Volume and Issues Obtainable at Center for Sustainability Research and Consultancy

Review of Politics and Public Policy in Emerging Economies
ISSN: 2708-3829 (E): 2708-356X
Volume 1: No. 1, June 2019
Journal homepage: www.publishing.globalcsrc.org/rope

Structural Analysis of Factors Affecting Dairy Cattle Industry Development in Malaysia

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ARTICLE DETAILS

History
Revised format: May 2019
Available Online: June 2019

Keywords
SEM, Smart-PLS 3, Quantitative Approach, Cow, Dairy Cattle, Farm, Milk, Dairy Products, SSL

JEL Classification:
E31, O23

ABSTRACT

Malaysian dairy cattle industry has not produced enough quantity of dairy products to satisfy domestic market needs. Various initiatives were made by the government to improve the industry output for more than five decades; however, the results are yet to be materialized. Indeed, Malaysia is still one of the highest milk and dairy products importing countries in the world in terms of overall volume and per capita. The objective of this study is to investigate the most important factors influencing the dairy cattle industry development in Malaysia. A quantitative approach involving Structural Equation Modeling is applied to achieve the aim of this study. After testing the validity and reliability (based on Cronbach's alpha technique) of the original research instrument, the Structural Equation Modeling (SEM) is implemented to analyze the data by using 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 growth. Industry stakeholders such as farmers, policymakers and researchers may benefit from this study. Results of this study can be used as the guidance and roadmap in their future development policies, plans, projects, and studies.

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Recommended citation: Faghiri, H., Yusop, Z., Othman, M. H. & Krauss, S. E., (2019). Structural Analysis of Factors Affecting Dairy Cattle Industry Development in Malaysia. *Review of Politics and Public Policy in Emerging Economies*, 1(1), 23-42
DOI: 10.26710/rope.v1i1.1132

1. Introduction

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, March 2019). Historically and traditionally, the small-scale dairy cattle industry has begun since the beginning of the 20th century mostly by the Indian immigrants in Malaysia. However, the fluid fresh milk production had increased by 48.32% from 2007 to 2016, due to the population growth, higher income, and rapid urbanization, this industry did not grow and develop rapidly in line with the increasing market demand for dairy products during the current decade (FAO, March 2019; DVS, 2018; Sim & Suntharalingam, 2015; Dong, 2006). Additionally, the number of dairy cattle are decreased from 838,859 in 2010 to 744,174 in 2017 (DVS, 2018). Therefore, Malaysia is not known for its dairy farming and milk producing.

One of the important indexes related to the dairy cattle industry development is the self-sufficiency level (SSL). In fact, there are only a few countries have 100% SSL in dairy products. In contrast, not many countries have SSL less than 25% such as Malaysia with only 3.04% in the year 2016 (FAO, 2016, June; DVS, 2018). It means that the total Malaysia dairy industry is only able to meet 3.04% of the domestic market demand in that year which shows the very low level of the local production.

Furthermore, the issues are started from the farm level. For example, Malaysian farms achieve very poor result and performance such as only 10 kg milk/ day/ cow, compare to realistic 15 kg/ day/ cow, calving intervals around 15 to 18 months, instead of 12 to 15 months, first calving age around 30 to 33 months, rather than 24 to 27 months etc. (Moran & Brouwer, 2013a; Moran & Brouwer, 2013b). In fact, the potential saving from reducing the age of the first calving by 6 months can save around RM 1400 per heifer and improve calving interval by 3 months can generate RM 1150 per cattle. Additionally, 2 months increasing the lactation length can reap RM 760 per cattle (Moran & Brouwer, 2013a). Boniface, Silip, & Ahmad (2007) stated that the overall milk production and management system have not reached the level of satisfaction in Malaysia. Therefore, they recommended that farmers should improve the animal feed quality, and implement the proper animal health, production, and genetic recording system.

The Malaysian government has supported the dairy cattle farming industry for more than five decades. The Department of Veterinary Services (DVS) as the body of the government has tried to provide technical consultation, veterinary services, and breeding advice to farmers and the farmers only needed to prepare the land and labor (Boniface, Gyau, Stringer, & Umberger, 2010). However, the Ministry of Agriculture's agencies were not able to approach the targets and develop the industry (Sim & Suntharalingam, 2015). According to the last National Agro-Food Policy (NAP) for the period of 2011-2020, the government and policy maker focuses are more on the SSL, food safety, and security. Therefore, the Malaysian government has the vision of reducing further the level of the dairy products import and at the same time increasing the domestic dairy production. They also have the plan to get better access to the market information by using communication technologies (NAP, 2011).

In fact, the new strategy of the Malaysian government is to develop the dairy cattle industry under the Economic Transformation Program (ETP, 2015). They prepared an Entry Point Projects (EPP) that are considered part of the agriculture national key economic areas, EPP13 consists of establishing dairy clusters in Malaysia by collaborating with the large dairy companies. Thus, the smallholder farmers will integrate into some large clustered scale because the newly established anchor companies should adopt better technology and know-how knowledge to increase the level of the production and efficiency (NKEA, 2016).

Another aspect of dairy farming is breeding which has a very long background in Malaysia. Suntharalingam et al., (2015b), stated that the imported breeds show better genetic traits in adapting the tropical environment condition in the future because of the higher productivity level compares to the local breeds. However, the genetic resources of the local animals should be conserved and inventoried to prevent their extinction. Therefore, farmers import purebred dairy cattle such as Jersey and Holstein

Friesian to improve the production level. Though, these purebreds could not simply adopt the tropical environment and need high tech and modern buildings and equipment.

