Jurnal Manajemen & Agribisnis, Vol. 18 No. 2, July 2021
Permalink/DOI: http://dx.doi.org/10.17358/jma.18.2.156

Available online at
http://journal.ipb.ac.id/index.php/jmagr

CRAFTING DESIGN STRATEGY ON SEAWEED INDUSTRY IN INDONESIA

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Abstract: The global demand for seaweed is expected to increase in the coming years due to new product development using seaweed. There are many benefits of seaweed such as pharmaceuticals, cosmetics, food industries, textiles, paper, and bioenergy production. On the other hand, Indonesia, as the archipelago country with the second-longest coastline after Canada, is expected to achieve competitiveness so Indonesia benefit more from the seaweed industry. This study aims to get the landscape of the seaweed industry and to select strategies. The strategies are designed using the Structural Equation Modelling Method – Partial Least Square (SEM – PLS). The findings of this study are the competitive advantage of Indonesia's carrageenan-producing seaweed industry using descriptive statistical methods through the perception model show considered weak. The three main parameters of concern are assessed as low-cost leadership, ability to increase export value and self-sufficiency in meeting the needs of domestic seaweed. The analysis also shows that the influence of innovation and stakeholder support on increasing the competitive advantage of Indonesia's carrageenan-producing seaweed industry is considered significant. Innovation is represented by the latent variable attributes of innovation, communication channels and the role of change agents, which are concluded to have a significant effect both directly and indirectly on the industry's competitive advantage.

Keywords: seaweed industry, competitiveness, carrageenan, innovation, SEM-PLS, stakeholder support

Abstrak: *Permintaan global akan rumput laut diperkirakan akan meningkat di tahun-tahun mendatang disebabkan oleh pengembangan produk baru menggunakan rumput laut. Banyak sekali manfaat rumput laut seperti obat-obatan, kosmetik, industri makanan, tekstil, kertas, dan produksi bioenergi. Di sisi lain, Indonesia sebagai negara kepulauan dengan garis pantai terpanjang kedua setelah Kanada diharapkan mampu mencapai daya saing sehingga mendapatkan keuntungan lebih dari industri rumput laut. Studi ini bertujuan untuk mendapatkan lanskap industri rumput laut dan mendapatkan pilihan strategi. Pilihan strategi tersebut dirancang menggunakan Metode Structural Equation Modelling – Partial Least Square (SEM-PLS). Temuan dari penelitian ini adalah keunggulan kompetitif industri rumput laut penghasil karaginan Indonesia dengan menggunakan metode statistik deskriptif melalui model persepsi yang dinilai lemah. Tiga parameter utama yang menjadi perhatian dinilai adalah low cost leadership, kemampuan meningkatkan nilai ekspor dan swasembada dalam memenuhi kebutuhan rumput laut dalam negeri. Analisis juga menunjukkan bahwa pengaruh inovasi dan dukungan pemangku kepentingan terhadap peningkatan keunggulan kompetitif industri rumput laut penghasil karaginan di Indonesia dinilai signifikan. Inovasi diwakili oleh atribut variabel laten inovasi, saluran komunikasi dan peran agen perubahan, yang disimpulkan berpengaruh signifikan baik secara langsung maupun tidak langsung terhadap keunggulan kompetitif industri.*

Kata kunci: *industri rumput laut, daya saing, karagenan, inovasi, SEM-PLS, dukungan pemangku kepentingan*

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INTRODUCTION

Indonesia's seaweed industry is currently experiencing a paradox: it is relatively prominent in domestic but inferior in the global market. Indonesia has a strategic geographical location with the longest coastline (UNCTAD, 2018), the largest coral triangle meeting in the world (KKP, 2018), and the abundance of human resources in coastal areas. However, it does not necessarily dominate Indonesia in the global competition of the world seaweed industry. Export Indonesia's seaweed is dominated by raw materials approximately 90%, so seaweed has low added value (ARLI, 2018). In contrast, import seaweed is dominated by processed products (ARLI, 2018; BPS, 2016). Production of Indonesian seaweed increase about 11.8% per year. In 2017, production of seaweed reached 13.3 million tons (KKP, 2018). National and global seaweed is growing at around 8.4%, and it is predicted until 2023 (marketsandmarkets, 2019).

