasti daya saing faktor-faktor yang mempengaruhi industri lembu tenusu. Satu sampel dua belas peserta telah ditemuramah dan data dikumpulkan daripada wawancara terbuka separuh berstruktur. Kajian ini mengintegrasikan kod yang berasaskan teori dan data menggunakan perisian Nvivo 10. Keputusan menunjukkan bahawa kebanyakan faktor mempunyai tahap daya saing rendah dan isu-isu merangkumi semua aspek industri seperti kondisi faktor; industri berkaitan dan sokongan; struktur syarikat; persaingan dan organisasi; peranan kerajaan; kebolehaksesan; dan kos. Terdapat hanya beberapa faktor seperti permintaan, sumber asli (air), infrastruktur (utiliti dan logistik) yang mempunyai tahap daya saing yang tinggi dan sederhana. Oleh itu, sumbangan pihak berkepentingan yang berkaitan adalah sangat penting untuk sebarang penambahbaikan dan perkembangan masa depan industri ini.

Kaedah kuantitatif dilaksanakan untuk menyiasat dan memberi tumpuan kepada faktor-faktor yang paling penting yang mempengaruhi industri lembu tenusu di Malaysia. Dalam bahagian ini, satu instrumen penyelidikan telah dibangunkan. Kaedah Pengesahan Kandungan (CVI) digunakan dalam "pretesting" dan ujian kebolehpercayaan (teknik alpha Cronbach) digunakan dalam ujian perintis. Pemodelan Persamaan Struktur (SEM) dilaksanakan untuk menganalisis data dengan menggunakan perisian Smart-PLS 3. Penemuan menunjukkan bahawa faktor-faktor seperti peruntukan tanah yang mencukupi untuk perladangan tenusu dan pemakanan haiwan, keadaan iklim, kos logistik, harga dan akses makanan haiwan, baka lembu yang lemah, kekurangan tenaga kerja yang terlatih dan berpengalaman, kurang pengetahuan mengenai pertanian tenusu, dasar kerajaan, dan persekitaran industri yang tidak sesuai adalah antara faktor terpenting yang mempengaruhi pertumbuhan industri lembu tenusu Malaysia. Hasil dari bahagian ini memberikan gambaran umum plan tindakan yang penting untuk industri tenusu bagi merancang pembangunan masa depan industri tersebut.

Akhirnya, Analisis Kos dan Manfaat (CBA) diterapkan ke 4 ladang lembu tenusu yang berbeza dengan kapasiti 100, 250, 500 dan 1,000 susu lembu susu dan 8, 20, 40 dan 80 hektar penternakan haiwan. Hasilnya menunjukkan bahawa saiz ladang yang paling ideal adalah sekurang-kurangnya 1,000 ekor lembu tenusu untuk Malaysia kerana ia menjana kos purata yang lebih rendah di samping pendapatan yang lebih baik. Walau bagaimanapun, ladang saiz lebih besar memerlukan pelaburan yang lebih tinggi. Kajian kami menunjukkan bahawa saiz ladang yang paling berdaya maju adalah 500 ekor lembu kerana ia boleh dilaksanakan dengan cekap pada kadar pelaburan yang lebih rendah. Di samping itu, ladang dengan 250 ekor lembu adalah dicadangkan hanya untuk permulaan dengan matlamat untuk berkembang pada masa akan datang. Akhirnya, ladang dengan kumpulan lebih kecil kurang daripada 250 ekor adalah tidak disyorkan kerana pendapatan yang rendah dan risiko yang tinggi.

Kesimpulannya, kajian ini mengenal pasti tahap daya saing dan kepentingan faktor-faktor yang mempengaruhi industri lembu tenusu di Malaysia di samping saiz ladang tenusu yang paling ideal untuk Malaysia. Penemuan ini memberi banyak faedah untuk semua pemegang taruh industri lembu tenusu seperti petani, pembuat dasar dan penyelidik. Para petani boleh menggunakan keputusan ini untuk memperbaiki keadaan ladang semasa mereka atau dalam reka bentuk ladang masa depan mereka. Maklumat ini bertindak sebagai pelan yang komprehensif untuk pembuat dasar untuk pelan pembangunan lembu tenusu masa depan mereka. Akhirnya, mencari penyelesaian yang tepat bagi setiap faktor kritikal yang diterokai dalam industri ini adalah merupakan antara topik penyelidikan yang dicadangkan pada masa akan datang.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

AI	Artificial Insemination
ARI	Average Return of Investment
ARR	Accounting Rate of Return
Ave	Average
AVE	Average Variance Extracted
BCG	Boston Consulting Group
BCR	Benefit and Cost Ratio
CBA	Cost and Benefit Analysis
CB-SEM	Covariance Based Structural Equation Modeling
CFA	Confirmatory Factor Analysis
CFT	Cool Farm Tool
CMV	Common Method Variance
CO ₂	Carbon Dioxide
CR	Composite Reliability
СТА	Confirmatory Tetrad Analysis
CVI	Content Validity Index
DEDJTR	Department of Economic Development, Jobs, Transport and
	Resources
DEFRA	Department for Environment, Food & Rural Affairs
DEPIV	Department of Environment & Primary Industries Victoria
DFA	Dairy Farmers of America
DI	Dairy Cattle Industry
DIY	Do It Yourself
DMI	Dry Matter Intake
DVS	Department of Veterinary Services
EFA	Exploratory Factor Analysis
EPP	Entry Point Projects
ETP	Economic Transformation Program
EU	Europe
FA	Factor Analysis
FAO	Food and Agriculture Organization
FB	Feed and Breed
FIMIX	Finite Mixture
G	Government
GHG	Greenhouse Gas
ha	Hectare
HCMs	Hierarchical component models
HOC	Higher-Order Component
HR	Human Resource
HTMT	Heterotrait Monotrait
I-CVI	Item Content Validity Index
IE	Industry Environment
INPVP	Incremental Net Present Values
IRR	Internal Rate of Return
JAKIM	Malaysian Islamic authority
Kg	Kilogram

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Km	Kilometer
KMO	Kaiser-Meyer-Olkin
KN	Knowledge
K-R20	Kuder-Richardson formulas 20
L	Litre
LCL	Land, Climate, and Logistic
LID	Local Indian Dairy
LOCs	Lower-Order Components
M	Mean
MCC	Milk Collection Centres
MGA	Multi Group Analysis
MICOM	Measurement Invariance of Composite Models
mil	Million
MOA	Ministry of Agriculture
n	Number
NAP	National Agricultural Policy
NDDP	National Dairy Development Program
NFS	Non-Fat-Solid
NIBM	National Institutes of Biotechnology Malaysia
NKEA	National Key Economic Areas
NPV	Net Present Value
NPVwp	Net Present Value of conducting a project
NPWwop	Net Present Value of not conducting a project
OLS	Ordinary Least Squares
PAF	Principal Axis Factoring
PCA	Principal Components Analysis
PLS	Partial Least Squares
PLSc	Partial Least Square consistent
PLS-SEM	Partial Least Squares Structural Equation Modelling
POS	Prediction Oriented Segmentation
PPIT	Government-run Dairy cattle industry Service Centers
PV	Present Value
QDA	Qualitative Data Analysis
RD&E	Research, Development, Extension
RM	Ringgit Malaysia
ROI	Return On Investment
S-CVI	Scale-level Content Validity Index
SD	Standard Deviation
SEM	Structure Equation Modelling
SSL	Self Sufficiency Level
	Lotal Economic Value
UAE	United Arab Emirates
UK	United Kingdom
USA	United State of America
	United State Dollar
	Variance Initiation Factor
	winnigness to Accept
WIP	willingness to Pay

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CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The global milk and dairy products production and the market are estimated to increase 2.2 percent from 2017 and reach 843 million tons at the year-end 2018. Asia (India, Turkey, and Pakistan), the European Union, the United States of America (USA) and Argentina are growing the production of the milk and dairy products; in contrast, China and Ukraine are at a decreasing trend. This milk output growth has come about as a result of increasing the number of the dairy cattle, improving milk collection process, implementing the high efficiency integrated dairy production systems, enhanced the productivity per cow, increased usage of idle capacity and higher market demand. The production drops mostly because of applying the industrial restructuring policies in China and reducing the dairy products profit margin in Ukraine (FAO, 2019, March). Table 1.1 shows the world dairy market at a glance.

|--|

Year	2016	2017	2018	2017/2016 (%)
World total milk production	821.8	824.8	842.9	2.2
World total trade	70.7	72.9	75	2.9

Source: FAO report, (2019, March; 2017, November)

In the global milk and dairy product markets, Malaysia is one of the greatest milk importer countries after China, Mexico, Algeria, Russian Federation, Indonesia, Saudi Arabia, and Philippines (FAO, 2019, March). Figure 1.1 shows the major importing of milk and dairy product countries in the world.



Figure 1.1: The milk and milk products importing countries (Million-ton, milk equivalent)

Source: FAO report, (2019, March).

Based on the above figure Malaysian imports of milk in the last two years from 2017 to 2018 remained the same. This is due to the inability of the Malaysian dairy cattle industry to fulfil the domestic market needs and demand. The Malaysian dairy cattle industry did not grow and develop rapidly in line with the increasing market demand for dairy products during the current decade due to the population growth, higher income, and urbanization (Dong, 2006). Additionally, statistics from the Department of Veterinary Services (DVS) show that milk production in Malaysia increased slowly. For example, the annual growth rate of milk production was only 3.26% in the year 2017. Table 1.2 shows the annual growth rate of milk production in Malaysia from 2012-2017 (DVS, 2018).