Milk categorizes as a highly perishable product and should send to the market after production immediately. This condition makes limited marketing flexibility for the milk compared to other livestock products. During the past two decades, the Malaysian government has tried to develop the dairy supply chain system with large amounts of investment and projects such as establishing plenty of Milk Collection Centers (MCCs) to support small-scale farmers. In fact, most of the farmers prefer to sell their products to the government-run Dairy Cattle Industry Service Centers (PPIT), however, the contract between the farmers and the MCC does not prevent them to sell their milk to other buyers and they could choose the best option (Suhaimi, Mey, & Lansink, 2017; Boniface, Gyau, Stringer, & Umberger, 2010). Therefore, the farmers receive different prices depending on who is the buyer (Boniface, 2012).

There are many factors such as price, accessibility, and culture influencing the of the milk and dairy products consumption per capita between the countries and even among the people of a country. Generally, the people of the modern and industrial countries consume more milk and dairy products (EU:250.19, Australia: 249.82, New Zealand: 241.88, US: 227.02, and Canada: 218.18 kg milk equivalent (ME), average consumption per capita in year 2018) in comparison to the developing and poor countries. However, the milk consumption per capita in many countries cannot reach even 10% of this volume today. Also, the global average of the milk consumption per capita is 117 kg in year 2018 (CLAL, 2019; IFCN, 2018). Although the DVS statistic report shows that milk consumption per capita increased from 25.85 kg in year 2013 to 37.99 kg in year 2016 (DVS, 2018), the dairy product consumption is much lower than the world average in Malaysia.

Malaysian dairy industry has faced many different challenges during the last few decades until the current time. According to the literatures, some of the most important factors influencing the dairy cattle farming process and development in Malaysia are insufficient number and dispersed distribution of the pure imported dairy cattle, low level of the lactation of the dairy cattle among local and imported cows, low record of the reproductive and calving performance of the local and imported cattle, inconsistent supply of suitable quality feed, high feed cost, poor dairy farm management, tropical and inappropriate climate and environmental conditions, inadaptability of the imported animals to local environmental conditions, lack of skills workers, Lack of knowledge, skills, and training, low productivity, lack of proper farm infrastructure, poor technical support service providers such as Artificial Insemination (AI), high level of investment risk (Suntharalingam & Ahmad, 2015a; Suntharalingam, Shanmugavelu, Graff, & Nor, 2015b; Suntharalingam, et al., 2015c; Sim & Suntharalingam, 2015; Jeyabalan, 2010; Shanmugavelu & Azizan, 2006; Abdullah, et al., 2017). Moreover, all of the applied government plans, strategies, policies are designed for the short period of time and there is no comprehensive long-term development plan which covers all aspects and challenges of the industry with a clear direction and road map (Sim & Suntharalingam, 2015; Panandam & Raymond, 2005; Shanmugavelu & Azizan, 2006).

As mentioned, previous studies have covered various aspects of the dairy cattle industry development and different parts of the farming process such as milk production, animal breeding and animal feed in Malaysia. However, many of them are reported repeatedly similar problems of the industry with the inabilities to reach the set targets. In fact, there was no comprehensive research to find out the overall factors influencing dairy cattle farming and distinguish their impact level on industry development. Therefore, the main aim of this paper is to explore all factors influencing dairy cattle industry development in Malaysia and highlight the importance level of each. Moreover, the findings of this study provide a clear road map for all stakeholders of this industry such as farmers, technical service providers, inputs distributors and especially the policymakers and governments for their future development plans and projects.

2. Methodology

This study employed the quantitative research method, utilizing the cross-sectional data collection. The measurement items have explored and extracted through qualitative research. Then, the original research instrument has drafted based on the findings in the qualitative approach and literature review. Then, the pretest was conducted through interviews with five experts who had an academic background and experience in dairy farming. Based on the pretest, the repeated items were removed, and the domains of some items have edited to avoid misinterpretation (Faghiri, Yusop, Othman, Krauss, & Mohamed, 2019). Next, Pilot-test has used to determine whether the instruments serve the aims for which it has been designed or whether further revisions and modifications are required based on the feedback received from the test (Maxfield & Earl, 2014; Sekaran & Roger, 2016). In this study, a pilot test was conducted among 31 respondents to measure the reliability of the questionnaire by employing the method of internal consistency. The values for Cronbach' Alpha (coefficient reliability) of the instrument have been greater than 0.797 in the pilot test. Therefore, all the constructs in the research instrument had internal consistency reliability in this study (Faghiri, Yusop, Othman, Krauss, & Mohamed, 2019).

The population of this research covers the whole stakeholders in the dairy cattle farming industry in Malaysia such as dairy cattle farmers, veterinaries, technical service providers, subsidiary industries, animal feed manufacturers, government departments, bank, and financial institutions. All participants should be involved in the dairy cattle industry directly and they should have the minimum one-year experience in the field of agriculture and dairy cattle farming industry. Table 1 shows the profile of the respondent of the questionnaire. According to table 1, among 114 participants, 34% were in the age range of 35 to 44, and around 30% in the range of 25-34. Additionally, 80.70% were male and, 51.76 % of them minimum had a university degree. More than 50% of them were Malay and work on the private farm.

Table 1. Respondent profile.