Carrageenan in one of the derivatives of seaweed products. Carrageenan is widely used in food, pharmaceutical and cosmetic preparations such as ingredient for gel, thickeners, and stabilizers. Currently, 70% of Indonesia's carrageenan products are absorbed by China (Katadata, 2018). Meanwhile, in 2018, United States (US) recently listed Indonesian carrageenan on the organic food lists on April 4, 2018. Therefore, the export of Indonesian carrageenan products the US is expected to increase (Katadata, 2018). Thus, the seaweed industry including carrageenan products has the potential to become a national strategic industry (KKP, 2018). Therefore, the carrageenan industry is the prime mover of the coastal economy (KKP, 2018).

Current studies have not currently focused on comprehensive strategy on improving the carrageenan competitiveness. The current studies on the carrageenan seaweed industry are divided into two broad categories. The first category focused on innovation and improving the productivity of seaweed cultivation (Serdiati & Widiastuti, 2010; Ngamel, 2012; Basmal, 2009; Pandelaki, 2012; Indonesia, 2010; Hurd, 2017; and Rabiei et al. 2016). The second category discussed thediversification of seaweed derivative products (Nitschke & Stengel, 2015; Milledge et al. 2016; Ngala, 2016; Bouga & Combet, 2015; Duarte et al. 2017).

The studies related to strategy of improving the carrageenan competitiveness are still limited and tend to be local-partial in which some of them focus on economic. The competitiveness of Indonesian carrageenan with revealed comparative advantage (RCA) is 1.92, while RCA of Philippines is 7.58 (Saptanto, 2017). The RCA of the other ASEAN countries for seaweed are Malaysia (0.69); Singapore (0.31) and Thailand (0.04). Therefore, the production capacity of seaweed and its derivative products is not based on the length of the coastline. Other studies focused on industry management such as Cluster-Based Industrial Development Strategy (Wibowo et al. 2016; Hidayat, 2019; Sahri, 2019; Zulhan et al. 2017) marketing management and financial management (Simanjuntak, 2017; Susanto, 2017).

This study focuses on strategies to increase the competitive advantage of the carrageenan-producing seaweed industry. The novelty lies in the theory used, research focus, and the resulting model. The MBV paradigm is used to encourage the implementation of strategies at the country, industry and company levels by making innovation and collaboration between stakeholders. This research focuses on the strategies to increase the competitive advantage in the carrageenan-producing seaweed industry in Indonesia.

The analysis of this research is based on the scope of the carrageenan-producing seaweed industry in Indonesia. The boundary of this paper is bowed to the strategy for improving the competitiveness of carrageenan on a national scale "strategies for improving the competitiveness of the carrageenan-producing seaweed industry". Seaweed cultivation has competitiveness in price levels and technology used and interconnected with industry players, namely farmers, local traders, processors, exporters and so on. The competitiveness that is analyzed in this study is national or state industry.

METHODS

Data collection was carried out from early February 2019 to June 2020. Primary data was collected by survey using questionnaires filled out by industry actors on seaweed processing. Selection of respondents used quota sampling. Furthermore, Experts were selected by purposive. The experts and then they were interviewed by face-to-face. Most of themlocated in Jakarta, Bogor, Surabaya, Makassar, Takalar, Jeneponto, Bantaeng, and Bulukumba. Secondary data was collected from

institutions or official website of companies observed in this study.RCA, a Structural Equation Modelling - Partially Leased Square (SEM-PLS), and Analytic Hierarchy Process (AHP) were used to data analysis.