Year	2012	2013	2014	2015	2016	2017	
Total (Million L)	27.0	<mark>28</mark> .8	34.1	36.5	36.7	37.9	
Growth rate (%)	7%	6.66%	18.40%	7.04%	0.55%	3.26%	
Source: DVS (2018).							

Table 1.2: Annual growth rate of the milk product in Malaysia

According to Table 1.2 information, the speed of milk production growth has decreased from 18.40% in the year 2014 to 3.26% in the year 2017. Possible reasons for this conclusion relates to the fact that the Malaysian dairy cattle industry has faced many challenges such as i) the lack of skills and training, ii) low breed performance and iii) inadaptability to local environmental conditions, poor dairy farm management, and inadequate nutritious feed, and iv) high input and feed costs (Sim & Suntharalingam, 2015).

The Malaysian government has supported dairy cattle farming for around five decades. They have planned and tried many economic development strategies and policies to improve the local dairy cattle industry, however, this industry is still undeveloped. This occurs because it has faced many unresolved complex challenges and issues (Sim & Suntharalingam, 2015).

1.2 The challenges and issues of the dairy cattle industry in Malaysia

Historically, the dairy cattle industry has not been the tradition of the local Malaysians. However, Indians immigrant started a small dairy cattle industry in early of the 20th century. The farms were concentrated nearby the rubber and oil palm plantation and the borders of the urban areas. In recent decades, the government of Malaysia has attempted to develop this industry especially those owned by the private sectors but the industry still remains small with average low production (Sim & Suntharalingam, 2015). There are several challenges and the issues that the Malaysian dairy industry has faced during the past decades.

Malaysia has to import milk and dairy products to satisfy its domestic market demand. In fact, the import value of the dairy products increased from less than RM 100 million in the year 1970 to more than RM 1 billion in the year 2017. Although the level of milk production has improved slowly over the past 40 years, Malaysia is still unable to fulfil the domestic market dairy demand (Boniface & Umberger, 2012; DVS, 2018).

Moreover, the increasing public awareness of the nutritional benefits of fluid milk consumption coupled with a preference towards other dairy products has gained the demand for both milk and dairy-derived products in Malaysia. The domestic demands for milk and dairy products are increasing continuously. Therefore, the government of Malaysia tried to formulate policies to provide support to overcome this market need (Sim & Suntharalingam, 2015).

One of the important factors related to the dairy cattle industry is SSL. Most of the countries import dairy products with only a few countries achieving 100% self-sufficient for these products such as India, Iran, Pakistan, and Turkey in Asia. A large majority of countries have dairy productions less than their market needs and demands (FAO, 2016, June). However, only a few countries have less than 25% SSL of dairy products and milk that included Malaysia, Philippines, the Democratic Republic of the Congo, Côte d'Ivoire, Gabon, Gambia, Ghana, Jamaica, and Papua New Guinea. For example, the milk production Self Sufficiency Level (SSL) for Malaysia was only 3.04% in the year 2016 (FAO, 2016, June; DVS, 2018).

In order to increase SSL, the domestic production of milk should be increased. Therefore, the Malaysian government decided to develop the dairy cattle industry and to increase the SSL of the country under the Third National Agricultural Policy (NAP3, 1999) from 1998-2010. They also have the same aim for the period of 2011-2020 in the fourth National National Agro-food Policy (NAP, 2011).

Furthermore, the problem is not limited to the low level of raw milk production only. Figure 1.2 illustrates the food balance sheet of different dairy products in Malaysia except for milk such as butter, cheese, skim milk powder, whole milk powder, and whey powder. It highlights that food balance sheet for dairy products have been negative since 2010. If we look closely at figure 1.2, the amount of dairy products imports has increased over the years. Therefore, the consumption level of the dairy products has increased over the years while the related and supporting dairy industries are not developed enough to cover the local demand and Malaysia still rely on importing different types of the dairy products. Perhaps, Malaysian need to pay special attention to the related and supporting dairy as well as food industries to produce more different types of dairy products domestically and improve the food balance sheet for these products.





Figure 1.2: The Food balance sheet of different dairy products in Malaysia (Thousand Ton)

Source: OECD (2018)

Moreover, the Malaysian government has formulated several new programs to develop further the dairy cattle farming industry. The Economic Transformation Program (ETP, 2015) proposed an Entry Point Projects (EPP) within the Agriculture National Key Economic Areas (NKEA): "EPP13: Establishing dairy clusters in Malaysia by collaborating with the large foreign dairy companies. This project aims to develop the local dairy cattle industry and increase SSL of dairy products. Additionally, it can improve the local market perception of the domestic dairy division and guarantee a stable demand and market" (NKEA, 2016). Indeed, the aim of these proposals is to integrate smallholder farmers into some large clustered scale. Therefore, the large scale of the agri-business supposed to perform higher value-added dairy products. The newly established anchor companies should adopt better technology, know-how, and knowledge to increase the level of production.

According to the Economic Transformation Program Annual Report (ETP, 2015), 281 farmers are under EPP13 of which 198 of them are considered smallholders because they only have less than 30 dairy cattle on their farm. The encouraging progress has shown in the report but still, the main challenge and problem is the competition between the prices of the local fresh milk and the imported milk that has a lower price than local milk.

Furthermore, the success of dairy farming is directly related to milk production costs and market price. The dairy farm operation depends on many different factors such as costs of production, market supply, and demand (Jayaweera, et al., 2007; Benni, Finger, & Mann, 2012). In fact, the stability of farm profits is

effectively influenced by off-farm revenue, direct costs, size, location, and liquidity.

Additionally, the investment in this industry is still considered very risky because of several factors such as lack of skills and training, Low breed performance and inadaptability to local environmental conditions, Poor dairy farm management and inadequate nutritious feed, High input and feed costs (Suntharalingam, Sithambaram, Graff, & Saari, 2015b; Panandam & Raymond, 2005; Jeyabalan, 2010; Sim & Suntharalingam, 2015; Suntharalingam, et al., 2015c; Suntharalingam & Ahmad, 2015a). Therefore, all of the mentioned factors should consider future plans to reduce the level of investment risk and increase the production level.

1.3 Problem statement

As mentioned, the Malaysian government has applied many plans for the development of the dairy cattle industry in Malaysia for around five decades. In fact, the government has tried many economic development strategies and corridors to improve the domestic dairy cattle industry and overcome all expected problems and weaknesses for decades, however, the dairy cattle industry still remains undeveloped. This occurs because the industry has faced many unresolved complex challenges and issues such as the lack of skills and training, low breed performance and inadaptability to local environmental conditions, poor dairy farm management, inadequate nutritious feed, high input and feed costs for decades. Additionally, there are many factors which do not list or the importance of them is still unclear. Thus, the government, farmers and the rest of the industry stakeholders should know all factors influencing the dairy industry and the importance of them before any further movement. This information will support them to draw the more practical roadmap, set the realistic targets and provide a comprehensive development plan.

Therefore, it is necessary first to explore all factors influencing the dairy cattle industry in general. Then, it is very essential to investigate and highlight the most important factors affecting the dairy cattle industry in Malaysia. The finding of this part provided a roadmap for the government and farmers so as to improve the level of the milk production, SSL, and the overall dairy cattle industry in Malaysia.

Additionally, the success of dairy farming is directly related to milk production costs and market price. The dairy farm operation depends on many different factors such as costs of production, market supply, and demand. Further, the stability of farm profits is effectively influenced by off-farm revenue, direct costs, size, location, and liquidity. For the healthy growth of the Malaysian dairy cattle industry, both the Malaysian government and farmers need the feasible, viable, and profitable dairy cattle farm model plans that could deliver the efficient milk production and income over the years. This plan should be able to provide the

lowest cost of production, optimum farm size, ideal location, and technology utilization for better implementation of the EPP13. Finally, these project plans should cover not only financial elements but also economic and technical parts as well as environmental concerns and requirements.

1.4 Objectives of the study

Given the above problem statements, three objectives have been identified namely:

i- To identify the competitiveness of the factors influencing the dairy cattle industry in Malaysia.

ii- To investigate and focus on the most important factors affecting the dairy cattle industry development in Malaysia.

iii- To determine the most appropriate and feasible dairy farm model (capacity and herd size) for Malaysia.

1.5 Significance of the study

The current dairy cattle industry in Malaysia is in an unhealthy condition and Malaysia imports a substantial amount of the different dairy products every year (Sim & Suntharalingam, 2015). Therefore, the main purpose of this study is to guide the farmers, government agencies, financial institutions, and the rest of the players in the dairy cattle industry to develop the level of the dairy production in Malaysia.

The first essay explored the overall factors influencing the dairy cattle industry development and the second essay focused on determining the most important factors affecting the dairy cattle industry in Malaysia. It is conjectured that the challenges are not only limited technically to dairy farms (Warr, Rodriguez, & Penm, 2008). The inadequacy of many other players involved in related and supporting industries of the domestic market demand are also constraining the healthy growth of the dairy cattle industry in Malaysia (Boniface, Gyau, Stringer, & Umberger, 2010). Certainly, the government has a significant role to play. This research is intended to focus on factors contributing to the various aspects of the dairy cattle industry.

Having a firm understanding of the forces influencing the state of development of the industry would provide a clear perspective on how to raise the milk and dairy products industry, as well as improve the Malaysian SSL. With knowledge of the relevant and important change forces, the proper technical, financial and economic elements of dairy cattle farm model plans could be properly framed. In the third essay, various models of dairy cattle farming (capacity and herd size) were identified and their technical, financial and economic feasibilities analyzed. This effort can contribute towards the Malaysian government's proposals for the future development of the industry (EEP13). In fact, any large scale and modern farming projects need a high initial capital and investment, which investors, bank, and other financing organizations, are not willing to partake without a proper feasibility study with clear financial and economic consideration and analysis. The third essay of this study has an objective to investigate the most ideal and suitable dairy farm size for Malaysian which could convince the governments, farmers, investors, financial institutions, and organizations to invest in it.