Age	Number of Participants	Percentage
18-24	15	13.16%
25-34	34	29.82%
35-44	39	34.21%
45-54	14	12.28%
55-64	11	9.65%
65<	1	0.88%
Gender		
Male	92	80.70%
Female	22	19.30%
Level of Education		
Primary School	1	0.88%
Secondary School	23	20.18%
The technical institution, Polytechnic	31	27.19%
University Degree	44	38.60%
Graduate Degree, Master, PhD	15	13.16%
Ethnic Background		
Malay	63	55.26%
Chinese	5	4.39%
Indian	45	39.47%
Kadazandusun	1	0.88%
Activity in Dairy Cattle Industry		
Government entity	35	30.43%
Private Farm	59	51.30%
University and training institute	15	13.04%
Vet clinic and Technical service provider	6	5.22%

The Structural Equation Modeling (SEM) is used for analysis to fulfill the objectives of the study. SEM methods have been used in many disciplines and have become an important method for analysis in scientific research (Byrne, 2010; Kline, 2005; Hair et al., 2010). For the purpose of the current study, the Partial Least Squares Structural Equation Modeling (PLS-SEM) and the computer software (Smart PLS 3) was used to test the acceptability of hypothetical statements (Marcoulides & Saunders, 2006). The reason for using PLS is predicting key target factors or identifying key 'driver' elements that are influencing dairy cattle farming in Malaysia and focusing on the most important ones. It also provides a high level of statistical power with small sample size. Further, PLS-SEM does not need a normal distribution assumption. This is an important point because the data for this study were collected from a population that does not have a normal distribution.

Moreover, Smart PLS 3 is a strong software that provides lots of analysis, algorithm tests which are necessary to evaluate the measurement and structural models such as Partial Least Squares (PLS) path modeling algorithm including consistent PLS (PLSc), Ordinary least squares regression based on sum scores, sample weighted data estimation, advanced bootstrapping options, discriminant validity testing using HTMT, and Hierarchical component models (second-order models). Hence, the most suitable software for this survey is the Smart PLS 3. (Ringle, Sven, & Jan-Michael, 2016; Chin, 1998b).

Reflective-formative Hierarchical component model (second-order models) have used in this research. Generally, Hierarchical model is characterized by (1) the number of levels (Rindskopf & Rose, 1988; Becker, Klein, & Wetzels, 2012) and (2) the relations (formative vs. reflective) between the latent variables (Edwards, 2001; Jarvis, MacKenzie, & Podsakoff, 2003; Ringle, Sarstedt, & Straub, 2012; Becker, Klein, & Wetzels, 2012; Wetzels, Odekerken-Schroder, & van Oppen, 2009). Normally, a higher order construct is the general concept for the Hierarchical model that characterizes the reflective or formative relationship with its lower order constructs. The reflective indicators reflect the effect of the latent variable. In fact, the reflective indicators should change when their latent variable or construct change because of the latent variable or construct form or caused by them. Thus, all the reflective indicators of a particular latent variable should be correlated positively (Bollen, 2011; Chin, 2010). In contrast, the formative indicators reflect the conditions under the latent variable. In fact, the formative indicators form or cause the construct or latent variable (Chin, 2010) and there is no direct relationship between the latent variable and formative indicators.

In this study, the reflective-formative second-order model used for accomplishing the aims of the research. It is the most suitable model for this research because the manifested variables (indicators) have a reflective relationship with their own construct (factors influencing the Dairy Cattle Industry). But these lower order constructs have the formative relationship with the higher order construct or dairy cattle industry development in Malaysia. As there is no observed variable for the higher order construct, the repeated indicator approach has been utilized. Becker et al. (2012), indicated that the repeated indicator approach is the best approach for reflective-formative hierarchical latent variables because it has the capability to take all of the homological networks and evaluate all constructs simultaneously. Thus, it delivers generally less biased outcomes, more reliable higher order construct score and more precise parameter estimates. Therefore, this approach is used in this study to estimate the relationship between the indicators and the lower and higher order constructs.

3. Results

3.1. Exploratory Factor Analysis (EFA)

EFA (Exploratory Factor Analysis) is used as the measurement refinement and initial analysis method in this study. We applied both Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity methods to determine the appropriateness of the data for EFA. Table 2 shows the results of the KMO and Bartlett's Test of Sphericity.

Table 2. KMO and Bartlett's Test results.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy. (KMO)		.919
Bartlett's Test of Sphericity	Approx. Chi-Square	3223.447
	Df	561
	Sig.	<0.001

The KMO index range is between 0 to 1 of which 0.50 and greater is considered suitable data for EFA (Kaiser, 1970; Tabachnick & Fidell, 2012; Williams, Brown, & Onsman, 2010; Hair, Anderson, Tatham, & Black, 1995). The KMO index for this data is 0.919 that means the sample is adequate for EFA. The result of Bartlett's Test of Sphericity should be significant ($p < .05$) to prove the appropriability of the data set for EFA (Williams, Brown, & Onsman, 2010; Hair, Anderson, Tatham, & Black, 1995; Tabachnick & Fidell, 2012; Angrecka, Herbut, Nawalany, & Sokołowski, 2017). The P value for the collected data for this study was <0.001 which shows the significant level. Therefore, the sample was suitable for EFA because it satisfied in all tests and their requirements.

For criteria of determining factors extraction, the cumulative percentage of variance (criterion) was applied in this study. The results explained that 6 factors out of 34 questions have eigenvalues more than one with 70.37% cumulative variance. This implies that these 6 items explained 70.37% of the variance. Table 3 shows the result of the total variance explained for the set of the data.

Table 3. Total variance explained.

