

IDENTIFICATION OF LEAN, AGILE, RESILIENT, AND GREEN (LARG) PRACTICES ON AGRO INDUSTRY INDONESIA

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Abstract. The undeveloped chocolate industry in Indonesia is characterized by low competitiveness. Improvement of the sustainable competitiveness chocolate industry need to be done. Several approaches (lean, agile, resilient, green) have been implemented in an effort to realize the sustainable competitiveness of the chocolate industry, but no one has integrated these four approaches directly. The purpose of this study was to analyze the implementation of the LARG issue in bean to bar chocolate SMEs in Indonesia. The calculation of the LARG index is done to find out how far SMEs have implemented the LARG issue. In addition, a mapping of the interests and performance of each LARG sub-indicator and also a rich picture were also carried out to illustrate the current situation of the chocolate SMEs. The results show many LARG sub-indicators that have not been implemented properly. Green have the most sub-indicators that need to be improved, namely P_{G1} (collaboration with suppliers and consumers in protecting the environment), P_{G3} (natural resource use), P_{G4} (environmentally friendly design, innovation, operation and packaging), P_{G5} (environmentally friendly label), and P_{G10} (reduce inventory levels). Comparison of the LARG index calculations shows the LARG index implementation is still very low at 3.66 while the interest according to Experts is 4.39. SMEs must improve the performance of the LARG issue in order to increase sustainable competitiveness.

Introduction

Indonesia is the world's fourth largest cocoa producer with an annual total production of 600.000 ton; however, the chocolate processing industry is still low in competitiveness level. The challenge of the domestic market for chocolate products in Indonesia is still high. Domestic brands of chocolate bars must compete with imported chocolates that have dominated the market [1]. Furthermore, Indonesia's chocolate imports are still high, led by India 28%, Malaysia 18%, China 11% and Singapore 11% [2]. This induces a various problems in the chocolate industry including high product selling prices, limited markets, inflexible production systems and low consumer interest in local chocolates. Therefore, it is necessary to increase the competitiveness level of chocolate product which considers the market and environmental aspects in its production.

Several studies on the competitiveness level of the chocolate industry have been carried out in Indonesia, including [3,4] who analyzed the competitiveness level of the cocoa bean and intermediate cocoa industry in the international market. The scope analysis of these studies only concerned in one aspect, none of them discussed the competitiveness aspect with comprehensive approach. In the future, industrial competitiveness must be based on more comprehensive aspects [5,6]. In addition to economic consideration, production and operational aspects, the addition of market and environmental aspects will strengthen the competitiveness of the chocolate industry.

Several approaches have been taken to improve sustainable competitiveness. A lean approach, oriented towards reducing the cost of process improvement through elimination of waste and processes that have no added value [7]. Agile approach creates the ability to respond quickly and cost effectively to unpredictable market changes [8]. Resilient, the ability of the system to return to

its original state after experiencing interference and avoiding a failure mode. Related to environmental sustainability, green industry management to reduce risks and environmental impacts while increasing ecological efficiency of organizations and partners [9].

Many industries have taken these four approaches to the supply chain process, however only partially done. Some studies discussed the incorporation of two or three approaches such as lean and agile [10,11,12], agile and resilient [13], lean, agile and leagile [8]. Integration of four approaches of Lean, Agile, Resilient and Green (LARG) has been applied by [14] in the automotive industry. The LARG approaches are able to have a positive impact on the industry to be more competitively sustainable, it is also able to improve economic, social, environmental performance, resource efficiency, maintain lead time, inventory levels, energy consumption and the amount of waste. Thus this study will identify the LARG approach to the bean to bar chocolate SMEs.

Method and Materials

Framework

The framework of this study began from the problem of competitiveness of bean to bar chocolate SMEs in implementing LARG approaches, then identifying other problems that affected the sustainable competitiveness of bean to bar chocolate SMEs. After successfully identifying the actual problem, the problem of the actual situation for sustainable competitiveness with LARG approaches on bean to bar SMEs was illustrated with rich picture (fig. 1).