1.6 Organization of the study

The present thesis is intended to investigate the business and economic factors affecting the dairy cattle industry in Malaysia and in trying to identify the appropriate dairy cattle industry model that have incorporated technical business and economic considerations to address the problems and constraints enveloping the industry in Malaysia. Chapter one has presented an introduction describing the current situation of the Malaysian dairy cattle industry and highlighting the importance of the milk production industry and SSL in the country. The Malaysian dairy cattle industry challenges and problems have been discussed in the statement of the problem followed by the objectives of the study and its significance followed by the importance of coming up with a technical and financially feasible dairy farm-scale in Malaysia. The following chapter two represents the dairy cattle industry in Malaysia. The literature relevant to the study is discussed in chapter three.

Chapter four illustrates the methods adopted in the study involving the mix method approaches of Porters' Diamond model, Structural Equation Modeling (SEM) and Cost and Benefit Analysis (CBA). Moreover, it covers the sampling procedure, the analytical framework, data collection and the rest of the information related to the methodology of the study. The fifth chapter provides the findings of research on objective one that identifying the competitiveness of the factors influencing the dairy cattle industry in Malaysia and the sixth chapter provides the findings of objective two that narrows down and focuses on the most important factors affecting the dairy cattle industry development in Malaysia. Chapter Seven discusses the findings on s the most appropriate dairy farm model (capacity and herd size) for Malaysia and chapter eight contains the summary, conclusion, limitation of the study and recommendations for the future research.

REFERENCES

- Euromonitor International. (2015). *Euromonitor Market Report 2015 Packaged Food.* Kuala Lumpur: Euromonitor International.
- 10times. (2019). *Agriculture & Forestry Events in Malaysia*. Retrieved 5 23, 2019, from https://10times.com/malaysia/agriculture-forestry
- AAFC. (2019). Customized report service Powdered milk in Malaysia. Agriculture and Agri-Food Canada (AAFC).
- Abdullah, F. F., Sadiq, M. A., Abba, Y., Ropie, A. M., Mohammed, K., Chung, E. L., . . . Saharee, A. A. (2017). A cross-sectional study on the association between farmers' awareness and compliance on herd health program among five selected dairy cattle farms in Selangor and negeri Sembilan states, Malaysia. *Malaysian Journal of Veterinary Research, 8, 1*, 19-29.
- Abdullah, F. F., Sadiq, M. A., Abba, Y., Ropie, A. M., Mohammed, K., Chung, E. L., . . . Saharee, A. A. (2017). A Cross-Sectional Study on The Association Between Farmers' Awareness And Compliance on Herd Health Program Among Five Selected Dairy Cattle Farms in Selangor and Negeri Sembilan States, Malaysia. *Malaysian Journal of Veterinary Research, 8, 1*, 19-29. Retrieved from http://psasir.upm.edu.my/id/eprint/56567
- Abel, V.-M., & Reynoso-Palomar. (2019). High prevalence, potential economic impact, and risk factors of Fasciola hepatica in dairy herds in tropical, dry and temperate climate regions in Mexico. *Acta tropica*, 169-175. doi:10.1016/j.actatropica.2019.03.005
- Abu Bakar, Z., & Ali, R. (2017). Regulation of Learning: From the Perspective of Male Students in Pakistan. *The Qualitative Report, 22, 8*, 2196–2205.
- Adler, M. D., & Posner, E. A. (2001). *Cost-benefit analysis. Legal, economic and philosophical perspectives.* Chicago: University of Chicago Press.
- Agrobank. (2019, July 17). Retrieved from smecorp: http://www.smecorp.gov.my/images/pdf/SMEFINANCING.pdf
- AHDB. (2015). Dairy Business Plan 2016-2019. AHDB.
- Ali, R. M. (2008). Logistics and supply chain in Malaysia: issues and challenges. EASTS International Symposium on Sustainable Transportation

incorporating Malaysian Universities Transport Research Forum Conference (pp. 12-13). Johor: Universiti Teknologi Malaysia.

- Alias, A. (2019, July 23). *Malaysia's Internet penetration is now 85.7 per cent.* Retrieved from NST: https://www.nst.com.my/business/2018/03/346978/malaysias-internetpenetration-now-857-cent
- Alliance. (2018, Aug 9). *About*. Retrieved from CFT online: https://app.coolfarmtool.org/about/
- An, Y. (2012). Analysis of qualitative data analysis software NVivo computer. *Chin Technol Inf 5*, 66–67.
- Ark, B. V. (1990). Manufacturing productivity levels in France and the UK. *National Institute Economic Review, 133,* 62-77.
- Ark, B. V. (1993). International Comparisons of Output and Productivity: Manufacturing Productivity Performance in Ten Countries from 1950 to 1990. Groningen: Monograph Series, University of Groningen.
- Azhar, H., Zamri-Saad, M., Jesse, F. F., & Annas, S. (2016). Retrospective Study on Milk Production and Reproductive Performance of Dairy Cattle in a Farm in Selangor, Malaysia. Proceedings of International Seminar on Livestock Production and Veterinary Tech (pp. 157-162). LPVT.
- Bailey, K. (2001). The fundamentals of forward contracting, hedging and options for dairy producers in the North East. *College of Agricultural Sciences*. *The Pennsylvannia State University. Staff Paper*, 338.
- Baker, S. E., & Edwards, R. (2012). *How many qualitative interviews is enough.* Southampton: NCRM.
- Bamire, A. S., Fabiyi, Y. L., & Manyong, V. M. (2002). Adoption pattern of fertilizer technology among farmers in the ecological zones of Southwestern Nigeria: A Tobit analysis. *Australian Journal of Agricultural research*, 53, 901-910.
- Bank Negara Malaysia. (2018, July 07). *Malaysia Interest Rate*. Retrieved from Trading Economics: https://tradingeconomics.com/malaysia/interestrate
- Barling, M. B. (2012). Lactose tolerance and intolerance in Malaysians. *IeJSME*, 12-23. Retrieved from https://pdfs.semanticscholar.org/9b2d/aba8561434008678a30a97620b cde9ead02e.pdf

- Bartkowski, B., Lienhoop, N., & Hansjürgens, B. (2015). Capturing the complexity of biodiversity: A critical review of economic valuation studies of biological diversity. *Ecological Economics*, *113*, 1-14.
- BCG. (2019, June 24). *The History of Boston Consulting Group*. Retrieved from BCG: https://www.bcg.com/about/our-history/default.aspx
- Becker, J. M., Klein, K., & Wetzels, M. (2012). Hierarchical latent variable models in PLS-SEM: guidelines for using reflective-formative type models . *Long Range Planning*, 45, 5-6, 359-394.
- Bengtsson, M. (2016). How to plan and perform a qualitative study using content analysis. *NursingPlus Open (2),*, 8-14. doi:10.1016/j.npls.2016.01.001
- Benni, N., Finger, R., & Mann, S. (2012). Effects of agricultural policy reforms and farm characteristics on income risk in Swiss agriculture. *Agricultural Finance Review, 72*, 301 – 324.
- Bentler, P. M., & Huang, W. (2014). On Components, Latent Variables, PLS and Simple Methods: Reactions to Ridgon's Rethinking of PLS. *Long Range Planning, 47*, 138-145.
- Berentsen, P. B., Kovacs, K., & Van Asseldonk, M. A. (2012). Comparing risk in conventional and organic dairy farming in the Netherlands: An empirical analysis. American Dairy Science Association. *Journal Dairy Science*, *95*, 3803–3811.
- Bergstrom, J. C., & Randall, A. (2016). *Resource economics: an economic approach to natural resource and environmental policy.* New York, USA: Cheltenham.
- Boardman, A., Greenberg, D., Vining, A., & Weimer, D. (2011). Cost-Benefit Analysis: Concepts and Practice (4th ed.). New York, USA: Prentice Hall.
- Bobirca, A., & Cristureanu, C. (2008). Analyzing Romania's competitiveness as a tourism destination in Advances in Hospitality and Leisure. *Published online*, 75-99.
- Bogdan, R. C., & Biklen, S. K. (1992). *Qualitative research for education: An introduction to theory and methods.* Boston, USA: Allyn and Bacon.
- Bollen, K. A. (2011). Evaluating effect, composite, and causal indicators in structural equation models. *MIS Quarterly, 35, 2,* 359-372.
- Boniface, B. (2012). Producer relationships segmentation in Malaysia's milk supply chains. *British Food Journal, 114*, 1501–1516.