According to Tambunan (2004), RCA was used to measure competitive advantage, If the percentage of the export goods from the country is higher than t share of the same goods in the number of world exports, the country has a competitive advantage over the production and export of such goods. The RCA formula is as follows:

$$RCA = (X_{ik}/X_{im}) / (X_{wk}/X_{wm})$$

Where: X_{ik} (value of product exports i country k); X_{im} (total export value of k country); X_{wk} (world export value of product I); X_{wm}(total world export value)

Based on RCA, if the value of the RCA index is greater than 1, it indicates that the competitiveness of a particular product in a country has a fairly strong competitiveness against the average size of the product. While, if RCA index is smaller than 1, indicating the absence of competitiveness of a particular product in the country. SEM-PLS was used to measure competitive advantages based on Porter Diamond Model. AHP was used to find out opinion of experts about the result of SEM-PLS.

The development of this model is based on the Porter diamond model with modifications for the seaweed business ecosystem (Figure 1). The structural model includes the relationship between latent variables and this relationship is considered to be linear. Parameters that describe the regression relationship between latent variables are generally written with the symbol ϒ for regression of exogenous latent variables to endogenous variables and written with the symbol β for regression of one endogenous latent variable to other endogenous variables. Exogenous latent variables can also be correlated with each other and the parameter that relates to this correlation is written with the symbol φ. The parameters derived from the Porter diamond model are arranged based on the literature review (Table 1).

