THE IMPROVEMENT OF METAL STAMPING PROCUREMENT PROCESS

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Abstract. This research is aimed to improve procurement process in supply chain management with the capability to reduce environmental effect by lean production technique, and 3Rs principle, and to improve supply chain by SCOR model. The research methodology, Value Stream Mapping (VSM)is used to analyze the development of on time delivery of suppliers, and then SCOR model is applied to improve and reduce energy consumption and recycle material in supply chain. The result has been revealed that new development process could be improved on time delivery rate from 38.51% to 93.80%. This procurement process has reduced frequency of supplier's transportation from 40 to 29 times per month so it could reduce fuel consumption on average cost of 45,230.98 Baht per year, packaging cost on average of 158,295.11 Baht per year and reduce total GHG emission about $20.896 TCo_2e$ per year. Therefore,the new process can improve supply chain and being environmental friendly or sustainable green supply chain management.

Introduction

Nowadays,entrepreneurs are encouraged to support green supply chain management in cooperate with the EU to comply with the demand of being environmental friendly and urging customer to acquire sustainable products. The European Union and Japan have launched campaigns and issued regulations that entrepreneurs are required to proceed with regard to the impact on the environment. The target of green industries since year B.E, 2554-2561 are approximately 70,000 accounts while currently the entrepreneurs have been certified in green industry at 9,471 accounts [1].

Green supply chain management has not only focused on products and production processes but also the immediate results of their efforts in environmental friendly delivery and an operating method of more green products with the concept of green supply chain. Accordingly,the partners can take place simultaneously with the green procurement [2]. The reference model for Supply Chain Operations Reference (SCOR model) has presented guidelines of the Supply Chain Council which is composed of 5 factors are 1) Plan 2) Source 3) Make 4) Delivery and 5) Return [3].

The study showed that the companies in the electrical and electronics industry that purchased material of a case study could not deliver materials on time from such purchase order. The root cause was the delay of production planning. Studying the data from January until March 2014, the on time delivery is at 29.87%, 37.06%, 48.61% respectively by 38.51% on average. Therefore, the frequency of transportation to deliver products shall be increase to minimize shortage of raw materials.

Improvement of production process using lean manufacturing techniques is used to analyze the plan of value stream mapping (VSM) as stated by Rahani and Muhammad [4], VSM is an effective tool for the practice of lean manufacturing to track heavy manufacturing, equipment in combination with the new integration of the press brake and cuts process. Sales revenue can be increased to 40 million Euros, the total number of machines produced per month is increased from 20 to around 38, while, the production lead-time was reduced from 30 to 10 days. The equipment productivity rate can be improved by 65%.

Value Engineering and the Resource Conservation, resources recycling of used recycled pursuant to Main 3Rs are reduction, reuse and recycling are applied with the analysis of profitability, green supply chain management by calculating the Greenhouse gas emissions (GHG) and economic analysis as refered to Dumrongkiat et al [5].

Therefore, the objective this research is to propose an on time delivery improvement model of suppliers as case study by using lean manufacturing techniques integrated with SCOR model. This result benifits the improvement of delivery process with environmental friendly function and eventually contribute to green procurement. The research methodology, a case study, conclusion and also recomendation are the following;

Research Methodology

This study applies tools of lean manufacturing techniques by applying value steam mapping to analyze the problem of delayed delivery. Green Supply Chain Management consists of 1) Green Design 2) Green Procurement 3) Green Manufacturing/Productivity 4) Green Logistics 5) Green Recycling or Reverse Logistic [6,7]. Integrated with reference model for Supply Chain Operations Reference (SCOR model) is shown in Fig. 1 including 1) Plan: Use backward scheduling method refers shortage list plan [8], 2) Source: Follow order by using MRP data from customer, 3) Make: Production used Lean technique applies JIT concept, 4) Delivery: Follow customer request to use JIT concept, 5) Return: Review material packing for reuse process.