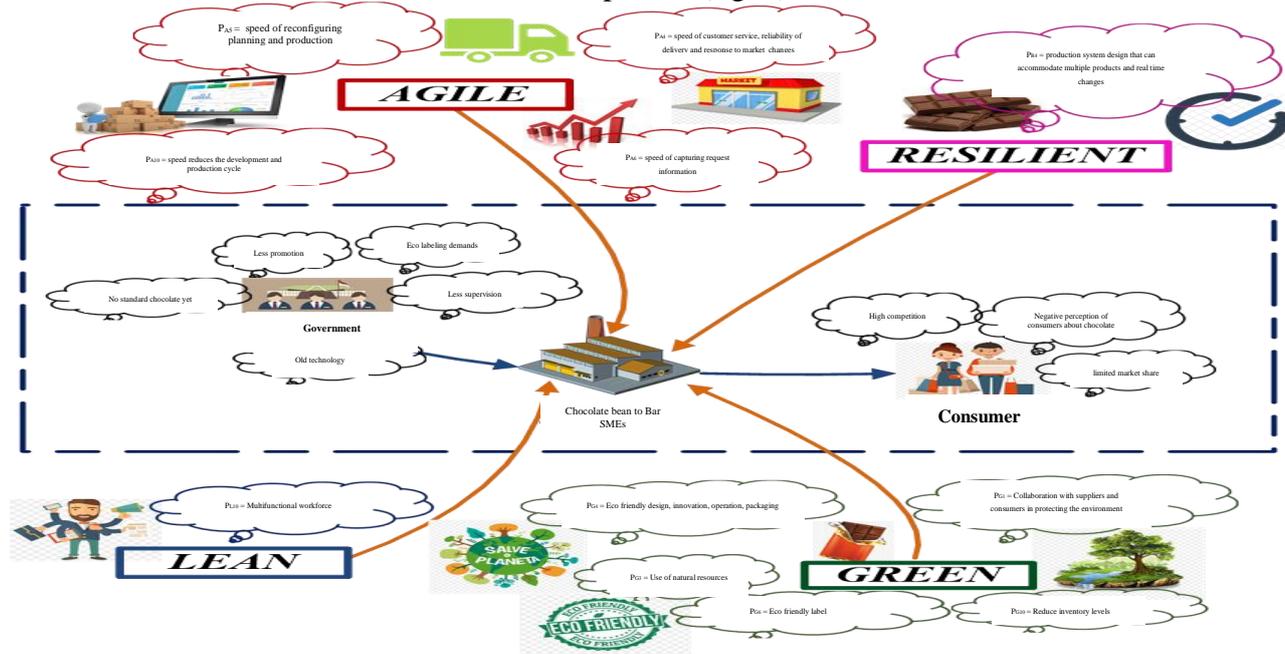


Figure 1 Rich Picture

Calculation of LARG index

The selection of LARG indicator was done first to determine the indicator number that would be used through literature studies. Furthermore, the importance of each indicator was determined by the Expert. The expert assessment results were used as a comparison of the LARG indicator implementation in the bean to bar chocolate SME. Calculation of the LARG index follows the hierarchical relationship of behavioral assessment of SME adapted from [15]. The indicator shows the behavior of each SME in the index of leanness, agility, resilient and greenness. These indicators are a combination of information collections on sub-indicators: SME's lean behavior (P_{L1}, \dots, P_{L4}); SME's agile behavior (P_{A1}, \dots, P_{A5}); SME's resilient behavior (P_{R1}, \dots, P_{R2}); and SME's green behavior (P_{G1}, \dots, P_{G5}). Each sub-indicator is assessed using a 1-5 Likert scale where, 1 means "the behavior is not implemented" and 5 means "the behavior is fully implemented".

Each SME can calculate the importance of each indicator based on the importance of each sub-indicator. The importance of indicators (B_x) in each SME (j) can be calculated by equation (1). Where x is L (*lean*), A (*agile*), R (*resilient*), and G (*green*). Equation (1) shows the behavior of SMEs based on the level of behavior implementation (P_{xy}) and the weight of each behavior (w_{xy})

$$(B_x)_j = f \left[w_{x1} \times (P_{x1})_j, \dots, w_{xy} \times (P_{xy})_j \right] \quad (1)$$

with $w_{xi} \geq 0$ and $\sum w_{xi} = 1$

Where $(B_x)_j$ is the behavior of SMEs j with $x(x=L, A, R, G)$. $(P_{xi})_j$ is the level of behavior implementation i of the paradigm x in SMEs j . Number of behaviors y based on each paradigm. Each level of behavior implementation was assessed using a 1-5 Likert scale where 1 means “the behavior is not implemented” and 5 “the behavior is fully implemented”. w_{xi} is the weight of behavior i in the paradigm x . The weight value shows the importance of each behavior to increase the sustainable competitiveness of bean to bar chocolate SMEs. Where the value between 0 is “not important” and 1 is “very important”.