Extraction Sums of Squared Loadings				Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	16.883	49.654	49.654	6.112	17.977	17.977
2	1.712	5.036	54.691	4.408	12.965	30.942
3	1.655	4.869	59.560	4.239	12.469	43.411
4	1.420	4.178	63.738	3.321	9.769	53.180
5	1.198	3.524	67.261	2.969	8.732	61.912
6	1.058	3.112	70.373	2.877	8.461	70.373

The next consideration for EFA is the rotation technique. The result of Orthogonal Varimax expressed the pattern for the questions that needed labeling and interpretation. Therefore, the questions of the research instrument were grouped according to the EFA's results and classified under major labels (domains). According to the findings there were 6 latent variables which were labeled as 1- Land, Climate and Logistic (LCL); 2- Feed and Breed (FB); 3- Knowledge (KN); 4- Human Resource (HR); 5- Industry Business Environment (IE); and 6- Government (G). Table 4 shows the rotated component matrix with the labels and the content of the question for each individual item.

Table 4. Rotated component matrix with the labels.

Labe	1	2	3	4	5	6	Questions content

l							
LCL1	0.797						Cost- Land for planting the grass
LCL2	0.789						Cost- Land for building the farm
LCL3	0.738						Access- Land for building the farm
LCL4	0.725						Access- Land for planting the grass
LCL5	0.708						Land for planting the grass
LCL6	0.635						Land for building the farm
LCL7	0.534						Climate
LCL8	0.532						Cost- Logistics and transportation
LCL9	0.492						Logistics and transportation
FB1		0.705					Animal feed (concentrate)
FB2		0.705					Access- Animal feed (concentrate)
FB3		0.621					Cost- Good cow breed
FB4		0.607					Cost- Animal feed (concentrate)
FB5		0.583					Animal feed (grass)
FB6		0.562					Cow Breed
KN1			0.722				Access- knowledge of farming
KN2			0.664				Farm management system and KPI (Key Performance Indicator)
KN3			0.645				Farm building design
KN4			0.623				knowledge of farming
KN5			0.457				Qualification of the farming applicant
HR1							Access- Vet clinic services
HR2				0.753			Vet clinic services
HR3				0.678			Access- Technical service provider
HR4				0.629			technical service provider
HR5				0.604			farm manager
HR6				0.51			Skilled worker

				5			
IE1					0.756		Cow festival
IE2					0.698		Milk price rivalry
IE3					0.673		Farm organization chart and job distribution
IE4					0.494		Control the import policies
G1						0.725	Capital resources
G2						0.624	Access- Capital resources
G3						0.526	Development policies
G4						0.499	Good production policies

3.2 Measurement Model Analysis

Measurement model analysis in Smart PLS consists of different analyses such as discriminant validity, internal consistency, and convergent validity. In fact, the discriminant validity methods use the empirical standards to suggest that a construct is unique in that model and the particular phenomenon is not characterized by other constructs (Hair, Hult, Ringle, & Sarstedt, 2017). For testing discriminant validity, Cross-Loadings Assessment method, Fornell, and Larcker criterion, and Heterotrait Monotrait (HTMT) criterion have been used in this study.

3.2.1 Cross-Loadings Assessment

According to Hair et al. (2017), the outer loadings for indicators on a construct should have a higher value than all its cross-loadings with other constructs. Additionally, the cross-loading scores have to be different by 0.1 to prove the uniqueness and discriminant validity. The results showed that the cross-loading value of "Access-Vet clinic services" (HR1) was equal to 0.721 in its own construct while the values for other constructs were FB= 0.664, G= 0.679, IE= 0.579, KN= 0.710, and LCL= 0.673. The comparison between the values displayed that the HR1 value of the cross loading for its own construct was higher than all of the values in other constructs. But the difference of this value was not more than 0.1 for the FB, G, KN, and LCL. Therefore, this indicator did not fully fill the requirement for discriminant validity and was removed from the items in this model. Another indicator that had a cross loading issue was "knowledge of farming" (KN4). The value of the KN4 cross-loading for KN construct was 0.824 while the value for G construct was 0.737. However, the cross-loading value for KN4 in KN construct was higher than the value in G construct by only 0.087. So, this item could not pass the discriminant validation minimum requirement condition. Therefore, this indicator is also removed from the items of this model. Table 5 demonstrates the indicators and cross loading results after removing the mentioned items.

Table 5. Loading and cross loading of constructs.

Indicator	FB	G	HR	IE	KN	LCL
FB1	0.863	0.543	0.597	0.472	0.704	0.632
FB2	0.824	0.537	0.541	0.468	0.579	0.565
FB3	0.749	0.455	0.470	0.453	0.487	0.528
FB4	0.787	0.516	0.609	0.498	0.579	0.603
FB5	0.856	0.610	0.634	0.473	0.606	0.758
FB6	0.820	0.557	0.575	0.547	0.696	0.741
G1	0.509	0.728	0.373	0.304	0.416	0.469
G2	0.537	0.861	0.527	0.525	0.640	0.627
G3	0.529	0.866	0.529	0.540	0.589	0.584
G4	0.622	0.874	0.520	0.591	0.671	0.678
HR2	0.513	0.345	0.770	0.402	0.440	0.489
HR3	0.586	0.495	0.791	0.463	0.458	0.552
HR4	0.454	0.390	0.746	0.475	0.330	0.481
HR5	0.556	0.466	0.787	0.530	0.511	0.499
HR6	0.599	0.564	0.793	0.526	0.626	0.651
IE1	0.398	0.403	0.480	0.804	0.371	0.398
IE2	0.372	0.455	0.473	0.759	0.485	0.446
IE3	0.497	0.451	0.514	0.801	0.514	0.537
IE4	0.552	0.537	0.451	0.739	0.416	0.559
KN1	0.521	0.590	0.480	0.499	0.844	0.630
KN2	0.606	0.586	0.432	0.440	0.825	0.530
KN3	0.680	0.549	0.519	0.397	0.835	0.653
KN5	0.645	0.586	0.587	0.559	0.779	0.676
LCL1	0.677	0.590	0.570	0.484	0.600	0.876
LCL2	0.609	0.577	0.551	0.505	0.589	0.845
LCL3	0.628	0.660	0.582	0.538	0.616	0.875
LCL4	0.613	0.556	0.702	0.541	0.535	0.855
LCL5	0.749	0.628	0.596	0.510	0.671	0.890
LCL6	0.590	0.596	0.641	0.542	0.697	0.837
LCL7	0.637	0.488	0.465	0.448	0.625	0.702
LCL8	0.714	0.630	0.515	0.600	0.692	0.801
LCL9	0.657	0.592	0.552	0.555	0.670	0.776

