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Enabler to successful implementation of lean supply chain in a book publisher

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Abstract

The intense business competition nowadays forces many industries to be able to perform their activities more efficient compare to their competitors. If at the past the competition is between the company and its competitor, however this paradigm is now changing. The competition is now longer between the company and its competitor but the competition is between a company's supply chain and its competitor's supply chain. Managing a supply chain require the knowledge of what key success variables for the implementation of supply chain strategy. One of supply chain strategy is lean supply chain strategy. The lean strategy concept matches with the company that has characteristics such as producing with high volume but less variety of products. CV. Andi Offset as a book publisher and offset company is also trying to apply the lean supply chain strategy to manage all activities in their supply chain. However key success variables of implementation lean supply chain have not been studied yet. The research in this paper is trying to use the Interpretive Structural Modeling (ISM) method to identify the hierarchy variables that affect the successful implementation of lean supply chain in CV. Andi Offset. The results show us that there are 10 success variables of implementing lean supply chain strategy. In addition, relationships among these variables are identified. ISM model shows that advanced in the use of IT and change management variables are the major key success variables of the successful implementation of lean supply chain in CV. Andi Offset.

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1. Introduction

Due to the intense competition in the business, a company has to develop strategy that enable them to perform their activities in their business process more efficient compare to their competitor. If at the past the competition is between the company and its competitor, however this paradigm is now changing. The competition is now longer between the company and its competitor but the competition is between a company's supply chain and its competitor's supply chain [1, 2].Therefore, supply chain strategy is needed in order for the company to find a way to win the competition. As one of the characteristics of the company can be seen through the amount of production volume and its variety of product, therefore Fisher [3] suggests that the selection of supply chain (SC) strategy should consider about the nature of demand. One of the type of supply chain strategy is lean supply chain strategy where it is appropriate for stable demand [4]. A lean suppy chain strategy is aimed at eliminating waste therefore just-in-time philosophy is implemented [5,6,7,8,9]. In order for the supply chain strategy can be well implemented, the development of the strategy should consider about the practices appropriate to the strategy [10]. Therefore, when the company start developing its supply chain strategy, the key success variable or it can be said as enabler to the succesfull implementation of supply chain strategy have to be identified.

The research in this paper is trying to identify the enablers in an lean supply chain and its relative importance in a book publisher company which is CV. Andi Offset in Yogyakarta, Indonesia. A lean supply chain strategy is chosen after considering the nature of the demand of this company. This company produce 200 title of new books per month, where for one title of the book, according to the company's policy, it should be printed around 3000 units, therefore the total number of unit book produced per months is 600.000. In addition, eventhough the the title of the book might vary, however, the variation of product is actually classified according to its paper size, and the thickness of the page. Paper type that is used by CV. Andi Offset is HVS paper. There are four types of book size produced that is 16 cm x 23 cm, 20 cm x 28 cm, 14 cm x 21cm, and 19 cm x 23 cm. Average thickness of book is 200-250 pages. In addition, CV. Andi Offset only uses one type of cover, which is Ivory 230.

Interpretive Structural Modeling (ISM) is used as a method to help and manage relation between enablers by providing a hierarchy of the enablers [11,12,13]. To the best of author knowledge, there is no research has been found related to identifying enabler to succesfull implementation of lean supply chain in a book publisher.

2. Define enablers of lean supply chain

In the research of this paper, the enablers of lean supply chain is defined based on the research of the previous research such as [15,16,17,18,19, 20]. There are 15 enablers where detail explanation of each variable can be seen in Table 1. As it is mentioned in the previous section that in order the strategy to be well implemented then it has to be appropriate with the practices of the company. Therefore in-depth interview was conducted with the Director and the Production Manager of CV. Andi Offset to gain any information about if the 15 variables from the literature relevant with the the need of the company. After finishing this step, then 5 out of 15 variables were removed because the company stated that those are irrellevant. The detail explanation of the irrellevant variables can be seen in Table 2. The remaining variables are divided into 3 parts, they are: 1) variable for Lean Supply Chain enablers, variable for results, and variables for inhibitors.