Behavior value (B_x) is the level of behavior implementation for each SME where 1 means “no behavioral paradigm is implemented” and 5 “overall behavioral paradigms are implemented”. The LARG index is then calculated for each SME ($LARG_j$) with equation (2).

$$LARG_j = f \left[w_L \times (B_L)_j, w_A \times (B_A)_j, w_R \times (B_R)_j, w_G \times (B_G)_j \right] \quad (2)$$

with $w_L, w_A, w_R, w_G \geq 0$ and $w_L, w_A, w_R, w_G = 1$

Where $(B_x)_j$ is SME j with behaviors based on paradigms $x(x=L, A, R, G)$ and w_L, w_A, w_R, w_G are the weights of the LARG paradigms. Weight values indicate the importance of each paradigm for SME sustainable competitiveness. The value of the weight consisting of 0 is “not important” and 1 is “very important”. The SME’s LARG index is valued at 1 means “no paradigm applied by SMEs” and 5 “overall paradigms applied by SMEs”.

Weight calculations for each LARG paradigm are calculated using the Delphi approach. Delphi is a technique formulated from communication methods designed to extract the maximum amount of information that is not biased from the opinion of a group of experts [16]. Each importance paradigm is measured using a score between 1-5, where 1 is “not important” and 5 is “very important”. Furthermore, the weight values for each LARG paradigm can be calculated using equation (3).

$$w_x = \frac{M_x}{\sum_{g=1}^n M_g} \quad (3)$$

Where w_x is the weight of paradigm x , M_x is the average value of importance of each paradigm x and $\sum_{g=1}^n M_g$ is the sum of the average level of importance of the total paradigm.

Priority Indicators Improvement

Determination of indicators that need to be improved is done using the Importance Performance Analysis (IPA). IPA is an effective method for determining priorities. Analysis is carried out in two dimensions where it will be compared between the level of importance and performance of each indicator. The results that will be obtained are priority areas, where there will be priority areas that need to be maintained and improved, areas that may be excessive and which lack benefits and can

be eliminated from priorities [17]. The analysis is done by comparing the results of the importance of each indicator according to the experts and the results of the implementation of the bean to bar chocolate SME by using the analysis of importance and performance quadrant which can be seen in (fig. 2).

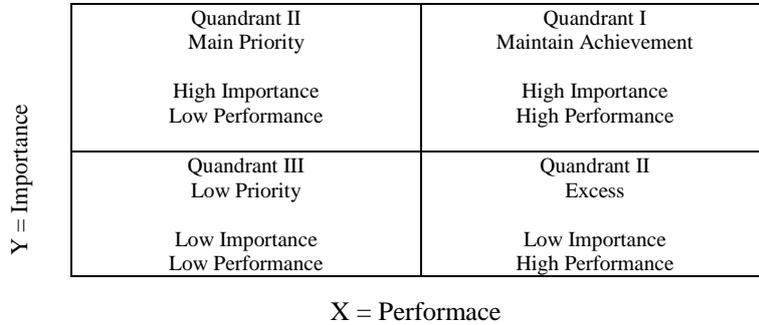


Figure 2 Distribution of Importance and Performance Quadrants [8]

Result and Discussion

Assessment Result of LARG Issue Importance According to Expert

LARG indicators and its sub-indicators are chosen because they are considered to have an influence on the condition of the sustainable competitiveness of bean to bar chocolate SME. There are 40 indicators used to evaluate the LARG issue in SMEs. Each indicator has 10 sub-indicators that can be seen in [Table 1].