3.2.2 Fornell-Larcker Criterion

This method is the second approach to examining the discriminant validity. It is based on a comparison between the square root of the Average Variance Extracted (AVE) and the latent variable correlation. A particular construct has discriminant validity when the square root of each construct's AVE is more than its maximum correlation value with any other construct. This means that a construct shares more variance with its own indicators than other constructs (Hair, Hult, Ringle, & Sarstedt, 2017). Based on the results exhibited in Table 6, the value of AVE for each construct is greater than its highest correlation value with other constructs. Hence, all of the constructs had adequate discriminant validity.

Table 6. Fornell-Larcker criterion results.

Construct	FB	G	HR	IE	KN	LCL

FB	0.817					
G	0.659	0.834				
HR	0.702	0.590	0.778			
IE	0.594	0.600	0.619	0.776		
KN	0.749	0.704	0.619	0.579	0.821	
LCL	0.787	0.713	0.694	0.633	0.762	0.831

3.2.3 HTMT Criterion

Heterotrait Monotrait (HTMT) consists of between-trait correlations to the within-trait correlations ratio. This method estimates what the actual correlation between two constructs would be when they measured perfectly which states have disattenuated correlation (Hair, Hult, Ringle, & Sarstedt, 2017). Two constructs in a model with similar conceptual constructs have the discriminant validity when the value of the disattenuated correlation between them is less than 0.9 (Gold, Malhotra, & Segars, 2001; Hair, Hult, Ringle, & Sarstedt, 2017; Henseler, Ringle, & Sarstedt, 2015). Table 7 exhibits the results of the Heterotrait Monotrait (HTMT) Criterion. All values of the disattenuated correlation between constructs were less than 0.9. it means that all of the constructs had the discriminant validity.

Table 7. Heterotrait Monotrait (HTMT) Criterion.

Construct	FB	G	HR	IE	KN
G	0.749				
HR	0.799	0.682			
IE	0.699	0.715	0.761		
KN	0.854	0.821	0.720	0.708	
LCL	0.848	0.788	0.773	0.729	0.854

3.3 Structural Model Analysis

This part contains examining the prediction capabilities of the model and the relationship among constructs.

3.3.1 Collinearity Validity

Variance Inflation Factor (VIF) is the measuring method to evaluate the collinearity. In fact, it is the reciprocal of tolerance. A VIF value equal or lower than 5 indicates that there is no collinearity problem (Hair, Ringle, & Sarstedt, 2011; Hair, Hult, Ringle, & Sarstedt, 2017; O'Brien, 2007; Rogerson, 2001). The estimated VIF values for the items were between 1.365 to 4.563 in this study. Thus, all of them are lower than 5 and there was no potential for collinearity among the items in this study. Table 8 shows the VIF values for the data set of this study.

Table 8. Collinearity assessment for indicators.

Item	**VIF**	**Collinearity (VIF < 5.0)**
FB1	2.817	No collinearity
FB2	2.453	No collinearity
FB3	1.954	No collinearity
FB4	2.109	No collinearity
FB5	2.724	No collinearity
FB6	2.386	No collinearity
G1	1.738	No collinearity
G2	2.346	No collinearity
G3	2.731	No collinearity
G4	2.887	No collinearity
HR2	1.809	No collinearity
HR3	1.793	No collinearity
HR4	1.612	No collinearity
HR5	1.803	No collinearity
HR6	1.692	No collinearity
IE1	1.785	No collinearity
IE2	1.594	No collinearity
IE3	1.581	No collinearity
IE4	1.365	No collinearity
KN1	2.380	No collinearity
KN2	2.182	No collinearity
KN3	1.940	No collinearity
KN5	1.581	No collinearity
LCL1	4.563	No collinearity
LCL2	3.604	No collinearity
LCL3	4.092	No collinearity
LCL4	3.617	No collinearity
LCL5	3.791	No collinearity
LCL6	3.164	No collinearity
LCL7	2.004	No collinearity
LCL8	2.572	No collinearity
LCL9	2.150	No collinearity

3.3.2 Significant Outer Loads and The Effect of The Items

In Outer Loadings, the high values of a construct demonstrate that the related indicators have much in common with the associated construct captured. The values of the outer loading are defined as the indicator reliability which all should be statistically significant. The rule of thumb for outer loading is that their values should be greater than 0.70 to be considered statistically significant for social science studies (Hair, Hult, Ringle, & Sarstedt, 2017; Hulland, 1999). According to the table 9, the values of all outer loadings in this study were greater than 0.7 and between 0.702 to 0.874 and all of them are statistically significant. Additionally, all path coefficients were significant because all P values were less than 0.01. the lowest coefficient interval 95% was 0.123 and the highest was 0.418 which means that in any condition and any other sampling from the same population of this study the direct effect will have not to exceed these values.

Table 9. Significant Outer Load for all Constructs.