3. Interpretive structural modeling methodology

As it is mentioned in the previous section ISM is used as a method to help and manage relation between enablers by providing a hierarchy of the enablers [11, 12, 13]. Previous research have been conducted relaed to the application of ISM for determining enabler of implementation supply chain strategy especially agile supply chain strategy such as [13]. ISM methology consider several steps as follows [13]: 1) Define the enabler to observe the key success variable of implementation of supply chain strategy ; 2) Define the relationship among variables; 3) Develop a structural self-interaction matrix (SSIM); 4) Develop initial reachability matrix; 5) Develop final reachability matrix after the matrix is checked for transitivity; 6) Do the partition of the reachability matrix to different levels; 7) Develop the directed graph; 8) Checking the ISM model.

Table 1. Definition of variables for enablers, results and inhibitors from the literature

Strategic Variables	Factor Description	Sources
Advanced in use of Information Technology (IT)	Advanced in use of IT enable the organization to see the end user demand clearly (visibility). In addition relevant and secure information along supply chain can be obtained using the use of IT.	[14,15,16]
TOC philosophy	TOC is an approach whose objective is to increase the throughput by improving the process is constrained to the system.	[15]
Minimize Lead Time	Lead time is the time rewuired from when the order is received until the order can be fullfilled.	[15]
Collaboration between SC	Good and long-term relationship between supply chain (supplier, manufacturers, and consumer).	[15,16]
Logistic efficiency	Logistic efficiency is the efficient movement of goods between buyer and seller including the frequency delivery of smaller quantities direct to the point of buyer.	[15,16]
Kanban System	The use of visual things to control production and movement of goods in supply chain.	[16]
Change Management	Change and improvement need to be planned well by top management by incorporating change management in order to provide wide visibility to worker about objective and benefit of become lean.	[12]
Demand Management	The underlying principle of the lean philosophy is a pull system to reduce the need for demand forecasting.	[14]
Financial Capability	The ability to take financial decisions based on the information.	[12]
Minimize waste	Waste is a non value added activities such as time, inventory, repetition of the process, or digital waste.	[14]
Standardization of product and process	Standardization process will allow continuous flow (movement does not stop on the products or services through the company's systems and the customer)	[14]
Customer Satisfaction	Customer satisfaction level is affected by the impact of other performance variables.	[17,18]
Quality Improvement	Enable Supply Chain to provide quality products and better services to the customers.	[18,19]
Trust between SC	Presents among the trading partners of the Supply Chain	[20]
Demand Variation	Demand variation is the result from Supply Chain complexity and volatile market.	[14]

Table 2. List of variables that are eliminated based on in-depth interview with the Director and Production Manager of CV. Andi Offset

Variables	Response	Example of question given to the company
Financial capability	This variable does not affect significantly because CV. Andi Offset are always able to make improvement in the financial matter	a. What do you spend the most? b. Do you always do some investment to improve the technology to support the activities in your company?
Collaboration between SC	This variable can be combined with other variables because according to the response from the company, the collaboration between SC can be represented by variable ' trust between SC'	a. How you define a relationship? b. What factors affect for building collaboration in SC? c. Why do you should have a program to improve relations with suppliers?
Customer Satisfaction	According to the response from the company customer satisfaction is the goal that has to be achieved.	a. What are the characteristics of your customer? b. Have you ever conducted any research to see the factors that might affect to customer satisfaction? c. Performing the cause-effect relationship activities, do you see that customer satisfaction is as a cause or as an effect?
TOC philosophy	This variable is not included in the ISM analysis because according to the response from the company, implementation of new philosophy like TOC requires a very long time	a. Do you face unbalanced production system? How does it affect the performance of the company?
Demand Management	This variable indirectly can be performed on other variables (i.e. the advanced IT variable demand management can be done.)	a. How does the company determine the production targets? b. Could you tell me how your demand has been changed over period of time? And how do you incorporate this issue to manage the demand.

3.1. Structural self-interaction matrix (SSIM)

This steps was performed in order to find the contextual relation among variables namely: 1) Advanced in use of IT; 2) Logistics efficiency; 3)Standardization of product and process; 4)Kanban system; 5)Change management; 6)Minimize lead time; 7) Minimize waste; 8) Quality improvement; 9)Demand variation; 10) Trust between SC. An opinion from the Director and the Production Manager of CV. Andi Offset was gained through a series of thorough brainstorming. For symbols are used to denote the direction of relationship between enable. They are V symbol indicates that the variable i helps to achieve variable j, the symbol A is used if the variable j helps to achieve variable i, the symbol X is used if the variable and j helps each other, the symbol O is used if the variable i and j are not related. Table 3 would explain the use of V, A, X, O in developing SSIM.