VSM analysis is found that the root causes of delivery delay are 1) manufacturer did not have adequate stocks of finished products according to requirements of material shortage list. 2) Planning could not plan with production lines to meet customer demand. The major factor in planning does not match the capacity of supplier (A) and customers (D). This case study makes a new backward schedule by refering the capacity of supplier (A) and customers (D) with the aim of on time matching finish goods. It is helpful to reduce the frequency of transportation by keeping record and returning packing materials for analyzing GHG emission of which GHG emission factor (EF) multiplied with activity data as formula equation 1 which unit was carbon dioxide equipvalent (CO_2e).
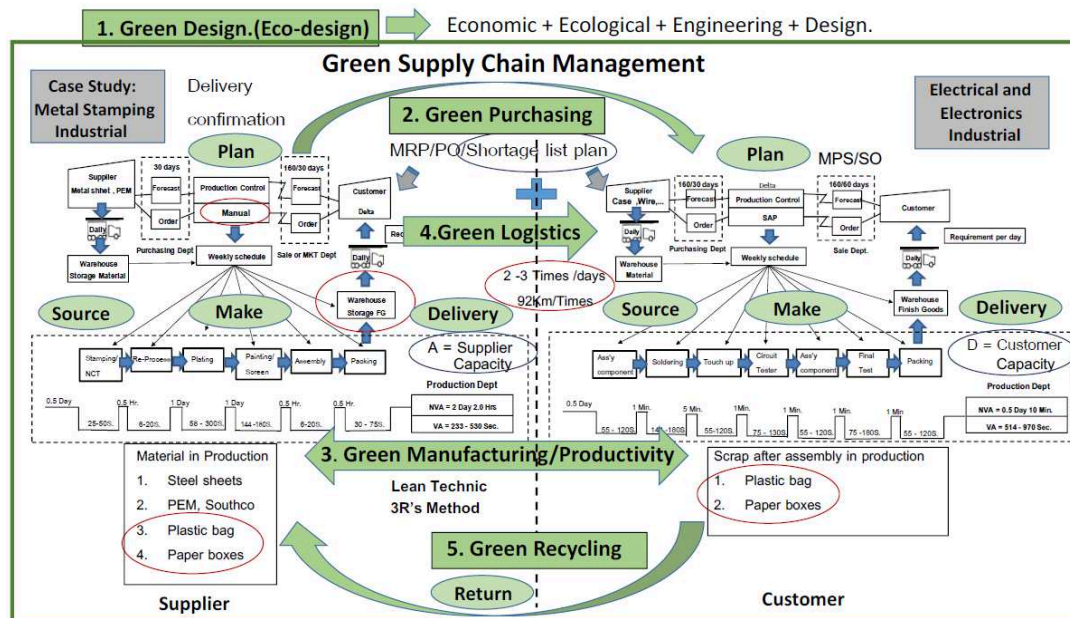
GHG emission = EF * Activity data (1)

Fig. 1 Integrated with VSM ,GSCM and SCOR model

Result of a case study

a) Supply Chain

Improvement of planning caused the on time delivery of finished goods as JIT concept. The result is found that the on time delivery rate can be improved from 38.51% to 93.80% as shown in Fig. 2 which is better than Nopadol and Kanjana in 2013 [8] becuase this research concerns Supplier (A) and customer capacity (D) for planning.
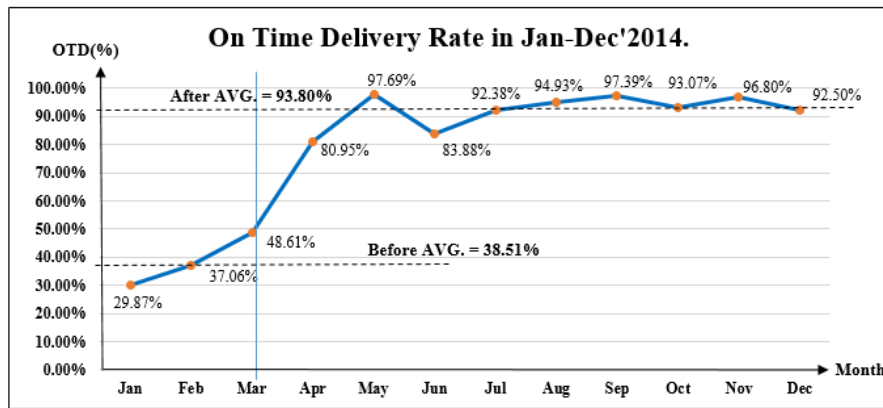
Fig. 2 On Time Delivery rate in Jan-Dec 2014.

b) Environment

Frequency of transportation could reduce from 40 to 29 times per month, therefore, they reduce GHG emissionsfrom 16.799 to 12.471 TCo$_2$e on average per year in the following Table 1.