Item	Outer Loading	SE	T Value	P Value	confidence interval 95% (Lower)	confidence interval 95% (Upper)	Statement
FB1<FB	0.863	0.035	24.349	<0.001	0.778	0.916	Animal feed (concentrate)
FB5<FB	0.856	0.036	23.634	<0.001	0.771	0.911	Animal feed (grass)
FB2<FB	0.824	0.043	19.144	<0.001	0.72	0.889	Access- Animal feed (concentrate)
FB6<FB	0.820	0.046	17.998	<0.001	0.713	0.89	Cow breed
FB4<FB	0.787	0.041	19.245	<0.001	0.697	0.859	Cost- Animal feed (concentrate)
FB3<FB	0.749	0.053	14.061	<0.001	0.63	0.841	Cost- Good cow breed
G4<G	0.874	0.029	30.224	<0.001	0.808	0.920	Good production policies
G3<G	0.866	0.033	26.193	<0.001	0.786	0.914	Development policies
G2<G	0.861	0.033	26.397	<0.001	0.782	0.909	Access- Capital resources
G1<G	0.728	0.077	9.396	<0.001	0.543	0.843	Capital resources
HR6<HR	0.793	0.044	17.944	<0.001	0.69	0.86	Skilled worker
HR3<HR	0.791	0.049	16.121	<0.001	0.678	0.867	Access- Technical service provider
HR5<HR	0.787	0.05	15.746	<0.001	0.666	0.86	farm manager
HR2<HR	0.77	0.053	14.568	<0.001	0.648	0.851	Vet clinic services
HR4<HR	0.746	0.067	11.198	<0.001	0.59	0.851	technical service provider
IE1<IE	0.804	0.046	17.313	<0.001	0.691	0.872	Cow festival
IE3<IE	0.804	0.05	16.05	<0.001	0.683	0.879	Farm organization chart and job distribution
IE2<IE	0.804	0.051	14.735	<0.001	0.644	0.842	Milk price rivalry
IE4<IE	0.804	0.062	11.922	<0.001	0.599	0.839	Control the import policies
KN1<KN	0.844	0.038	22.395	<0.001	0.755	0.901	Access-knowledge of farming
KN3<KN	0.835	0.052	16.203	<0.001	0.701	0.903	Farm building design
KN2<KN	0.825	0.047	17.61	<0.001	0.709	0.889	Farm management system and KPI
KN5<KN	0.779	0.053	14.672	<0.001	0.651	0.863	Qualification of the farming applicant
LCL5<LCL	0.89	0.031	29.116	<0.001	0.813	0.933	Land for planting the grass
LCL1<LCL	0.876	0.038	23.019	<0.001	0.78	0.928	Cost- Land for planting the grass
LCL3<LCL	0.875	0.028	30.771	<0.001	0.811	0.921	Access- Land for building the farm
LCL4<LCL	0.855	0.044	19.385	<0.001	0.746	0.917	Access- Land for planting the grass
LCL2<LCL	0.845	0.041	20.81	<0.001	0.746	0.905	Cost- Land for building the farm
LCL6<LCL	0.837	0.05	16.608	<0.001	0.72	0.914	Land for building the farm
LCL8<LCL	0.801	0.045	17.83	<0.001	0.695	0.869	Cost- Logistics and transportation
LCL9<LCL	0.776	0.053	14.658	<0.001	0.658	0.864	Logistics and transportation
LCL7<LCL	0.702	0.079	8.837	<0.001	0.52	0.829	Climate

3.3.3 Path Coefficients

Before assessing the Path coefficient results, the structural model collinearity was examined for the constructs. As mentioned, the measuring method to evaluate the collinearity is the VIF. A VIF value equaling or lower than 5 indicates that there is no collinearity problem (Hair, Ringle, & Sarstedt, 2011; Hair, Hult, Ringle, & Sarstedt, 2017; O'Brien, 2007; Rogerson, 2001). Table 10 illustrates that the highest value of the VIF among all constructs is belonged to the LCL, with 3.765 which was lower than 5. Therefore, there was no potential of collinearity problem among the constructs in this study.

Table 10. Collinearity assessment for constructs.

Construct	VIF	Collinearity (VIF < 5.0)
FB	3.392	No collinearity
G	2.470	No collinearity
HR	2.387	No collinearity
IE	1.978	No collinearity
KN	3.057	No collinearity
LCL	3.765	No collinearity

Figure 1 and table 11 displays the relationship between the lower order construct and the higher order construct. According to the findings, the most important factor in the dairy cattle industry development was LCL (Land, Climate and Logistic) with 0.368 direct effects. The second important aspect was FB (Feed and Breed) with 0.226 direct effects on DI (Dairy Cattle Industry Development). The HR (Human Resource) was the third important factor with 0.155 direct effects on DI. The KN (Knowledge) and G (Government) had a direct effect on DI with 0.146, and 0.143, respectively. The last but not the least aspect is the IE with 0.113 direct effects on DI. Additionally, all path coefficients were significant because all P values were less than 0.01. the lowest coefficient interval 95% was 0.123 and the highest was 0.418 which means that in any condition and any other sampling from the same population of this study the direct effect will have not to exceed these values.

Table 11. Path Coefficient.