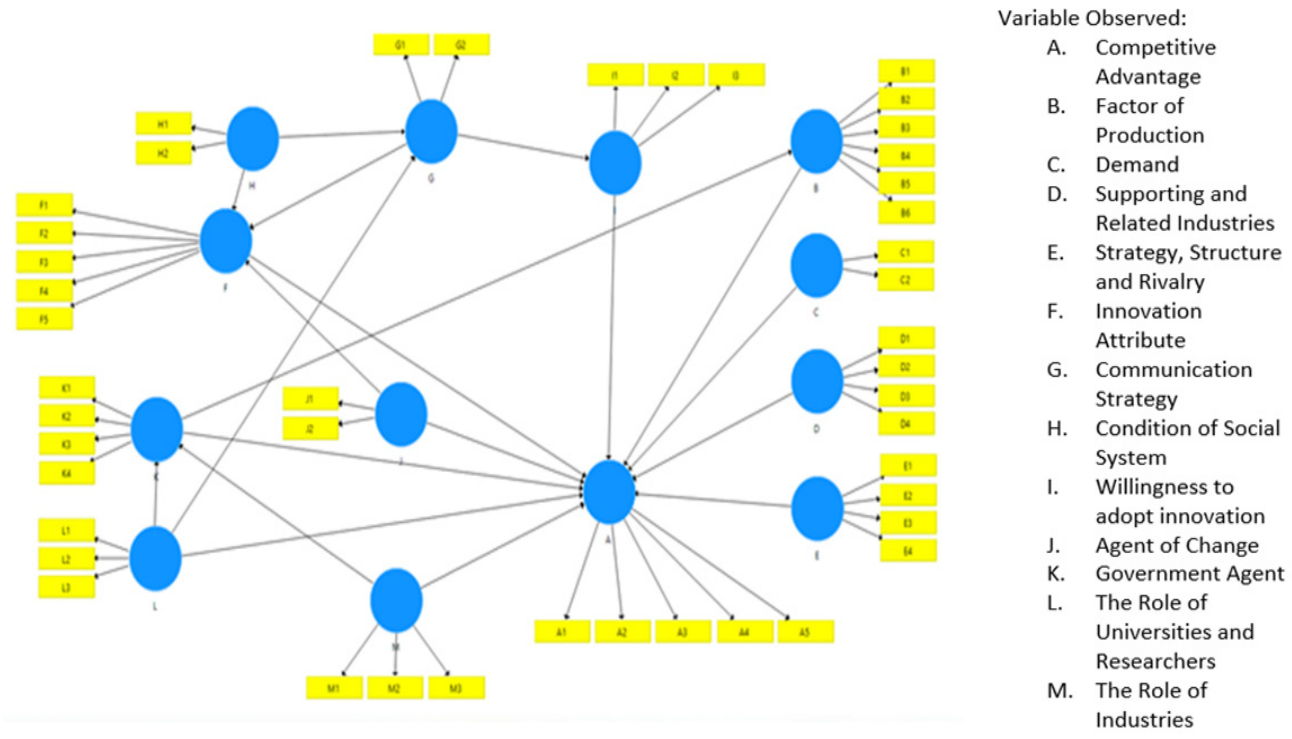

Figure 1. Structural research models

Table 1. Variables, parameters and referral references

Theory	Code	Parameters	Parameters
Competitive advantage	A1	Cost Leadership	Mahatama et al. (2013);
	A2	Product Diversification	Wu et al.(2018)
	A3	Increase in seaweed commodity export value	Tarigan (2015); Mulyati (2015)
	A4	Competence of seaweed cultivation and entrepreneur	Sunadji et al. (2018)
	A5	Self-help domestic seaweed needs	Sublime et al.(2017)
Factor of Production	B1	Quantity of HR from upstream to downstream	Nuroktaviana et al.(2018)
	B2	Upstream to downstream HR quality	Sukadi (2017)
	B3	Total seaweed cultivation land	Sahri (2018)
	B4	Climate support	Radiarta et al.(2016)
	B5	Staining	Hikmayani et al.(2017)
	B6	Supply chain infrastructure	Suryawati et al.(2017)
Demand	C1	Total global demand	Loureiro et al.(2015); Tiwari et al.(2015)
	C2	Total local/national demand	Aziz (2011)
Supporting and Related Industries	D1	Banking	Fauzi et al.(2017); Zulham (2017)
	D2	Research and Universities	Susanto et al.(2017); Terada et al.(2017); Villanueva-Rey et al.(2017)
	D3	Warehousing	Wauran (2018)
	D4	Transportation	Ali et al.(2015)
Innovation Attribute	E1	Selling price stability	Teniwut et al.(2018)
	E2	Not monopolized by the middle man	Pomeroy et al.(2017)
	E3	Availability of seed supply	Yudiastuti et al.(2018)
	E4	Global marketing strategy	Khaldun (2017)
Innovation Diffusion	F1	Nursery and Cultivation	Aqmal et al.(2016); Priono (2016)
	F2	Post Harvest	Ali et al.(2017)
	F3	Processing	Fithriani et al.(2017)
	F4	Supply Chain	Syafiuddin et al.(2018)
	F5	Value Chain	Yulisti et al.(2017)
Communication Strategy	G1	Mass media channel compatibility	Suardana et al.(2018); Christian et al.(2018)
	G2	Counseling in farmer groups	Préat et al.(2018)
Condition of Social System	H1	Tradition does not hinder the spread of new ways of farming	Juariyah (2008)
	H2	Bureaucracy in a cooperative society	Juariyah (2008)
Willingness to Adopt Innovation	I1	Farmers and Entrepreneurs know how to adopt innovation	Muhammad et al.(2018)
	I2	Farmers and Entrepreneurs want to adopt innovation	Muhammad et al.(2018)
	I3	Farmers and Entrepreneurs have begun to adopt innovation	Muhammad et al.(2018)
Agent of Change	J1	Agent competency changes	Muhammad et al.(2018)
	J2	Change agents have no conflict of interest	Muhammad et al.(2018)
Triple Helix Plus	K1	Capital support	Ratna et al.(2018)
	K2	Ease of Business License Support	Adam (2016); Octaviany (2016)
	K3	Global Promotional and marketing support	Risal et al.(2017); Mirza et al.(2017)
	K4	Research and Development Funding	Trawanda et al.(2014); Agustine (2014)

Table 1. Variables, parameters and referral references (continue)

Theory	Code	Parameters	Parameters
The Role of Universities and Researchers	L1	Human Resources Farmers and educated and trained entrepreneurs	Santosa et al.(2015); Pradana (2015)
	L2	Suitability of research based on industry needs	Aaron et al.(2013)
	L3	Number of research and development per year	Kurnianto et al.(2013); Pongarrang et al.(2013)
The Role of Industries	M1	Adoption research	Bahri et al.(2017)
	M2	investment allocation research and development	Najamuddin et al.(2015)
	M3	Sustainable business orientation	Groenendijk et al.(2016)

RESULTS

Descriptive Statistics of Competitive advantage

Result of descriptive statistics of 100 observations. The ability of seaweed farmers to overcome the problem will affect their competences. Currently, product diversification of seaweed industry is low because 80% of seaweed exports are dominated by dry raw material. Therefore, it is necessary to expand the product diversification of seaweed.