Table 3.SSIM for Lean Supply Chain in CV. Andi Offset

		Variables (j)									
		1	2	3	4	5	6	7	8	9	10
V	1		O	O	V	X	V	V	O	V	V
a	2			A	O	A	V	V	O	A	V
r	3				V	A	V	V	V	A	V
i	4					A	O	V	O	O	V
a	5						O	O	O	O	V
b	6							O	O	A	V
l	7								X	O	V
e	8									A	V
s	9										V
(i)	10										

3.2. Initial reachability matrix

In this step SSIM is transformed in to a binary form with the following rule [13]: 1) if the (i,j) entry in the SSIM is V, then the (j,i) entry in the reachability matrix is set to 1 and the (j,i) entry is set to 0; 2) if the (i,j) entry in the SSIM is A, then the (j,i) entry in the reachability matrix is set to 0 and the (j,i) entry is set to 1; 3) if the (i,j) entry in the SSIM is X, then the (j,i) entry in the reachability matrix is set to 1 and the (j,i) entry is set to 0; 4) if the (i,j) entry in the SSIM is O, then the (j,i) entry in the reachability matrix is set to 0 and the (j,i) entry is set to 0. Table 4 shows the initial reachability matrix that is established from SSIM formed into a binary form.

Table 4. Initial reachability matrix

		Variables (j)									
		1	2	3	4	5	6	7	8	9	10
V	1		0	0	1	1	1	1	0	1	1
a	2	0		0	0	0	1	1	0	0	1
r	3	0	1		1	0	1	1	1	0	1
i	4	0	0	0		0	0	1	0	0	1
a	5	1	1	1	1		0	0	0	0	1
b	6	0	0	0	0	0		0	0	0	1
l	7	0	0	0	0	0	0		1	0	1
e	8	0	0	0	0	0	0	1		0	1
s	9	0	1	1	0	0	1	0	1		1
(i)	10	0	0	0	0	0	0	0	0	0	

3.3. Final reachability matrix

After checking for the transitivity, then the final reachability matrix was obtained and the result is presented in Table 5. In this final reachability matrix, the driving power and the dependence of each enablers can be idenied.

Table 5.Final reachability matrix

		Variables (j)									
		1	2	3	4	5	6	7	8	9	10
Variables (i)	1		1	1	1	1	1	1	1	1	1
	2	0		0	0	0	1	1	1	0	1
	3	0	1		1	0	1	1	1	0	1
	4	0	0	0		0	0	1	1	0	1
	5	1	1	1	1		1	1	1	1	1
	6	0	0	0	0	0		0	0	0	1
	7	0	0	0	0	0	0		1	0	1
	8	0	0	0	0	0	0	1		0	1
	9	0	1	1	1	0	1	1	1		1
	10	0	0	0	0	0	0	0	0	0	

3.4. Level partition

Level partition step is to divide the variables into hierarchical levels in the ISM. From the partition level, 6 iterations were performed so that all variables are divided in levels. Table 6 shows a breakdown from the first interation and Table 7 shows the result from the final iteration. IT is noted that the enablers that both the reachnability and the intersection sets are the same occupy the highest level in the ISM [13].

Table 6. Iteration 1

Variable	Reachability Set	Antecedent Set	Intersection Set	Level
1	1,2,3,4,5,6,7,8,9,10	1,5	1,5	
2	2,6,7,8,10	1,2,3,5,9	2	
3	2,3,4,6,7,8,10	1,3,5,9	3	
4	4,7,8,10	1,3,4,5,9	4	
5	1,2,3,4,5,6,7,8,9,10	1,5	1,5	
6	6,10	1,2,3,5,6,9	6	
7	7,8,10	1,2,3,4,5,7,8,9	7,8	
8	7,8,10	1,2,3,4,5,7,8,9	7,8	
9	2,3,4,6,7,8,9,10	1,5,9	9	
10	10	1,2,3,4,5,6,7,8,9,10	10	1