PATH	Direct Effect (ß)	SE	T Value	P Value	confidence interval 95% (Lower)	confidence interval 95% (Upper)
FB -> DI	0.226	0.015	15.538	<0.001	0.201	0.258
G -> DI	0.143	0.012	12.108	<0.001	0.125	0.171
HR -> DI	0.155	0.010	15.280	<0.001	0.133	0.173
IE -> DI	0.113	0.011	10.699	<0.001	0.092	0.135
KN -> DI	0.146	0.011	13.477	<0.001	0.123	0.166
LCL -> DI	0.368	0.020	18.019	<0.001	0.337	0.418

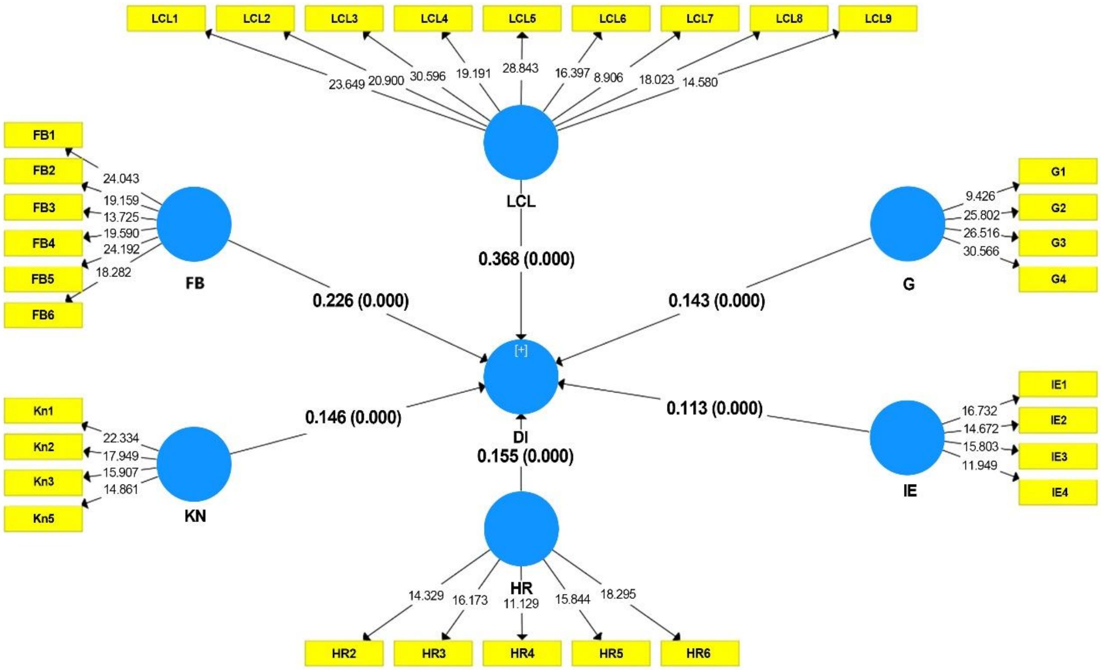

Figure 1. Illustration of indicator approach.

4. Discussion

Malaysian dairy industry still remains undeveloped because it has faced many different challenges during the last few decades (Sim & Suntharalingam, 2015). As mentioned, the previous studies only covered various aspects of the dairy cattle industry. However, this study tried to explore the overall factors influencing the dairy industry in Malaysia and highlight the impact of each on the industry. Additionally, the results can use in the future development plan as the guidance and roadmap by farmers, policymakers and governments and the rest of the industry stakeholders.

The findings (factors influencing dairy industry development) are categorized in several groups with different impact level and the effect of the items under each construct to the industry development. The most important group of factors was Land, Climate and Logistic. Additionally, the important items which they have the most effect on this construct respectively were land for planting the grass, cost of the land for planting the grass, access to the land for building the farm, access to the land for planting the grass, cost of the land for building the farm, land for building the farm, cost of the logistics and transportation, logistics and transportation in general, and climate. Truly, land has the main and basic role in the dairy cattle industry development. It is very difficult to find a proper piece of land with reasonable price for dairy farming and planting the grass in Malaysia. Additionally, logistic is one of the major issues mostly for the smallholder farmers because they cannot afford to buy the animal feed and other inputs in bulk (Faghiri, Yusop, Othman, Krauss, & Mohamed, 2019; Suntharalingam, Shanmugavelu, Graff, & Nor, 2015b; Sim & Suntharalingam, 2015). Therefore, the policymakers should find a solution to allocate adequate land to support the farmers and develop the dairy industry. Additionally, the new methods of agriculture such as vertical farming and hydroponic should propose by researchers to increase productivity per unit area of cultivated land. Climate condition is the next important challenge under this construct. In fact, the tropical climate has a negative impact on dairy cattle performance. Consequently, different types of cowsheds and their location, climate control building designs, materials, and equipment are innovated and used in dairy farms such as fog system, circulation fan, and full isolated close house barn around the world. (Lorenzo, et al., 2019; Abel & Reynoso-Palomar, 2019; Sachin & Gokhale, 2006;

Kinfe, Temple, Vaast, & Iglesias, 2019; Pinto, et al., 2019; Angrecka, Herbut, Nawalany, & Sokołowski, 2017). Therefore, the researchers could examine the different climate control systems and suggest the most practical climate control design and materials to the Malaysia government and farmers in the future.

The second important aspect of this study was Feed and Breed. Among all items in this construct, the animal feed (concentrate) had the highest effect on the industry development. The next items were animal feed (grass), access to the animal feed (concentrate), cow breed in general, cost of the animal feed (concentrate), and cost of the good and high-quality cow breed. Sim and Suntharalingam (2015) stated that the inconsistent access to good quality animal feed, the high price of quality feed, lack of proper feed management system, imported dairy cows with low reproduction performance and lactation capacity were the current challenges of the dairy cattle farming development in Malaysia. Future studies may apply on the role of the quality animal feed on the lactation and reproduction performance and try to provide appropriate feed management system with the aim of reducing the animal feed cost and increasing the efficiency and yield. Moreover, the areas such as genetics, crossbreeding, performance recording system, Artificial Insemination (AI) should cover by the researchers in the future.