- Boniface, B., & Umberger, W. (2012). Factors influencing Malaysian consumers' consumption of dairy products. *56th AARES annual conference, Fremantle.* Western Australia.
- Boniface, B., Gyau, A., Stringer, R., & Umberger, W. (2010). Building producer loyalty in Malaysia's fresh milk supply chain. *Australasian Agribusiness Review,* 18, 66-84. Retrieved from https://ageconsearch.umn.edu/record/114423
- Boniface, B., Gyau, A., Stringer, R., & Umberger, W. (2010). Building suppliers' loyalty in the Malaysian fresh milk supply chain. *Australasian Agribusiness Review, 18*, 66-84.
- Boniface, B., Silip, J. J., & Ahmad, A. H. (2007). Dairy cattle management: survey on dairy cattle lactation trend in Sabah. *MPRA Paper No. 23781*.
- Bora, B. (2015). Comparison Between Net Present Value and Internal Rate of Return. International Journal of Research in Finance and Marketing, 61-71.
- Boyatzis, R. (1998). *Transforming qualitative information: Thematic analysis and code development*. Thousand Oaks, CA: Sage.
- Bradford, R. E. (2014). Common Method Variance Techniques. *MWSUG 2014 Conference* (p. AA11). Chicago, Illinois: MWSUG.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*, *2*, 77-101.
- Brown, J. D. (2013). Classical theory reliability. *The companion to language* assessment, 3, 1165-1181.
- Bryman, A. (2001). Social Research Methods. Oxford: Oxford University Press.
- Cafiso, S., & D'Agostino, C. (2016). Assessing the stochastic variability of the Benefit-Cost ratio in roadway safety management. *Accident Analysis & Prevention, 93*, 189-197.
- California Department of Water. (2005). Ecosystem Valuation Methods. Revised Draft. Multi-Objective Approaches to Floodplain Management on a Watershed Basis. California, USA.
- Campbell, H. F., & Brown, R. B. (2003). *Benefit-cost analysis: financial and economic appraisal using spreadsheets.* Cambridge: Cambridge University Press.

- Carter, N. B.-L. (2014). The use of triangulation in qualitative research. In Oncology nursing forum 41, (5), 545-547.
- Casey, D. (2013). Economic Impact of Dairy Expansion in Churchill County through Value Chain Analysis. *ProQuest. University of Nevada, Reno.*
- CEIC. (2019, July 23). *Malaysia Road Length Statistics*. Retrieved from ceicdata: https://www.ceicdata.com/en/malaysia/road-length-statistics
- Cellini, Riegg, S., & Kee, J. E. (2010). Cost-Effectiveness and Cost-Benefit Analysis. In Handbook of Practical Program Evaluation, edited by Joseph S. Wholey, Harry P. Hatry, and Kathryn E. Newcomer, 3rd ed., 493–530. San Francisco: John Wiley & Sons.
- Champion, V., Skinner, C. C., & Menon, U. (2005). Development of a selfefficacy scale for mammography. *Research in Nursing & Health, 28*, 329–336.
- Chee, Y. (2004). An ecological perspective on the valuation of ecosystem services. *Biological conservation* 120, 459–565.
- Chin, W. W. (2010). How to write up and report PLS analyses. In V. E. Vinzi, W.
 W. Chin, J. Henseler, & H. Wang, *Handbook of partial least squares: Concepts, methods, and applications* (pp. 655-690). Berlin: Springer.
- CLAL. (2019, 4 10). *Per capita Consumption*. Retrieved 5 7, 2019, from CLAL.it: https://www.clal.it/en/?section=tabs_consumi_procapite
- Coffey, A. J., & Paul, A. A. (1996). *Making Sense of qualitative data.* Thousand Oaks, California: Sage.
- Costello, A. B., & Osborne, J. W. (2005). Best Practices in Exploratory Factor Analysis: Four Recommendations for Getting the Most From Your Analysis. *Practical Assessment, Research & Evaluation, 10, 7*, 1-9.
- Creswell et al. (2007). Qualitative Research Designs: Selection and Implementation. *The counseling psychologist 35 (2)*, 236-264. doi:10.1177/0011000006287390
- Creswell, J. W., Fetters, M. D., & Ivankova, N. V. (2004). Designing a mixed methods study in primary care. *Annals of Family Medicine, 2, 1.*, 7-12.
- Creswell, J. W., Plano, C. V., Gutmann, M. L., & Hanson, W. (2008). An expanded typology for classifying mixed methods research into designs. *The mixed methods reader*, 159-196.

- DaCoTA. (2012). Cost-benefit analysis, Deliverable 4.8d of the EC FP7 project DaCoTA.
- Davudov, D., & Moghanloo, R. G. (2017). A systematic comparison of various upgrading techniques for heavy oil. *Journal of Petroleum Science and Engineering*, *156*, 623-632.
- Decrop, A. (1999). Triangulation in qualitative tourism research. *Tourism Management, 20*, 157-161.
- DEDJTR. (2018, June 01). Innovation doubles milk production. Retrieved from Agriculture Victoria: http://agriculture.vic.gov.au/agriculture/dairy/dairyscience-and-research/dairy-mega-evaluation/innovation-doubles-milkproduction
- DEFRA. (2017, June 23). AVERAGE UK MILK YIELD. Retrieved from AHDB Dairy: https://dairy.ahdb.org.uk/market-information/farming-data/milkyield/average-milk-yield/#.Ww_0yEiFNPZ
- Department of Agriculture Sarawak. (2019, July 19). Dairy Cattle Farming. Retrieved from DOA. Sarawak: file:///C:/Users/hamed/Downloads/Dairy%20Cattle%20Farming%20(1). pdf
- Department of Statistics. (2018, July 07). *Malaysia Inflation Rate*. Retrieved from Trading Economics: https://tradingeconomics.com/malaysia/inflationcpi
- Diamantopoulos, A., Riefler, P., & Roth, K. P. (2008). Advancing formative measurement models. *Journal of Business Research, 61, 12*, 1203-1218.
- Dijkstra, T. K. (2014). PLS' Janus Face Response to Professor Rigdon's 'Rethinking Partial Least Squares Modeling: In Praise of Simple Methods'. *Long Range Planning, 47*, 146-153.
- Dijkstra, T. K., & Henseler, J. (2015). Consistent Partial Least Squares Path Modeling. *MIS Quarterly*, *39*, 297-316.
- Dikko, M. (2016). Establishing construct validity and reliability: Pilot testing of a qualitative interview for research in Takaful (Islamic insurance). *The Qualitative Report, 21(3),* 521-528.
- Dlamini, C. S. (2012). Types of values and valuation methods for environmental resources: Highlights of key aspects, concepts and approaches in the

economic valuation of forest goods and services. *Journal of Horticulture and Forestry*, *4*, *1*2, 181-189.

- Dong, F. (2006). The outlook for Asian dairy markets: the role of demographics, income, and prices. *Food Policy*, *31*, 260-271.
- DOSM. (2019, July 18). Selected Agricultural Indicators, Malaysia, 2017. Retrieved from Department of Statistics Malaysia: https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=7 2&bul_id=MDNYUitINmRKcENRY2FvMmR5TWdGdz09&menu_id=Z0 VTZGU1UHBUT1VJMFIpaXRRR0xpdz09
- DVS. (2018, May 10). *Statistic*. Retrieved from DVS: http://www.dvs.gov.my/index.php/pages/view/1847
- Dwivedi, Y. K., Choudrie, J., & Brinkman, W. P. (2006). Development of a survey instrument to examine consumer adoption of broadband. *Industrial Management & Data Systems*, 106(5), 700-718.
- Economic Planning Unit. (1976). *Third Malaysia Plan 1976- 1980.* Putrajaya, Malaysia: Prime Minister's Department.
- Economic Planning Unit. (1981). *Fourth Malaysia Plan 1981- 1985.* Putrajaya, Malaysia: Prime Minister's Department.
- Economic Planning Unit. (1999). Seventh Malaysia Plan 1999- 2000. Putrajaya, Malaysia: Prime Minister's Department.
- Economic Planning Unit. (2006). *Ninth Malaysian Plan 2006- 2010.* Putrajaya, Malaysia: Prime Minister's Department.
- Edwards, J. (2001). Multidimensional constructs in organizational behavior research: an integrative analytical framework. *Organizational Research Methods 4, 2,* 144-192.
- ETP. (2015). *Economic Transformation Programme, Annual Report 2014.* Putrajaya, Malaysia: Performance Management & Delivery Unit, Prime Minister's Department.
- Euromonitor International. (2017). *Powdered Milk in Malaysia.* Euromonitor International.
- Euromonitor International. (2018). *Consumer Lifestyles in Malaysia*. Euromonitor International.
- Euromonitor International A. (2017). *Drinking Milk Products in Malaysia.* Euromonitor International.

- European Commission. (2008). Guide to Cost Benefit Analysis of Investment Projects. Structural Funds, Cohesion Fund and Instrument for Pre-Accession. Brussels: European Commission.
- Expoglobe. (2019). Agri Malaysia. Retrieved 5 23, 2019, from https://agrimalaysia.com/en
- Faez, F., Muhammad, A. S., Yusuf, A., Abdul, M. R., Konto, M., Chung, L., & ... & Abdul, A. S. (2017). A cross-sectional study on the association between farmers' awareness and compliance on herd health program among five selected dairy cattle farms in Selangor and Negeri Sembilan states, Malaysia. *Malaysian Journal of Veterinary Research*, 8(1), 19-29.
- Fan, Y., Zhu, J., Pei, J., Li, Z., & Wu, Y. (2015). Analysis for Yangmingtan Bridge collapse. *Engineering Failure Analysis, 56*, 20–27.
- FAO. (2012). Capacity building to implement good animal welfare practices Report of the FAO Expert Meeting. Rome, Italy: FAO.
- FAO. (2013). Enhancing animal welfare and farmer income through strategic animal feeding Some case studies. Rome, Italy: FAO.
- FAO. (2015, December). *Milk and milk products: price and trade update.* FAO-The meat and dairy section of the Trade and Markets Division.
- FAO. (2016, June). FAO-Food Outlook, Biannual Report on Global Food Markets. FAO.
- FAO. (2017, November). *MILK AND MILK PRODUCTS.* FAO-The meat and dairy section of the Trade and Markets Division.
- FAO. (2019, March). *Dairy market review.* FAO. Retrieved from http://www.fao.org/3/ca3879en/ca3879en.pdf
- FAO, GDP, & IFCN. (2018). *Dairy Development's Impact on Poverty Reduction*. Chicago, Illinois, USA: FAO, GDP, IFCN.
- Fedotovs, A. (2010). A small nation's comparative advantage: The case of Latvia. *BEH Business and Economic Horizons, 1*, 51-57.
- Fereday, J., & Cochrane, E. M. (2006). Demonstrating Rigor Using Thematic Analysis: A Hybrid Approach of Inductive and Deductive Coding and Theme Development. *International Journal of Qualitative Methods*, *5*, *1*, 83.