Table 1 Indicators and Sub-Indicators of LARG

	Sub-Indikator	Sub-Indikator
<i>Lean</i>	P _{L1} : quality system & self-examination	P _{A1} : use of IT in the integration of industrial activities
	P _{L2} : reduction of cycle times & setup	P _{A2} : increased frequency of new product introduction
	P _{L3} : innovation in performance appraisal	P _{A3} : centralized planning & collaboration
	P _{L4} : minimal resource inventory	P _{A4} : speed of improving service, shipping & market response
	P _{L5} : shorten leadtime	P _{A5} : speed of reconfiguring the production plan
	P _{L6} : increased utilization of resources	P _{A6} : able to quickly capture information
	P _{L7} : TQM	P _{A7} : able to maintain supplier & consumer hubs
	P _{L8} : JIT	P _{A8} : produce products with added value
	P _{L9} : reduces lot size	P _{A9} : product design according to consumers
	P _{L10} : functional workforce	P _{A10} : reduction in development cycle time
<i>Resilient</i>	P _{R1} : raw material source strategy	P _{G1} : collaboration with suppliers and consumers
	P _{R2} : contract commitment with suppliers	P _{G2} : ISO 14000 certification
	P _{R3} : utilization of flexible raw materials	P _{G3} : use of natural resources
	P _{R4} : multi-product production system & real time	P _{G4} : design, innovation, operation, packaging that is environmentally friendly
	P _{R5} : a good inventory strategy	P _{G5} : eco-friendly label
	P _{R6} : cooperation in all production activities	P _{G6} : reuse of materials & packaging
	P _{R7} : lead time reduction	P _{G7} : improving environmental performance
	P _{R8} : flexible transportation system	P _{G8} : sorting of waste
	P _{R9} : multi skill workforce	P _{G9} : discussion of packaging changes with consumers
	P _{R10} : demand-based management	P _{G10} : reduction in inventory levels

Forty sub-indicators of LARG are assessed by experts to determine the importance ranking of each sub-indicator of each indicator. Moreover, the average value of importance of each indicator is calculated and the average value of importance is calculated, therefore the weight of each indicator can be calculated. The LARG index can be calculated using (eq. 2). The calculation results can be seen in [Table 2].

Table 2 The LARG index based on the opinions of Experts

Behavior	Average value of importance according to experts (M_x)	Total value of average value of importance ($\sum_{g=1}^n M_g$)	Weight of each indicator (w_x)
Lean (B_L) _j	4.40	17.56	0.25
Agile (B_A) _j	4.39		0.25
Resilient (B_R) _j	4.22		0.24
Green (B_G) _j	4.55		0.26
LARG Index = 0.25 (B_L) _j +0.25 (B_A) _j +0.24 (B_R) _j +0.26 (B_G) _j			4.39

Based on Table 2, it can be seen that the values for each lean lean, agile, resilient and green behavior according to experts, namely green behavior (4.55) is more important than the other three behaviors. Current environmental issues are very important in a business [19]. Furthermore, green operation must be applied from product development to management throughout the product life cycle [9]. The index value of the importance of LARG issue in bean to bar chocolate SME in Indonesia is 4.39. This result means that the issue of LARG is very important to be implemented in an effort to improve competitiveness.

Implementation of the LARG Issue in Bean to Bar Chocolate SMEs in Indonesia

The implementation of the LARG issue in bean to bar chocolate SMEs is carried out in Aceh, Bali, Jakarta, Yogyakarta. Assessment is carried out by the leaders of each SME by means of self-assessment can be seen in [Table 3].

Table 3 The results of assessment of LARG implementation in bean to bar chocolate SMEs

Behavior	Indicator	Implementation Level of LARG				Average	Contribution	Rank of Contribution
		Aceh	Bali	Jakarta	Yogyakarta			
Lean	P _{L1}	3	5	5	4	4.25	0.113	1
	P _{L2}	2	4	5	5	4.00	0.106	2
	P _{L3}	2	4	4	4	3.50	0.093	4
	P _{L4}	3	5	5	4	4.25	0.113	1
	P _{L5}	3	4	4	4	3.75	0.099	3
	P _{L6}	2	5	5	4	4.00	0.106	2
	P _{L7}	2	5	5	5	4.25	0.113	1
	P _{L8}	3	4	4	5	4.00	0.106	2
	P _{L9}	2	3	4	3	3.00	0.079	5
	P _{L10}	2	3	3	3	2.75	0.073	6
Importance Average Total							37.75	

so on

Description:

Level 1-5 starts from 1 (not implemented) to 5 (fully implemented)