Human Resource was the third important group for the development of the dairy cattle industry in Malaysia. According to the results, the most important aspect of this construct was skilled worker. The next important factors were Access to the technical service provider, farm manager, vet clinical services, and animal husbandry technical service provider respectively. Moreover, lack of proper human resources such as skilled worker, technical service has mentioned as one of the most important challenges of the dairy cattle industry in Malaysia in previous researches (Abdullah, et al., 2017; Sim & Suntharalingam, 2015; Moran, 2013). Therefore, the linkage between the researchers and farmers need to be strengthened due to the effective transfer of knowledge. In fact, the future studies topics would be about finding the proper ways of transferring the knowledge to the farmers to enhance their skills and support industry development.

The next important factor for developing the dairy industry is Government. In this construct, good production policies had the most effect and development policies, access to the capital resources, and capital resources in general had the next stronger effects' levels respectively. In fact, Malaysian government has supported the dairy cattle farming industry for more than five decades, while, they could not reach their targets and develop the industry (Boniface, Gyau, Stringer, & Umberger, 2010; Sim & Suntharalingam, 2015; NAP, 2011; ETP, 2015; Suhaimi, Mey, & Lansink, 2017). It was happened because of many reasons. The reasons for the failure of the government to develop the dairy industry and the loss of resources and forces can be the subject of future research. Additionally, the researchers should provide and suggest the academic and practical solutions to the DVS for developing this industry. The government also need to prepare and apply appropriate development policies based on the research and studies such as allocating the proper piece of land for dairy farming and planting the grass in the future.

One of the important constructs in this study was the Knowledge which covered the different aspects of the information in the dairy farming industry. The knowledge I general had the highest direct effect on dairy industry development in Malaysia. Respectively, access to the knowledge of farming, farm building design, farm management system and KPI (Key Performance Indicator), qualification of the farming applicant had the most effects on the dairy industry. Sim and Suntharalingam (2015) mentioned the importance of the knowledge in dairy cattle industry development and suggested to strengthen the communication linkages between researchers and farmers, workers and farm organizations for effective transfer of knowledge. Moreover, they emphasized the necessity of modern technology and design coupled with effective training plans to enhance farmers' skills and knowledge, resulting in the improved local dairy industry. In fact, the main issue is not the lack of knowledge since there are many veterinary schools, universities and veterinarians and animal scientists in Malaysia. The major problem is the gap between academics and farmers. Therefore, future studies incorporating the essential training materials and programs to provide a strong bond between researchers and farmers. These studies will facilitate knowledge transfer from universities and schools to dairy farms. Therefore, the farmers will have better access to the knowledge, modern farm design, farm management system and so on in the future.

Industry Environment is the last construct in this study which has the lowest effect on the dairy industry development in Malaysia; however, it contains significant items. The items cow festival, farm organization chart and job distribution, milk price rivalry system, and control the import policies have the most effect on the Industry development respectively. Actually, a large number of agricultural exhibitions and conferences are held annually in Malaysia such as Agri Malaysia, International Conference on Agricultural and Food Sciences (Agripace), International Conference on Agricultural and Biological science (ICABS), Livestock Malaysia, and Feeds & Livestock Malaysia (IMS, 2019; Expoglobe, 2019; 10times, 2019); however, they do not have tangible effect on the dairy industry developed. Additionally, most of the Malaysian dairy farms do not have a proper organization chart and job distribution. There is no milk price rivalry in Malaysia since the local production level is very low and the government has the only way to import dairy products to fulfill the local market demand (Faghiri, Yusop, Othman, Krauss, & Mohamed, 2019; Sim & Suntharalingam, 2015). In fact, the factors of this construct will be useful when the other mentioned problems are resolved, and the dairy industry is on the right growth path.

In conclusion, there are plenty of different challenges involved in the development of the dairy cattle industry in Malaysia. this study explored the overall factors influencing dairy cattle industry development in Malaysia and distinguished the importance level of them. The results of this study provide a comprehensive picture of the Malaysian dairy industry and a clear road map and guidance for the future dairy industry development plan in Malaysia. In fact, it is very important that all major players in the industry such as the government, farmers, schools and other supporting and related industries work more closely together and make an attempt to find the proper development plans and policies to address the explored challenges one by one and based on their impact level. The government can provide supportive policies to solve major issues such as land and so on. The farmers can create a Non-governmental organization (NGO), group and corporative entities to support one another and exchange the knowledge and experiences to improve the environment of the industry. The future research should cover the aspects of mentioned main factors and their subset items deeply to provide practical recommendations and solution for government and farmers.

Author Contributions: Conceptualization, Hamed Faghiri and Mohdshahwahid Hj Othman; Data curation, Hamed Faghiri; Formal analysis, Hamed Faghiri; Investigation, Hamed Faghiri; Methodology, Hamed Faghiri and Mohdshahwahid Hj Othman; Resources, Hamed Faghiri; Supervision, Zulkornain Yusop , Mohdshahwahid Hj Othman, Steven Eric Krauss and Zainalabidin Mohamed; Validation, Hamed Faghiri, Zulkornain Yusop , Mohdshahwahid Hj Othman, Steven Eric Krauss and Zainalabidin Mohamed; Writing – original draft, Hamed Faghiri; Writing – review & editing, Hamed Faghiri, Zulkornain Yusop and Steven Eric Krauss .

Funding:
This research received no external funding.

Acknowledgments:
The authors thank the Department of Veterinary Services Malaysia (DVS) and Mr. Amurthalingam Muthiah for their help in the data collection process, Dr. Mahmoud Danae for his support in data analysis of this research, and Alis Nerindo for his help for graphic design.

Conflicts of Interest: The authors declare no conflict of interest.

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