- Fisher, T. E. (2013). Small and Midscale Dairy Farming in the Northeast: Achieving Economic Resilience through Business Opportunity Analysis. *ProQuest. Franklin Pierce University.*
- Gebregziabher, G., Hagos, F., Haileslassie, A., Getnet, K., Hoekstra, D., Gebremedhin, B., & Getahun, G. (2016). Does investment in motor pump-based smallholder irrigation lead to financially viable input intensification and production? An economic assessment. Addis Ababa: International Livestock Research Institute (ILRI).
- Gentles, S. J., Charles, C., Ploeg, J., & McKibbon, K. (2015). Sampling in qualitative research: Insights from an overview of the methods literature. *The Qualitative Report, 20 (11)*, 1772-1789.
- Gersbach, H., & Ark, B. V. (1994). *Micro foundations for international productivity comparisons.* Groningen: Memorandum of Institute of Economic Research, University of Groningen.
- Global Trade Tracker. (2019, June 8). Global Trade Tracker. Retrieved from Market share and competition: https://www.globaltradetracker.com/start/index.php/free-trial
- Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The Qualitative Report*, 597-606.
- Gold, A., Malhotra, A., & Segars, A. (2001). Knowledge Management: An Organizational Capabilities Perspective. *Journal of Management Information Systems, 18*, 185-214.
- Gomez, G. (2012). The Economic Impact of the New Insensitive Sorghum Cultivars in the Dairy Market of Nicaragua. *ProQuest. Purdue University*.
- Goussios, D. e. (2014). Developing the typical dairy products of Thessaly Diagnosis and local strategy. LACTIMED.
- Grant, R. (1991). Porter's 'competitive advantage of nations': an assessment. *Strategic Management Journal*, *12*, 535-548.
- Green, J. e. (2007). Generating best evidence from qualitative research: the role of data analysis. *Australian and New Zealand Journal of Public Health, 31, 6,* 545-550.
- Greenway, D. (1993). The competitive advantage of nation. *Kyklos, 46*, 145-146.
- Guest, G. S., MacQueen, K. M., & Namey, E. E. (2012). *Applied Thematic Analysis.* Thousand Oaks, CA: Sage.

- Guo, Y. (2009). *Qualitative data analysis: use bible of Nvivo 8.* Taipei: Higher Education Culture.
- Hair, J. F., Hult, G. T., Ringle, C. M., & Sarstedt, M. (2014). A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). Thousand Oaks, CA: Sage.
- Hair, J. F., Hult, G. T., Ringle, C. M., & Sarstedt, M. (2017). A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM) second edition. Los Angeles: SAGE.
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a Silver Bullet. Journal of Marketing Theory and Practice, 19, 139-151.
- Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An Assessment of the Use of Partial Least Squares Structural Equation Modeling in Marketing Research. *Journal of the Academy of Marketing Science, 40*, 414-433.
- Hakkert, A. S., & Wesemann, P. (2005). *The use of efficiency assessment tools: solutions to barriers.* Ledschendam: Report R-2005-2. SWOV Institute for Road Safety Research.
- Hassan, S. H., Ramayah, T., Mohamed, O., & Maghsoudi, A. (2015). E-Lifestyle Conceptualization: Measurement Model Validation Using Variance Based Structural Equation Modeling (SEM-PLS). *Modern Applied Science*, *9*, *2*, 319-332.
- Hellerstein, J. M. (2008). *Quantitative Data Cleaning for Large Databases.* United Nations Economic Commission for Europe (UNECE).
- Henderson, K. A. (2011). Post-positivism and the pragmatics of leisure research. *Leisure Sciences*, *33(4)*, 341-346.
- Henseler, J., Dijkstra, T. K., Sarstedt, M., Ringle, C. M., Diamantopoulos, A., Straub, D. W., . . . Calanton, R. J. (2014). Common Beliefs and Reality about Partial Least Squares: Comments on Rönkkö & Evermann. Organizational Research Methods, 17, 182-209.
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*, 115–135.
- Henson, R. K., & Roberts, J. K. (2006). Use of Exploratory Factor Analysis in Published Research: Common Errors and Some Comment on Improved Practice. *Educational and Psychological Measurement, 66, 3.*

- Heuberger, C. F., Staffell, I., Shah, N., & Mac Dowell, N. (2017). A systems approach to quantifying the value of power generation and energy storage technologies in future electricity networks. *Computers & Chemical Engineering*, *107*, 247-256.
- Ho, L. H., & Tsai, C. C. (2018). A Model Constructed to Evaluate Sustainable Operation and Development of State-Owned Enterprises after Restructuring. Sustainability, 10, 23-54.
- Hooi, T. K., Abu, N. H., & Rahim, M. K. (2018). Relationship of Big Data Analytics Capability and Product Innovation Performance using SmartPLS 3.2.6: Hierarchical Component Modelling in PLS- SEM. International Journal of Supply Chain Management, 7, 1. 5, 51-64.
- Hough, J. (1994). Educational cost-benefit analysis. *Education Economics*, 2, 93-128.
- Hovden, J., Størseth, F., & Tinmannsvik, R. K. (2011). Multilevel learning from accidents case studies in transport. *Saf Sci., 49*, 98–105.
- IFCN. (2018). *The Global Dairy World 2017/18.* Kiel, Germany: IFCN Dairy Research Network. Retrieved from https://ifcndairy.org/wp-content/uploads/2018/10/Dairy-Report-Article-2018.pdf
- Iftekhar, M. S., Polyakov, M., Ansell, D., Gibson, F., & Kay, G. M. (2017). How economics can further the success of ecological restoration. *Conservation Biology*, *31* (2), 261-268.
- IMF. (2019, July 18). *IMF Country Report No. 18/62.* Retrieved from IMF: https://www.imf.org/en/search#q=IMF%20Country%20Report%20No. %2018%2F62&sort=relevancy
- IMS. (2019). Feeds and Livestock Malaysia. Retrieved 5 23, 2019, from http://ims-asia.org/feeds-livestock-malaysia-2019/
- International Dairy Federation. (2019). *The IDF Guide to Good Animal Welfare in Dairy Production 2.0.* Brussels: International Dairy Federation.
- Islam, M. M., Topader, A. H., & Rob, A. (2010). Comperative Study on the Cost Benefit Between Indigenous And Cross Bred Cows Reared In Rural Area of Dinajpur District, Bang. J. Anim. Sci, 39, 191 – 196.
- JAKIM. (2019, June 8). Muat Turun. Retrieved from Jabatan Kemajuan Islam Malaysia: http://www.dagangasia.com/download/Checklist%20of%20JAKIM%20 Halal%20Certificate_AGENT.pdf

- Jamshed, M., & Ahmad, S. (2018). Niche Marketing of Date Palm based Food and Beverages as Health Products. *Journal of Economic Cooperation & Development, 39*(2), 49-67.
- Jantzen, J. (2006). *The economic value of natural and environmental resources, Background document training.* TME, Institute for Applied Environmental Economics.
- Jarvis, D., MacKenzie, S., & Podsakoff, P. (2003). A critical review of construct indicators and measurement model misspecification in marketing and consumer research. *Journal of Consumer Research 30, 3*, 199-218.
- Jayaweera, T., Ruwandeepika, H., Kendaragama, K., Fernando, W., Jayarathne, H., & Thotawaththe, T. (2007). Analysis of Cost of Milk Production in Ratnapura District. *The Journal of Agricultural Sciences*, 3.
- Jeyabalan, V. (2010). Individual cow recording and analysis system for small scale dairy farmers in Malaysia. *International Journal of Computer Applications*, *8*, 11.
- Jin, B., & Moon, H. (2006). The diamond approach to the competetiveness of Korea's apparel industry. *Journal of Fashion Marketing & Management, 10*, 1361-2026.
- JLARC. (1998). Department of Corrections Dairy Farm Cost/ Benefit Analysis. Washington : State of Washington Joint Legislative Audit and Review Committee.
- Johnston, R., & Rosenberger, R. (2010). Methods, Trends and Controversies in the Contemporary Benefit Transfer. *Journal of Economic Surveys. 24,* 3, 479-510.
- Junyao Group. (2001). Dairy Cow Farming and Dairy Processing Project to Improve Employment and Elevate Poverty in Poorer Regions. China: UN Global Compact Case Study.
- Kammar, M. R., Sulagitti, A., Kadagi, M., & Biradar, A. P. (2019). An experience of hydroponics fodder production by farmers of Bagalkot district. *Journal* of *Pharmacognosy and Phytochemistry*, 8(1), 1033-1035.
- Karim, J. (2009). Emotional intelligence and psychological distress: Testing the mediatory role of affectivity. *Europe's Journal of Psychology*, *5*, 20-39.