Table 7. Iteration 6

Variable	Reachability Set	Antecedent Set	Intersection Set	Level
1	1,5	1,5	1,5	6
5	1,5	1,5	1,5	6

3.5. Directed graph (Digraph) of ISM

Based on the level partition, directed graph ISM can be established as it is shown in Fig. 1. It explains the relationship and the level of existing elements. The relationship between 2 variables is shown by the arrow which point from variable i to variable j. For example variable "Advanced in the use of IT" and "Change management" in the level 6 support the variable "Demand variation" in the level 5. The variable "Demand variation" in the level 5 force the "Standardization of product and process" in level 4 while the "Standardization of product and process" in level 4 result in "Logistic efficiency" in level 3. If the logistics is efficient then it will "Minimize the lead time " in the level 2 and it leads to the improvement of "Trust between SC" in level 1. In addition "Standardization of product and process" in level 4 support the implementation of "Kanban System" in level 3 and the "Kanban system" is able to "Minimize waste and cost" in the level 2. According to Toyota Production System [21], one category of waste is "defect". If we are able to minimize the defect, it means that we are able to "Improve the quality" that can leads to the "Trust bestween SC". According to the result from ISM shown in Fig. 1 it can be seen that the variable 'Advanced use of IT" and "Change Management" is related one to each other. Based on the result from in-depth interview with the Director and the Production Manager at CV. Andi Offset, then they stated that the implementation of the new information technology requires the implementation of change management in order for the new information technology can be succesfully implemented. [22]
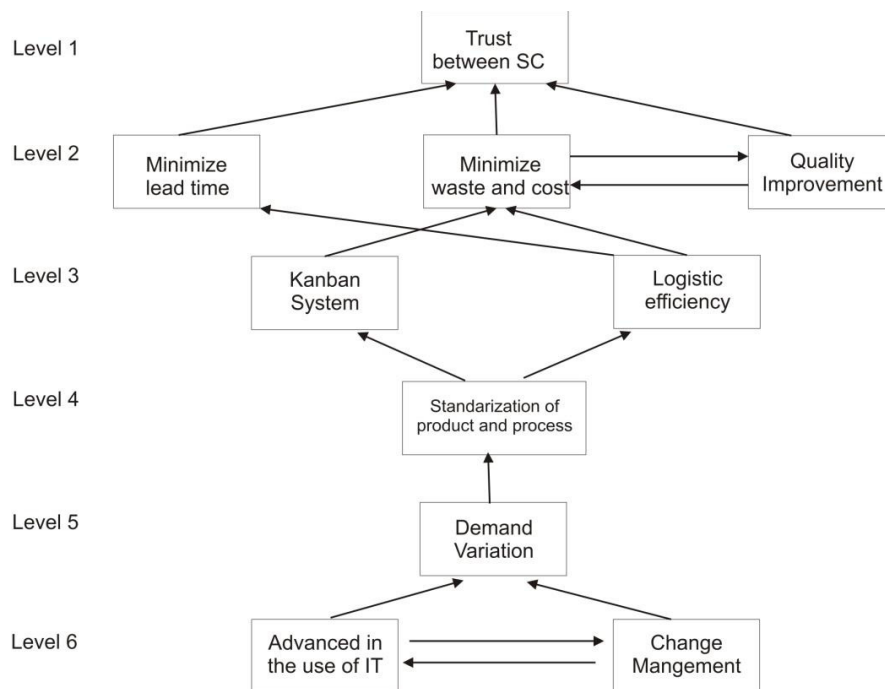

Fig. 1.Digraph ISM.