The results show the total average for the practices of lean (37.75), agile (38.25), resilient (37) and green (33) which ideally the average for each practice is 50 means that all SME have fully implemented the LARG practices. Furthermore, the average value of LARG indicator implementation on bean to bar chocolate SME can be seen in [Table 4]. From the average performance values of SME, LARG index implementation in SME can be calculated by first calculating the weights for each indicator using the Delphi (eq. 3). In addition, the weights for each lean, agile, resilient and green can be calculated in the same way. The results of the weights for each LARG indicator can be seen in [Table 4]. From [Table 4], the level of implementation that has the highest score is found in the agile approach with a score of 3.83 for all industries studied. The fourth LARG index of bean to bar chocolate SMEs is 3.7 which means that SME in this study have implemented some of the LARG issues.

Table 4 Implementation of LARG in Bean to Bar Chocolate SMEs in each region

	(B _x) _j				Average value of SME performance (M_x)	$\sum_{g=1}^n M_g$	Weight of each indicator (w_x)
	Aceh	Bali	Jakarta	Yogyakarta			
<i>Lean</i>	2.4	4.2	4.4	4.1	3.78	14.60	0.26
<i>Agile</i>	3.5	4.1	4.0	3.7	3.83		0.26
<i>Resilient</i>	3.4	3.8	4.1	3.5	3.70		0.25
<i>Green</i>	2.4	3.7	4.0	3.1	3.30		0.23
LARG Index = 0.26 (B _L) _j +0.26 (B _A) _j +0.25 (B _R) _j +0.23 (B _G) _j							3.66

The next step is to compare the results of the implementation of LARG practices in the four industries studied with the importance of the LARG practices according to the experts that can be seen in [Table 5] below. The implementation value is still low compared to the assessment of the importance of LARG practice shown in [Table 5]. An example is for lean, the value of implementation in SME is 3.78 lower than the importance of experts value, namely 4.40. This means that in the SMEs studied, the implementation level is still lower than what should be done according to experts to be considered to have good competitiveness. The results of the overall analysis can be seen that the four LARG implementations in bean to bar chocolate SME in the regions of Aceh, Bali, Jakarta and Yogyakarta are still low and there needs to be an increase in the implementation of LARG practices to become more competitive SME.

Table 5 Comparison of importance and implementation of LARG issue

Indicator	Importance	Performance
<i>Lean behaviour</i>	4.40	3.78
<i>Agile behaviour</i>	4.39	3.83
<i>Resilient behaviour</i>	4.22	3.70
<i>Green behaviour</i>	4.57	3.30
LARG index	4.39	3.66

LARG Sub-Indicators Improvement

Importance Performance Analysis (IPA) analysis is carried out for each LARG indicator. This is done to determine which sub-indicators need to be improved from each indicator. The results of the analysis can be seen in (Fig. 3). In lean, the sub-indicator that needs to be improved is P_{L10} (multifunctional workforce) located in Quadrant II. This sub-indicator has a high level of importance according to Experts but has not been well implemented by SME. Agile sub-indicators that need to be improved are P_{A4} (speed improving customer service, delivery reliability, market change response), P_{A5} (speed of reconfiguring planning and production processes), P_{A6} (speed of capturing demand information), and P_{A10} (speed reducing development cycle and production). The resilient sub-indicator that needs to be improved is P_{R4} (designing a production system that can accommodate multiple products and real time changes). The green sub-indicators that need to be improved are P_{G1} (collaboration with suppliers and consumers in protecting the environment), P_{G3} (natural resource use), P_{G4} (environmentally friendly design, innovation, operations and packaging), P_{G5} (environmentally friendly label), and P_{G10} (reduce inventory levels). Green indicators have the most sub-indicators that need to be improved in performance and are a top priority for increasing sustainable competitiveness. The green concept has also been applied in the green supply chain management for agricultural products where there are also several aspects in it, namely green production, green transportation, green processing and circulation, green consumption and green recycling [20].

Conclusion

The analysis results of LARG implementation in bean to bar chocolate SMEs show that there are still many LARG sub-indicators that have not been implemented properly. Green indicators have the most sub-indicators that need to be improved, P_{G1} (collaboration with suppliers and consumers

in protecting the environment), P_{G3} (natural resource use), P_{G4} (environmentally friendly design, innovation, operation and packaging), P_{G5} (environmentally friendly label), and P_{G10} (reduce inventory levels). Comparison of the results of LARG index calculations from experts and implementation in SMEs show that the application of the LARG index is still very low at 3.66, while the importance according to Experts is 4.39. SMEs must improve the performance of LARG issue in order to increase the sustainable competitiveness.