- Karim, Z. M., Arumugam, N., & Bonaventure, B. (2016). The Sustainability Practices among Dairy Farmers: The Case of Johor. *International Journal of Agricultural Management and Development*, 6,1, 109-115.
- Kaur, S. (2019, July 17). Govt moo-ves to increase local dairy production. Retrieved from Star online: https://www.thestar.com.my/metro/metronews/2019/06/15/govt-mooves-to-increase-local-dairy-production/
- Khine, M. S., Fraser, B. J., Afari, E., Oo, Z., & Kyaw, T. T. (2018). Students' perceptions of the learning environment in tertiary science classrooms in Myanmar. *Learning Environments Research*, 21(1), 135-152.
- Kiminami, D. L. (2008). Promotion of dairy farming and poverty reduction in Inner Mongolia, China. *Agricultural Economic Review, 1*, 82-96.
- Kinfe, A., Temple, L., Vaast, P., & Iglesias, A. (2019). Innovation Systems to Adapt to Climate Change: Lessons from the Kenyan Coffee and Dairy Sectors. In W. L. Filho, *Handbook of Climate Change Resilience*. Springer International Publishing. doi:10.1007/978-3-319-71025-9_25-1
- Kline, R. B. (2005). *Principles and practice of structural equation modeling (2nd edn)*. New York: Guilford.
- Krauss, S. E. (2005). Research paradigms and meaning making: A primer. *The Qualitative Report, 10, 4*, 758-770.
- Kristen, S., & Kevin, D. (2010). Factors Impacting Dairy Profitability: An Analysis of Kansas Farm Management Association Dairy Enterprise Data. Kansas: Department of Agricultural Economics. Kansas State University.
- Latham, J. R. (2013). A framework for leading the transformation to performance excellence part I: CEO perspectives on forces, facilitators, and strategic leadership systems. *Quality Management Journal*, 20-22.
- Lau, S. (2019, July 17). *Better strategy for cattle farming*. Retrieved from Star Online: https://www.thestar.com.my/opinion/letters/2018/06/20/betterstrategy-for-cattle-farming/
- Lee, H., Summer, D. A., & Ahn, B. I. (2006). Consequences of Further Opening of the Korean Dairy Market. *Forthcoming in Food Policy, 31*, 238–248.
- Levitt, H. M., Bamberg, M., Creswell, J. W., Frost, D. M., Josselson, R., & Suárez-Orozco, C. (2018). Journal article reporting standards for qualitative primary, qualitative meta-analytic, and mixed methods

research in psychology: The APA Publications and Communications Board task force report. *American Psychologist*, 73(1), 26-46.

- Linn, M. (2011). Cost and benefit analysis: examples. *The Bottom Line*,24, 68-72.
- Livermore, A. M. (2011). Can cost-benefit analysis of environmental policy go global? *New York university environmental law journal 19*.
- Loch, A., & Rolfe, J. (2000). Irrigation development in the Fitzroy Basin: production and development tradeoffs, Valuing Floodplain Development in the Fitzroy Basin. *Research Report No.2*.
- Loch, A., & Rolfe, J. (2000). Irrigation development in the Fitzroy Basin: production and development tradeoffs, Valuing Floodplain Development in the Fitzroy Basin Research Report No.2. Central Queensland University, Emerald.
- Lorenzo, E. H.-C., Nally, J. E., Lindahl, J., Wanapat, M., Alhidary, I. A., Fangueiro, D., . . . Almeida, A. M. (2019). Dairy science and health in the tropics: challenges and opportunities for the next decades. *Tropical Animal Health and Production*, 1-9. doi:10.1007/s11250-019-01866-6
- MacDonald, J. M., O'Donoghue, E. J., McBride, W. D., Nehring, R. F., Sandretto, C. L., & Mosheim, R. (2007). Profits, Costs, and the Changing Structure of Dairy Farming. United States Department of Agriculture(USDA). *Economic Research Report, 47.*
- Mahirwe, A. M., & Wei, L. (2018). Investigation of Competitive Advantage of the Dairy Industry Cluster: The Case of Rwanda. *American Journal of Industrial and Business Management*, 8(05), 1358-1388.
- Maletic, J. I., & Marcus, A. (2005). *Data mining and knowledge discovery handbook.* Springer.
- Mangones, S. C., Fischbeck, P., & Jaramillo, P. (2017). Safety-related risk and benefit-cost analysis of crash avoidance systems applied to transit buses: Comparing New York City vs. Bogota, Colombia. *Safety science*, *91*, 122-131.

Marcoulides, G. A. (2006). PLS: A Silver Bullet? MIS Quarterly, 30, 2.

Mason, G., Ark, B. V., & Wagner, K. (1994). Productivity, product quality and workforce skills: food processing in four European countries. *National Institute Economic Review*, *147*, 62-83.

- Matthew, N. K., Shuib, A., Muhammad, I., Eusop, M. E., Ramachandran, S., Afandi, S. H., & Samdin, Z. (2018). Carbon Stock and Sequestration Valuation in a Mixed Dipterocarp Forest of Malaysia. *Sains Malaysiana 47*, *3*, 447–455.
- MCNally, R., & Othman, M. S. (2002). *Environmental Economics A Practical Guide*. UK: WWF & Malaysia: University Putra Malaysia.
- McQuitty, S. (2004). Statistical power and structural equation models in business research. *Journal of Business Research, 57*, 175-183.
- Mendon, S., Salins, M., & Aithal, P. S. (2018). Organic Agricultural Products: A Comparative Study of India with Other Economies. *International Journal* of Case Studies in Business, IT and Education (IJCSBE), 2(2), 86-97.
- Metro News. (2019, 18 July). *Promising growth for milk industry*. Retrieved from Star Online: https://www.thestar.com.my/metro/metronews/2019/04/15/promising-growth-for-milk-industry/
- MGCC. (2015). Potential and challenges of dairy products in the Malaysian market. Kuala Lumpur: EU-Malaysia Chamber of Commerce and Industry (EU-MCCI).
- Mishra, A., Wilson, C., & Williams, R. (2009). Factors affecting financial performance of new and beginning farmers. *Agricultural Finance Review, 69*, 160-179.
- Moran. (2012). Feeding Management of the Milking Herd. Malaysian Farm Management Note 7, 1-9.
- Moran. (2013). Addressing the key constraints to increasing milk production from smallholder dairy farms in tropical Asia. *International Journal of Agriculture and Biosciences*, 90-98. Retrieved from http://www.ijagbio.com/.../90-98.pdf
- Moran. (2013). Addressing the key constraints to increasing milk production from smallholder dairy farms in tropical Asia. *Int. J. Agric. Biosci., 2, 3*, 90-98.
- Moran, J. B., & Brouwer, J. W. (2013a). Feeding Management and Farmer Concerns about Constraints to Production on Malaysian Dairy Farms. *Inter J Agri.*
- Moran, J. B., & Brouwer, J. W. (2013b). Interrelationships between measures of cow and herd performance and farm profitability on Malaysian dairy farms. *Inter J Agri Biosci, 2, 5*, 221-233.

- Morse, J. M. (1991). Approaches to qualitative-quantitative methodological triangulation. *Nursing Research, 40*, 120-123.
- Mozaffarian, D., Liu, J., Sy, S., Huang, Y., Rehm, C., Lee, Y., & Micha, R. (2018). Cost-effectiveness of financial incentives and disincentives for improving food purchases and health through the US Supplemental Nutrition Assistance Program (SNAP): A microsimulation study. *PLoS medicine*, *15(10)*. doi:10.1371/journal.pmed.1002661
- Musa, Z. (2019, July 19). *Malaysia can save billions of ringgit by making own animal feed*. Retrieved from Star Online: https://www.thestar.com.my/business/businessnews/2017/09/14/malaysia-can-save-billions-of-ringgit-by-making-ownanimal-feed/
- NAP. (2011). *National Agro-food Policy (2011-2020)*. Kuala Lumpur: Ministry of Agriculture and Agrofood Industry.
- NAP3. (1999). Third National Agricultural Policy (1999-2010) Executive Summary. Kuala Lumpur: Ministry of Agriculture.
- Natalio, M. A., Faria, C. D., & Salmela, L. F. (2014). Content validation of a clinical assessment instrument for stair ascent and descent in individuals with hemiparesis. *Brazillian Journal of Physical Therapy*, 353-363.
- Neubio. (2018). ORGANIC WASTE MANAGEMENT FOR LIVESTOCK INDUSTRY.
- Ng, C. P., Law, T. H., Jakarni, F. M., & Kulanthayan, S. (2019). Road infrastructure development and economic growth. *In IOP Conference Series: Materials Science and Engineering* 512, (1), 1-10.
- Nizamuddin, Q. (2019, July 22). Veterinary Service in Malaysia: Its Relevance to nation building. Retrieved from vam: http://vam.org.my/home/wpcontent/uploads/2018/11/VAM-2018-Dato-Dr.-Quaza-Nizamuddin-KPPV.pdf
- NKEA. (2016, September 9). *Malaysian Ministry of Agriculture and Agro-Based Industry*. Retrieved from Agriculture National Key Economic Areas: http://etp.pemandu.gov.my/annualreport2011/12_National_Key_Econo mic_Areas-@-12_National_Key_Economic_Areas.aspx
- Noble, H., & Smith, J. (2015). Issues of validity and reliability in qualitative research. *Evidence-based nursing*, *18*(2), 34-35.