Revealed Comparative Advantage (RCA) HS Code 121221 (Seaweeds and Other Algae)

Based on RCA method, seaweed products in Indonesia have comparative advantage in export products. the RCA value of seaweed products from 2012 to 2019 is more than 1 with an average the highest among competitors is 27.92 (Table 2).

The competitive advantage of the carrageenan has an average value of 2.945 (Figure 2). The stakeholders consider that five parameters of competitive advantage is still not fairly competitive. Three of five parameters have an average value of bunder 3.0, namely cost leadership, increasing export value and self-supporting domestic needs. While the other parameters, namely product diversification and competence are quite good. The RCA shows high comparative advantages but it represents raw seaweed with low added value. Therefore, the high competences of farmers and entrepreneurs should be encouraged to increase added value of seaweed.

According to Export Product Dynamic (EPD, Indonesia South Korea and the United Kingdom are "rising star" in the seaweed export growth. While, China, Chile and the United States have a good comparative advantage. However, the three countries along with the Netherlands and Japan are in the "lost opportunity" Figure 3).

Structural Equation Model – Partially Least Square

Convergent Validity Test

The entire outer loading with a value > 0.7 was retained (Table 3). Parameters with values between 0.5 to 0.7 are entirely excluded from the model, except SCA1 (cost efficiency) parameters. The A1 (Leadership Cost) parameter is maintained because it is theoretically solid (Porter, 1990). Leadership Cost is an inseparable parameter from measuring the competitive advantage. As a result, a new structural model consists of an inner model with 13 latent mods and an outer model consisting of 38 reflective parameters (Figure 4).

Inner Model Hypothesis Test

In the hypothesis test, ten hypotheses received and nine hypotheses rejected based on the statistical T value (1.96) (Confidence Level 95%) Table 4. SEM-PLS can map the indirect effect mediated by meditative mods that can be tested by T-Statistical Table 5 shows the significance of indirect effect of each hypothesis if mediated by a mediative altered. Two latent variables, variable B (main production factors and variable F (attributes of innovation) directly affect to competitive advantage of the sea weed industry. Therefore, these latent variables have a significant indirect effect on competitive advantage.

Table 2. Competitiveness Seaweeds in Indonesia (RCA Methods)

Country	RCA Value								Average RCA
	2012	2013	2014	2015	2016	2017	2018	2019	
Korea. Rep	11.69	11.94	10.52	11.40	15.72	16.60	14.43	13.56	13.23
Indonesia	13.45	24.36	34.42	35.20	20.08	26.92	35.14	33.83	27.92
China	2.63	1.59	1.27	0.98	1.09	0.60	0.76		1.27
Japan	0.99	1.20	1.07	0.98	1.11	0.93	0.84	0.73	0.98
United States	0.33	0.48	0.43	0.40	0.33	0.25	0.22	0.19	0.33
United Kingdom	0.34	0.46	0.65	0.63	0.93	0.76	0.75	0.61	1.64
Netherlands	0.60	0.95	0.82	0.36	0.30	0.24	0.42	0.25	1.49
Chile	3.69	8.34	5.12	2.87	3.14	1.70	1.45	1.91	3.78

Table 3. Evaluation of outer loading values

Parameters in Variables	Latent Variables												
	A	B	C	D	E	F	G	H	I	J	K	L	M
1	0.6	0.73	0.76	0.78	0.75	0.65	0.78	0.93	0.77	0.87	0.91	0.88	0.9
2	0.73	0.62	0.95	0.8	0.7	0.72	0.9	0.85	0.91	0.88	0.9	0.77	0.86
3	0.8	0.48		0.83	0.62	0.82			0.92		0.69	0.84	0.88
4	0.83	0.7		0.79	0.78	0.74					0.72		
5	0.41	0.67				0.77							
6		0.61											