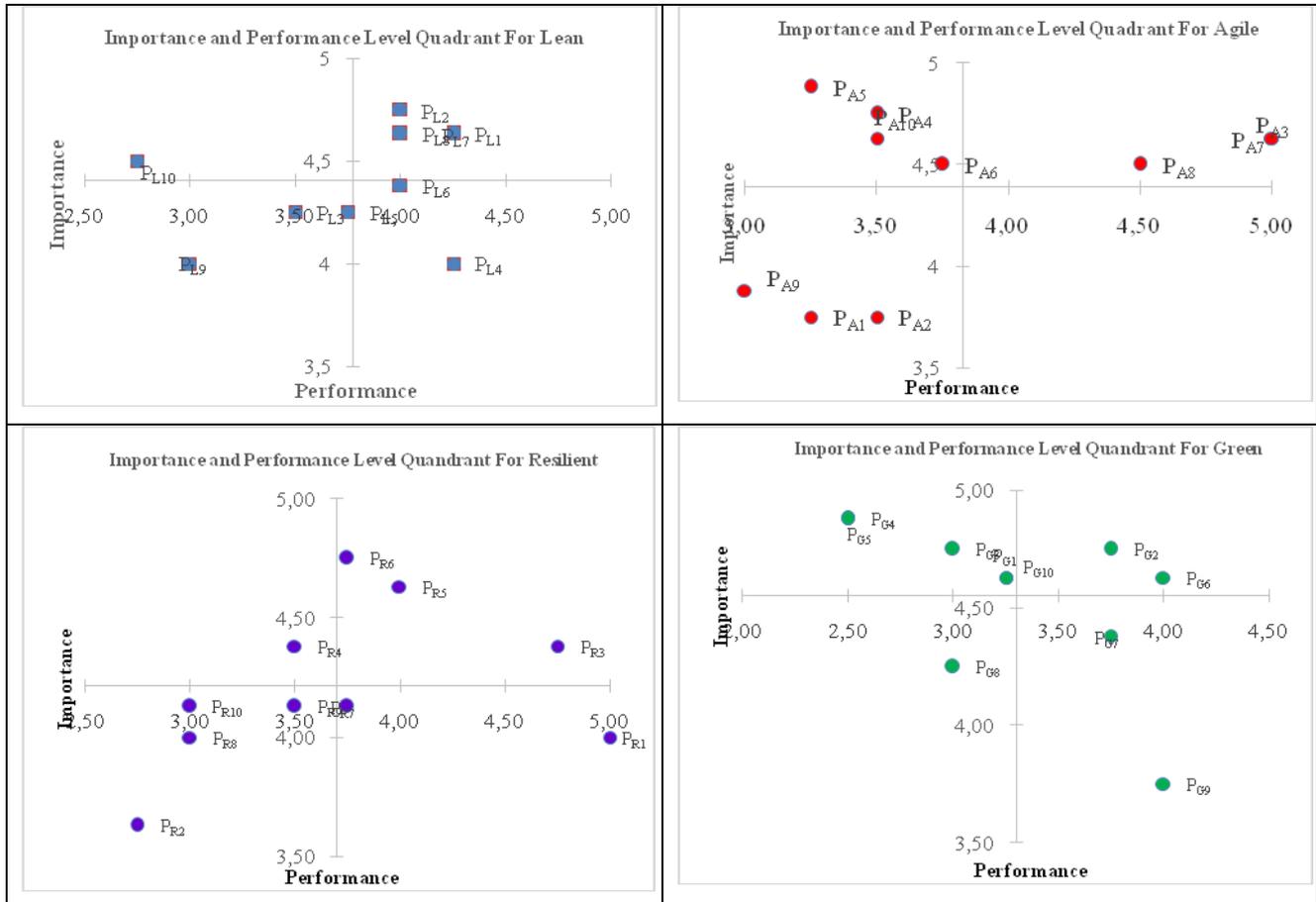


Figure 3 The importance and performance of LARG sub-indicators Mapping

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