- Nor, N. A., Rosali, M. H., Nazmi, M. S., Zainol Abidin, A. Z., & Sulaiman, N. H. (2018). Adoption of Technology in Malaysia's Livestock Industry. *Malaysian Agricultural Research and Development Institute (MARDI)*. Retrieved from ap.fftc.agnet.org/ap_db.php?id=946&print=1
- Nunes, P. A., & Bergh, J. C. (2001). Economic valuation of biodiversity: sense or nonsense? *Ecological Economics* 39, 203-222.
- O'Brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & Quantity, 41*, 673-690.
- Obst, C., Hein, L., & Edens, B. (2016). National accounting and the valuation of ecosystem assets and their services. *Environmental and Resource Economics*, 64 (1), 1-23.
- OECD. (2006). Cost-Benefit Analysis and the Environment Recent Developments. The Organization for Economic Co-operation and Development (OECD).
- OECD/FAO. (2016). Dairy and Dairy Products, OECD-FAO Agricultural Outlook 2016-2025,. Paris: OECD.
- OECD-FAO. (2018, September 04). OECD-FAO Agricultural Outlook. Retrieved from OECD-FAO Agricultural Outlook: https://stats.oecd.org/Index.aspx?datasetcode=HIGH_AGLINK_2018#
- Ong, T. S., & Thum, C. H. (2013). Net Present Value and Payback Period for Building Integrated Photovoltaic Projects in Malaysia. International Journal of Academic Research in Business and Social Sciences, 153-171.
- Öz, Ö. (2002). Assessing Porter's framework for national advantage: the case of Turkey. *Journal of Business Research, 55*, 509-515.
- Panandam, J., & Raymond, A. (2005, July 21). Development of the Mafriwal dairy cattle of Malaysia. AGTR Case Study. *International Livestock Research Institute (ILRI)*. Retrieved from Development of the Mafriwal Dairy Cattle of Malaysia: http://agtr.ilri.cgiar.org/index.php?option=com_content&task =view&id=89&Itemid=106
- Pascual, U., Balvanera, P., Díaz, S., Pataki, G., Roth, E., Stenseke, M., & ... & Maris, V. (2017). Valuing nature's contributions to people: the IPBES approach. *Current Opinion in Environmental Sustainability*, *26*, 7-16.

- Pascual, U., Balvanera, P., Díaz, S., Pataki, G., Roth, E., Stenseke, M., & ... & Maris, V. (2017). Valuing nature's contributions to people: the IPBES approach. *Current Opinion in Environmental Sustainability*, 26, 7-16.
- Pei, C., & Wang, L. (2002). International competitiveness: concept formulation and analytical measurement. *China Industrial Economy, 169*, 41-45.
- Peng, Z. K. (2013). Towards an internationalized sustainable industrial competitiveness model. *Competitiveness Review: An International Business Journal*, 23, 95-113.
- Pett, M. A., Lackey, N. R., & Sullivan, J. J. (2003). *Making Sense of Factor Analysis: The use of factor analysis for instrument development in health care research.* California: Sage.
- Pew-MacArthur report. (2013). *states' use of cost-benefit analysis, Improving Results for Taxpayers.* The Pew Charitable Trusts.
- Pitts, E., O'Connell, L., & McCarthy, B. (2001). *The Competitiveness of the Irish Food Processing Industry*. Dublin: The National Food Centre, Dunsinea, Castleknock, Dublin 15.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Podsakoff, P. M., MacKenzie, S. B., LeeCommon method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*, *5*, 879-903.
- Pogue, M. (2004). Investment Appraisal: A New Approach. Managerial Auditing Journal, 19, 4, 565–570.
- Polit, D. F., & Beck, C. T. (2006). The Content Validity Index: Are You Sure You Know What's Being Reported? Critique and Recommendations. *Research in Nursing & Health, 29*, 489–497.
- Polit, D. F., Beck, C. T., & Owen, S. V. (2007). Focus on Research Methods Is the CVI an Acceptable Indicator of Content Validity? Appraisal and Recommendations. *Research in Nursing & Health, 30*, 459–467.
- Polit, D., & Beck, C. (2004). *Nursing research: Principles and methods (7th ed.)*. Philadelphia: Lippincott, Williams, & Wilkins.
- Popescu, A. (2014). Research on Milk Cost, Return and Profitability in Dairy Farming. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development. 14, 2.
- Porter, M. (1998). The Competitive Advantage of Nations (with the new introduction). New York, NY: The Free Press.

- Pratt, N. A., Staal, S., & Jabbar, M. (2005). *Explaining Dairy Development in South Asia.* Washington, DC: International Food Policy Research Institute.
- Rahman, M. (2019, July 23). *Rainfall in Malaysia 2008-2015.* Retrieved from ORtech: http://www.ortechnologies.net/blog/posts/rainfall-in-malaysia-2008-2015/
- Raji, M. Z., Karim, S. A., Ishak, F. A., & Arshad, M. M. (2017). Past and present practices of the Malay food heritage and culture in Malaysia. *Journal of Ethnic Foods* 4, 221e231.
- Rasby, R., & Funston, R. N. (2016). Invited review: Nutrition and management of cows: Supplementation and feed additives. *Professional Anim Scientist* 32, 135-144.
- Raymond, A. K., & Safullizam, A. K. (2010). The cattle artificial insemination industry in Malaysia. *Malaysia Journal of veterinary research*, *1*, *1*, 1-7.
- Razak, A. B. (2019, July 23). *The Daily Engineering & Construction News Malaysia's Road Infrastructure Development*. Retrieved from kkr.gov: http://www.kkr.gov.my/public/The%20Daily%20Engineering%20%26% 20Construction%20News%20-%20Malaysia%20-Artikel%20oleh%20TKSU%20DP.pdf
- Ready, R., & Navrud, S. (2005). Benefit Transfer. The Quick, the Dirty, and the Ugly? *Choices. 20, 3*, 195-199.
- Reinartz, W. J., Haenlein, M., & Henseler, J. (2009). An Empirical Comparison of the Efficacy of Covariance-Based and Variance-Based SEM. International Journal of Research in Marketing, 26, 332-344.
- Ringle, C. M., Sarstedt, M., & Straub, D. W. (2012). Editor's comments: a critical look at the use of PLS-SEM in MIS quarterly. *MIS Quarterly 36, 1*, 3-14.
- Ringle, C. M., Sven, W., & Jan-Michael, B. (2016, June 9). *SmartPLS 3. Bönningstedt: SmartPLS.* Retrieved from SmartPLS: http://www .smartpls.com
- Ritchie, J., & Spencer, L. (2002). Qualitative data analysis for applied policy research. *The qualitative researcher's companion*, *573*(2002), 305-329.
- Rizal, A., Sahidin, A., & Herawati, H. (2018). Economic value estimation of mangrove ecosystems in Indonesia. *Biodiversity International Journal*, 2(1), 98-100.

Rogerson, P. A. (2001). Statistical methods for geography. London: Sage.

- Rolfe, J., Loch, A., & Bennett, J. (2002b). Tests of benefit transfer across sites and population in the Fitzroy Basin, Valuing floodplain development in the Fitzroy Basin. *Research report, No. 4*.
- Rolfe, J., Loch, A., & Bennett, J. (2002b). Tests of benefit transfer across sites and population in the Fitzroy Basin, Valuing Floodplain Development in the Fitzroy Basin Research Report No.4. Central Queensland University, Emerald.
- Rosenberger, R., & Loomis, J. (2001). Benefit Transfer of Outdoor Recreation Use Values. A Technical Document Supporting the Forest Service Strategic Plan (2000 Revision). U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO.
- Rossiter, J. R. (2002). The C-OAR-SE procedure for scale development in marketing. *International Journal of Research in Marketing*, *19*, *4*, 305–335.
- Rothgeb, J., Willis, G., & Forsyth, B. (2007). Questionnaire pretesting methods: Do different techniques and different organizations produce similar results? *Bulletin of Sociological Methodology/Bulletin de Méthodologie Sociologique*, 96 (1), 5-31.
- Rotz, C. A. (2018). Symposium review: Modeling greenhouse gas emissions from dairy farms. *Dairy Sci. 101*, 6675–6690.
- Rubin, E. L. (2018). Regulatory Analysis and the Modern Concept of Law: A Response. *Am. UL Rev., 68, (1).*
- Ryan, P. A., & Ryan, G. P. (2002). Capital Budgeting Practices of the Fortune 1000: How Have Things Changed? . Journal of Business and Management.
- Sachin, J., & Gokhale, S. (2006). Status of mastitis as an emerging disease in improved and periurban dairy farms in India. *Annals of the New York Academy of Sciences 1081*, 74-83. doi:10.1196/annals.1373.007
- Sandor, K. (2003). Some Aspects for Raising of Economic Competitiveness of Dairy Farming. *Agriculturae Conspectus Scientificus, 68*, 169-172.
- Sandy, Q. Q., & Dumay, J. (2011). The qualitative research interview. *Research in Accounting & Management, 8 (3)*, 238-264.
- Schreiber, J. B. (2006). Reporting Structural Equation Modeling and Confirmatory Factor Analysis Results: A Review. *The Journal of Educational Research, 99*, 323-337.