Table 1 The result of greenhoues gas emission for transportation.

Transporation data		Emission	Before						After					
Distance (Km)	92	Factor	Frequency (Times)			Fuel usage	Fuel Cost	GHG	Frequency (Times)			Fuel usage	Fuel Cost	GHG
Fuel	Unit	Co2e/Km	FEB	MAR	Average	(L)	(THB)	(TCo$_2$e)	APR	MAY	Average	(L)	(THB)	(TCo$_2$e)
Diesel	L	0.4309	39	25	32	390.01	13,797.83	1.269	27	22	24.5	353.90	10,563.97	0.971
LPG	L	0.1720	7	3	5	51.52	669.22	0.079	1	1	1	10.30	133.84	0.016
NGV	L	0.1888	4	2	3	23.18	243.43	0.052	3	3	3	23.18	243.43	0.052
		Monthly	50	30	40	464.72	14,710.48	1.400	31	26	28.5	387.39	10,941.24	1.039
		Yearly			480	5,576.59	176,525.81	16.799	Yearly		342	4,648.67	131,294.83	12.471

After returning material for packaging,the recycling materials are plastic bag and paper boxes. It has been found that GHG emission could be reduced to 16.568 TCo$_2$e on average per year as shown in Table 2.

Table 2 The result of recycle and greenhoues gas emission for packaging

Packing material	Series No.	Dimension (mm.)	Unit Weight (Kg)	Unit price (THB)	Return per month(PCS.)			Average weight(Kg)	Emission Factor	GHG (TCo$_2$e)	Total cost (THB)
					Apr	May	Average				
Paper Boxes	CB01	356*305*298	0.3805	23.2	98	59	78.5	29.86925	0.826	0.025	1,821.20
	CB02	240*220*168	0.2775	12	253	344	298.5	82.83375	0.826	0.068	3,582.00
	CB03	498*290*205	0.358	22.6	499	739	619	221.602	0.826	0.183	13,989.40
	CB04	360*310*220	0.3245	19.8	125	153	139	45.1055	0.826	0.037	2,752.20
	CB12	600*315*220	0.61	27.8	54	77	65.5	39.955	0.826	0.033	1,820.90
	CB17	498*290*240	0.421	29.7	937	1896	1416.5	596.3465	0.826	0.493	42,070.05
Plastic Bag	A	220*165	0.01	0.1675	2808	3224	3016	30.16	1.52	0.046	505.18
	B	220*190	0.01	0.1675	4491	6651	5571	55.71	1.52	0.085	933.14
	C	615*410	0.02	0.9305	9428	17620	13524	270.48	1.52	0.411	12,584.08
									Monthly	1.381	80,058.15
									Yearly	16.568	158,295.11

c) Economic

As shown in Table 1, the reduction in fuel costs of transportation is emerged as well, with the average fuel cost from 14,710.48 to 10,941.24 Baht per month so it can reduce fuel costs at 45,230.98 Baht per year on average and can reduce cost of packaging material by returning for reuse. Consequently, it can save cost on average of 158,295.11 Baht per year as shown in Table 2.

Conclusion

This research uses lean manufacturing techniques with 3Rs principle and SCOR model to improve procurement processes and supply chain management. A novel of this research is to present the metal stamping procurement model for green supply chain management that minimizes traditional supply chain packaging and transportation cost, in addition to the carbon emissions cost

through carbon GHG reduction technique.The design and development production planning model by using backward scheduling is applied. Effective on time delivery rate is increased from 38.51% to 93.80%. Suppliers can reduce greenhouse gas emission on average of 20.896 TCo_2e per year and reduce fuel costs on average of 45,230.98 Baht per year. The packaging material cost can also be saved on average of 158,295.11 Baht per year. Accordingly, the total saving cost approximately 203,526.09 Baht per year. The improvement result in the suppliers and customers in terms of productivity, environment, economics, and social aspects of green supply chain management which is leading to sustainable in the future.

Acknowledgments

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