4. MICMAC analysis

The main purpose of the analysis MICMAC is to analyze the driving forces and the dependence power of variables [23] where those variables are plotted in the map that is grouped into 4 clusters. A cluster that comprises of the variable that have a strong driving force and low dependence is called as independent cluster. The variables belongs to this cluster such as "Advanced use of IT", "Change management", "Demand variation", and "Standardization of product and process" occupy in the bottom place of the hierarchy as it shown in Figure 1. While

a cluster that comprises of the variables that have high dependence and low driving force is called as dependent cluster. According tothe result from MICMAC analysis presented in Fig. 2 it can be seen that the variable such as "Minimize waste and cost", "Minimize lead time" "Quality improvement" and "Trust between SC" are called as dependent variable. The variable that has strong dependence and strong driving power belongs to another cluster namely linkage. No linkage variables found in this case. The autonomous cluster which is the cluster that consist of the variables that have low dependence power and low driving power are called as autonomous variables such as "Kanban system" and " Logistics efficiency".
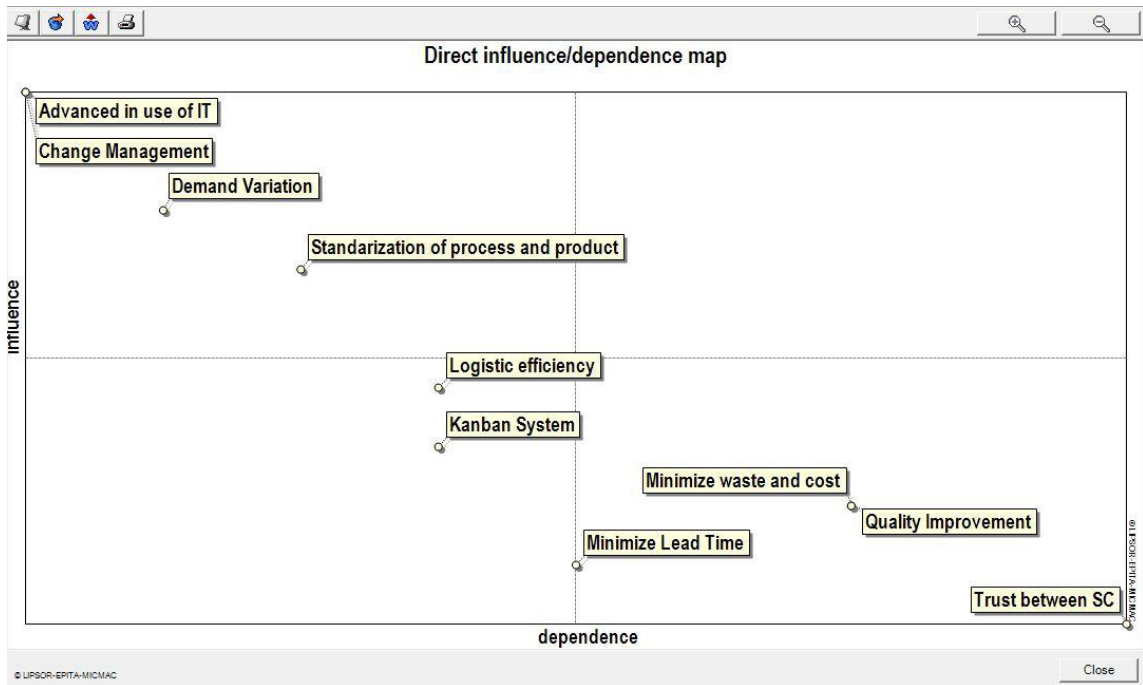
Fig. 2.Direct map

5. Conclusion

This research gives a contribution to identify the enabler of implementation of lean supply chain strategy using ISM methods in a book publisher which to the best of authors knowledge it has not found yet in the literature. A lean supply chain strategy is chosen after considering the nature of the demand of this company. As the data inputed to the ISM method was taken from a book publisher namely CV. Andi Offset, therefore the result from this study has to be validated if it is going to be implemented in other book publishers. ISM model shows relationship between enabler in hierarchy. The variable that have strong driving power and low dependence power is "Advance use of IT" and " Change management'. As a book publisher company, there exist some activities that require the use of IT, such as in the graphic designing process. In order for this activity to be performed faster and result in an excellent quality of graphic, the company has to update their graphic design software to the newest version therefore it requires also the high standard of computer processor to run the software. Therefore, the company has to invest some amount of money to incorporate this issue. Once the new version of graphic design software is implemented then it might affect the people in the company, such as the graphic designer has to get used to the latest version of sofware, therefore the change management is needed to ensure that the worker is able to adapt to the new system. In a book publisher, if the company is able to invest with the latest IT then the company is able to catch the demand variation, i.e. by rapid design process of new book titles.

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