- Seidel, J., & Klaus, U. K. (1995). Different Functions of Coding in the Analysis of Data. in K.U. Kelle ed., Computer Aieded Qualitative Data Analysis: Theory, Method and Practice. Thousand Oaks, CA: Sage.
- Selli, F., Eraslan, I. H., Chowdhury, D., & Sukumar, A. (2010). International Competitiveness: Analysis of Turkish Animal Husbandry: An Empirical Study in GAP Region. *Enterprise Risk Management*, 1, 1.
- Sen, A. K. (2000). The discipline of cost-benefit analysis. *Journal of Legal Studies, 29,* 931-952.
- Severino, P., Hoffmann, G., Ammon, C., Heuwieser, W., Levit, H., Halachmi, I., & Amon, T. (2019). Effect of two cooling frequencies on respiration rate in lactating dairy cows under hot and humid climate conditions. *Annals* of *Animal Science*. doi:10.2478/aoas-2019-0026
- Sidhu, B. K. (2019, July 23). Internet access for all, vows Gobind. Retrieved from Star Online: https://www.thestar.com.my/news/nation/2018/08/04/internet-accessfor-all-vows-gobind-move-expected-to-result-in-lower-broadbandprices-and-higher-spe/
- Silva, J. L., Sobreiro, V. A., & Kimura, H. (2018). Prepurchase financing pool: Revealing the IRR problem. *The Engineering Economist, 63(2),* 158-170.
- Sim, R. I., & Suntharalingam, C. (2015). Dairy Sector in Malaysia: A Review of Policies and Programs. Economics and Social Science Research Centre, Malaysian Agricultural Research and Development Institute (MARDI).
- Sim, R. M., & Suntharalingam, C. (2015). Dairy sector in Malaysia: a review of policies and programs. *Food & Fertilizer Technology Center Agricultural Policy Platform*. Retrieved from http://ap.fftc.agnet.org/ap_db.php?id=501
- Suhaimi, N. A., Mey, Y. D., & Lansink, A. O. (2017). A transaction cost analysis of Malaysian dairy farmers' marketing channel selection. *Towards Sustainable Agri-food Systems: Balancing Between Markets and Society.* Parma, Italy: EAAE.
- Suhaimi, N. A., Mey, Y. D., & Lansink, A. O. (2017). A transaction cost analysis of Malaysian dairy farmers' marketing channel selection. *Towards Sustainable Agri-food Systems: Balancing Between Markets and Society.* Parma, Italy: EAAE. Retrieved from https://ageconsearch.umn.edu/record/261436

- Suhaimi, N. A., Mey, Y. D., & Lansink, A. O. (2017). Measuring and explaining multi-directional inefficiency in the Malaysian dairy industry. *British Food Journal*, 119, 12, 2788-2803.
- Sun, Y., Liu, N., Shang, J., & Zhang, J. (2017). Sustainable utilization of water resources in China: A system dynamics model. *Journal of cleaner* production, 142, 613-625.
- Suntharalingam, C., & Ahmad, M. F. (2015a). Strategies addressing food security concerns within the Malaysian dairy industry. 6th Pan Commonwealth Veterinary Conference and the 27th Veterinary Association of Malaysia (PCVC6 & 27VAM). March 23-27, 2015. Kuala Lumpur, Malaysia (pp. 135-136). Kuala Lumpur, Malaysia: Commonwealth Veterinary Association and Veterinary Association Malaysia.
- Suntharalingam, C., Shanmugavelu, S., Graff, G., & Nor, A. S. (2015b). Characterizing innovation in the livestock industry: a Malaysian case. International Journal of Tropical Agriculture 33, no. 2, 879-885. Retrieved from https://www.cabdirect.org/cabdirect/abstract/20153336350
- Suntharalingam, C., Sithambaram, S., Graff, G., & Saari, N. A. (2015b). Characterizing Innovation in the Livestock Industry: A Malaysian Case. International Journal of Tropical Agriculture, 33, 2.
- Suntharalingam, C., Sithambaram, S., Graff, G., Ahmad, M. F., Saari, N. A., & and Saad, S. M. (2015c). Livestock innovations in Malaysia: Are we heading in the right direction? *10th MARDI Science and Technology Exhibition (MSTE), August 25-27.* Serdang, Selangor, Malaysia.
- Swisher, L. L., Beckstead, J. W., & Bebeau, M. J. (2004). Factor Analysis as a Tool for Survey Analysis Using a Professional Role Orientation Inventory as an Example. *Physical Therapy*, *84*, *9*, 784-799.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using Multivariate Statistics.* Boston: Pearson Education.
- Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education*, *48*(*6*), 1273-1296.
- Tashakkori, A., & Teddlie, C. (2003). Issues and dilemmas in teaching research methods courses in social and behavioural sciences: US perspective. *International Journal of Social Research Methodology 6 (1)*, 61-77.

- Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. International Journal of Medical Education, 2, 53-55.
- The World Bank Group. (2019, July 23). *The World Bank*. Retrieved from Access to electricity (% of population): https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS
- Thoma, G. J., Popp, D. W., Nutter, D. R., Shonnard, R., Ulrich, M. D., Matlock, D., . . . Adom. (2013). Greenhouse gas emissions from milk production and consumption in the United States: A cradle-to-grave life cycle assessment circa 2008. . *Int. Dairy J.* 31, 3-14.
- Thompson, B. (2004). *Exploratory and confirmatory factor analysis: understanding concepts and applications.* Washington, DC: American Psychological Association.
- Todde, G., Murgia, L., Caria, M., & Pazzona, A. (2017). Dairy Energy Prediction (DEP) model: A tool for predicting energy use and related emissions and costs in dairy farms. *Computers and Electronics in Agriculture 135*, 216– 221.
- Tsang, E. W. (2002). Acquiring knowledge by foreign partners from international joint ventures in a transition economy: learning-by-doing and learning myopia. *Strategic Management Journal, 23, 9*, 835-854.
- U.S. Department of Commerce. (2019, June 8). *Malaysia Agriculture Sector*. Retrieved from Export.gov: https://www.export.gov/article?id=Malaysia-Agricultural-Sector
- United Nations. (2018, June 24). *List of Countries by Population*. Retrieved from Statistic Times: http://statisticstimes.com/population/countries-bypopulation.php
- Urbach, N., & Ahlemann, F. (2010). Structural equation modeling in information systems research using partial least squares. *Journal of Information Technology Theory and Application, 11*, 5-40.
- Vaismoradi, M., Jones, J., Turunen, H., & Snelgrove, S. (2016). Theme development in qualitative content analysis and thematic analysis. *Jouranl of Nursing Education and Practice, 6, 5*, 100.
- VandeHaar, M. J., & St-Pierre, N. (2006). Major Advances in Nutrition: Relevance to the Sustainability of the Dairy Industry. *Journal of Dairy Science*, 89, 1280–1291.

- Waltz, C., Strickland, O., & Lenz, E. (2005). *Measurement in nursing and health research (3rd ed.).* New York: Springer.
- Warr, S., Rodriguez, G., & Penm, J. (2008). Changing food consumption and imports in Malaysia: opportunities for Australian agricultural exports. *ABARE research report 86*.
- Waverman, L. (1995). A critical analysis of Porter's framework on the competitive advantage of nations. *Research in Global Strategic Management*, *5*, 67-95.
- Wetzels, M., Odekerken-Schroder, G., & van Oppen, C. (2009). Using PLS path modeling for assessing hierarchi- cal construct models: guidelines and empirical illustration. *MIS Quarterly 33, 1*, 177-195.
- Whitehead, R. (2019, April 16). Artisanal dairy is slowly reaching Malaysia as more consumers plump for premium. Retrieved from dairyrsporten.com: https://www.dairyrsporten.com/Article/201 8/1 1/21/Ar1isanal-dairy-isslowly-reaching-Nlalaysia-as-more-ccnsumers-plump-for-premium
- Willaby, H. W., Costa, D. S., Burns, B. D., MacCann, C., & Roberts, R. D. (2015). Testing complex models with small sample sizes: A historical overview and empirical demonstration of what partial least squares (PLS) can offer differential psychology. *Personality and Individual Differences, 84*, 73-78.
- Williams, e. a. (2010). Exploratory factor analysis: A five-step guide for novices. Journal of Emergency Primary Health Care (JEPHC), 8, 3, 2010, Article 990399.
- Wilson, B. H. (2007). Modeling Reflective Higher-order Constructs Using Three ApproaChes with PLS Path Modeling: A Monte Carlo Comparison. Australian and New Zealand Marketing Academy Conference, (pp. 791-800). Otago, Australia.
- Wilson, M., & Hoehn, J. (2006). Valuing environmental goods and services using benefit transfer: The state-of-the art and science. *Ecological Economics*. *60, 2*, 335-342.
- Windle, J., & Rolfe, J. (2003). Valuing Aboriginal cultural heritage sites in central Queensland. *Australian Archaeology*, 35-41.
- Windle, J., & Rolfe, J. (2005). Designing a choice modelling survey to assess community values for better NRM outcomes in Queensland, Research Report for AGSIP Project #13. Economics and Natural Resource Management in Queensland.

- Wong, K. K. (2019). Mastering Partial Least Squares Structural Equation Modeling (Pls-Sem) with Smartpls in 38 Hours. iUniverse.
- Wynd, C., Schmidt, B., & Schaefer, M. (2003). Two quantitative approaches for estimating content validity. Western Journal of Nursing Research, 25, 508–518.
- Zamri-Saad, M., & Kamarudin, M. I. (2016). Control of animal brucellosis: The Malaysian experience. Asian Pacific Journal of Tropical Medicine, 9 (12), 1136-1140.
- Zerbe, J., Richard, O., & Allen, S. B. (2006). *A Primer for Benefit-Cost Analysis.* Cheltenham, Northampton: Edward Elgar Publishing.
- Zhanga, B., & Chena, B. (2016). Emergy-Based Cost-Benefit Analysis For Urban Biogas Project. *Energy Procedia*, 119 – 125.
- Zhao, J., & Wen, Y. (2004). Chinese Industrial Competitiveness Index System and Evaluation. Harbin: Dongbei University of Finance and Economics.
- Zhao, L. (2018). Determinants of Food Industry Competitiveness in China from the Perspectives of Porter's Diamond Model. In 3rd International Conference on Judicial, Administrative and Humanitarian Problems of State Structures and Economic Subjects (JAHP 2018) (pp. 281-286). Atlantis Press.
- Zhao, Y., & Li, J. (2007). Research on the Competitiveness of China's Transition of Economic Growth Mode. Beijing: Standards Press of China.