Table 4. Evaluation of Statistical T value hypothesis

	T Statistics	P Value
B→A	2.880	0.004
C→A	0.633	0.527
D→A	1.120	0.263
E→A	1.625	0.104
F→A	7.864	0.000
G→F	3.645	0.000
G→I	7.710	0.000
H→F	0.788	0.431
H→G	6.163	0.000
I→A	0.495	0.621

	T Statistics	P Value
J→A	1.334	0.183
J→F	5.026	0.000
K→A	1.399	0.162
K→B	6.631	0.000
L→A	1.327	0.185
L→G	2.281	0.023
L→K	4.144	0.000
M→A	1.735	0.083
M→K	2.605	0.009

Table 5. Evaluation of Statistical T value hypothesis

	T Statistics	P Value
M→A	0.088	0.930
L→A	0.814	0.416
L→F	1.890	0.059
L→I	2.051	0.041
G→A	2.134	0.033
M→B	2.232	0.026

	T Statistics	P Value
K→A	2.584	0.010
H→F	2.916	0.004
H→A	3.072	0.002
L→B	3.770	0.000
J→A	4.026	0.000
H→L	4.586	0.000

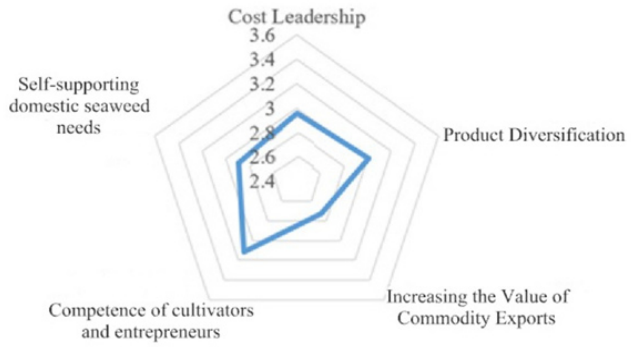

Figure 2. Model perception of the competitiveness of the seaweed industry

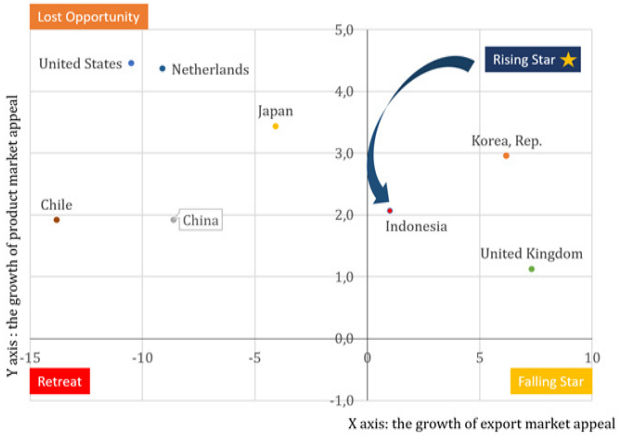

Figure 3. Competitiveness growth of the seaweed industry

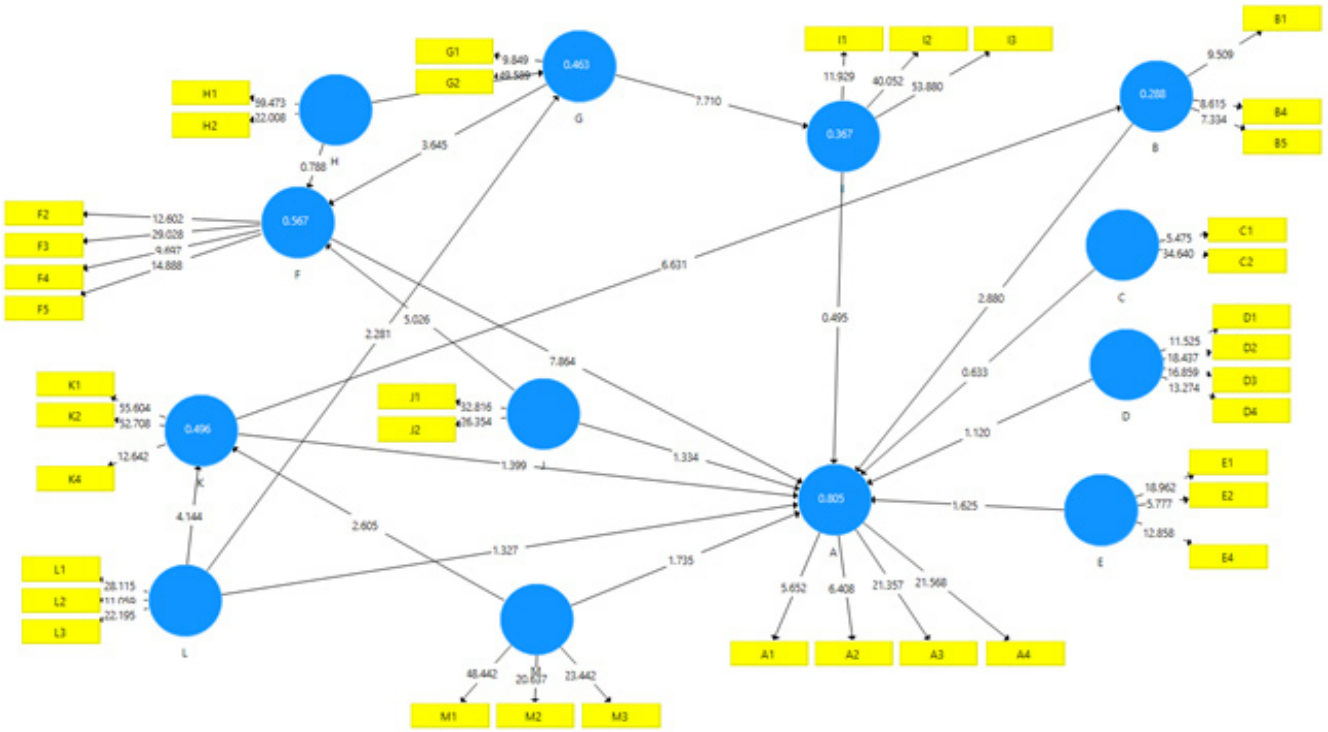

Figure 4 Hypothesis Testing

Based on SEM-PLS he value reflects how much effect a latent changer on other latent variables. The value was used as a guide to developing a strategic priority to improve competitiveness of the carrageenan-producing seaweed industry (Figure 5). Latent Variable B (main production factors) is influenced by latent variable E (strategy structure and rivalry) with the parameters of price control, middlemen. Latent variable B (main production factors) is also influenced by latent variable G (communication channel in spreading innovation), and latent variable J (role of change agent). Variable B (main production factors) is also strongly influenced by variable K(government role).The latent variable G (communication channel is strongly influenced by variable L (the role of the university in producing research2) and variable H (conducive social system conditions). Moreover, the latent variable H (conducive social system conditions) greatly affects the latent variable K (government role).

There are two latent variables that directly affect to competitiveness of the carrageenan-producing seaweed industry namely variable B (Factor of major production) and variable F (innovation attributes). Latent variable B (Main production factors) is influenced by variable latent E (strategy structure and rivalry) with the

parameters are price control, middleman, etc.. Latent variable B (Major production factors) is also influenced by variable latent variable G (communication channel in disseminating innovation), and latent variable J (role of change agent). Variable B (main production factor) is also heavily influenced by variable K(government role). Latent variable G (communication channel), is heavily influenced by variable L (the role of the university in producing research) and variable H (conducive social system conditions). Furthermore, latent variable H (conducive social system condition also significantly affects latent variable K (role of the milker).

Managerial Implication

1. The industry is expected to improve efficiency and take advantage of the external environment. A company can profit by reducing production costs so the price can be competitive.
2. The company is expected to conduct education and socialization related to modern cultivation techniques. It will encourage farmers to increase the quality of their products and guarantee the supply of seaweed.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This study shows that the comparative advantages of are still low. The three main parameters of concern are low-cost leadership, the ability to increase the value of exports and self-help fulfillment of domestic seaweed needs. The effect of innovation and stakeholder support to increase the competitive advantage of the Indonesian carrageenan-producing seaweed industry is significant. Innovation is represented by the latent variables of innovation attributes, communication channels and the role of change agents. The variables have a significant effect either directly or indirectly on the competitive advantage of the industry. The effect of innovation and stakeholder support on the increasing competitiveness of Indonesia's carrageenan-producing seaweed industry is significant. Innovation that represent by latent variable attributes of innovation, communication channels and the role of change has a significant effect both directly and indirectly on the competitiveness.

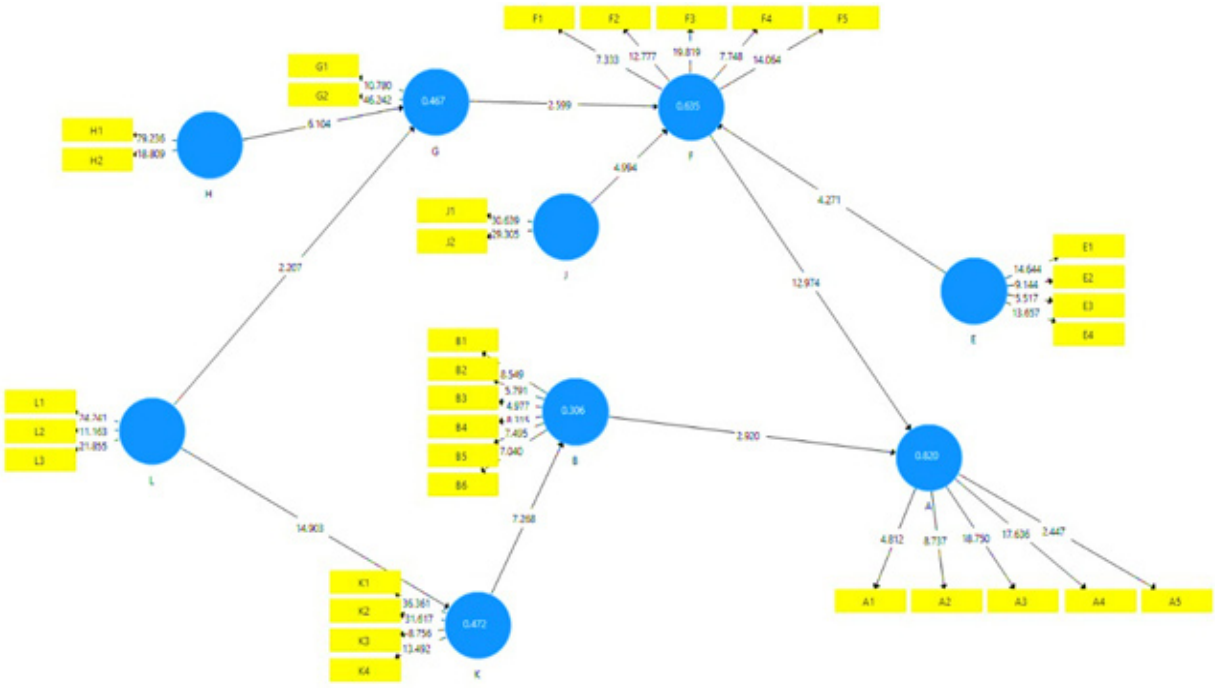

Figure 5. Structural Model of the competitiveness excellence strategy of the carrageenan-producing seaweed industry in Indonesia

Recommendations

Improving the quality of production in the seaweed industry can be able to keep up along with increasing the competitiveness of the seaweed industry. Self-reliance is needed to meet the demand of seaweed by establishing strategic partnerships with farmers.

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