Logistics Cost in Wooden Furniture Industry

Saranyu Wasuwat*, Nivit Charoenchai

Department of Industrial Engineering, Faculty of Engineering, Chiang Mai University
239 Huay Kaew Road, Muang , Chiang Mai, Thailand, 50200
Tel: +6653-944125 Fax: +6653-944185 E-mail pong_1232@hotmail.com

Abstract
This analysis of logistics cost in Wooden Furniture Industry started from gathering all the cost information in the factory. Then, the Activity-Based Costing (ABC) was applied and used for the cost analysis. Four types of costs were examined: labor cost, land cost, machinery cost, and material cost. After that, cost calculation was distributed to all resources and to evaluate the total cost. Then, the total cost was divided based on 13 logistics activities to identify the logistics cost. This cost analytic method can propose a practical way to improve logistics cost of the industry for more efficient and effective management.

Keywords: Logistics Cost**,** Furniture, Activity-Based Costing

Introduction

Furniture Industry has nowadays become a popular and a highly competitive business in Thailand. Most business try to manage their investment funds to providing cheap goods and customer service along with satisfaction. Furniture Industry is one of business that the government is focusing on its high capability of market competition because of its potential contribution to the Thai economy. Approximately 59,000 – 60,000 million baht of the market value was generated and it has expanded 7 – 10 percent compared to 2012. Manufacturing costs including design and engineering activities have critical impacts on overall manufacturing costs. Many of the problems encountered in manufacturing can be traced back to the design process. In wood products companies such as furniture firms, there are many manufacturing problems that arise because of a bad design. [1]

The purpose of this research is to reduce logistics cost in furniture industry, especially on inventory cost, transportation cost and administration cost. This research analysed the cost by Activity-Based Costing (ABC) techniques and proposed a way to reduce logistics cost of the wooden furniture industry.

Literature review

Costs can be calculated in many ways. Activity-Based Costing (ABC) systems have been developed to improve the costing system, and claimed to be more accurate than traditional costing methods . David J. Robb studied supply chain and operations practice and performance in Chinese furniture manufacturing. They proposed and developed a model exploring these connections, utilizing data from a survey of 72 furniture manufacturers located throughout China. The industry is of particular interest in that, while labor productivity remained relatively low, exports had undergone substantial growth[2].

Logistics activities are searching constantly for ways to improve process capabilities, shorten throughput times, improve quality, and cut costs. Thararoop C. [3] studied logistics cost of industrial adhesive company. It was found that the highest logistics cost is transportation cost (63%). The second, third and fourth highest cost were logistics communication cost (19%) , material management cost (7%) , warehouse and storage cost (6%). The results showed that batch picking and routing order picker reduced the distance used in picking up the products by an average of 30% per day. The reduction of distance had a significant effect on the fuel cost of forklift. All so Kanlaya P.[4] studied logistics activities occurring in the process of exporting Nam-Dok-Mai mangoes and studied problems and barriers in each activity. The result of this research revealed that there were six logistic activities occurred in exporting process with composed of transportation activity, receiving and storage activity, material handling activity, customer service activity, packaging activity and inventory management activity. The problems found in each activity caused an increased in cost and lowered in the product quality. The critical problem was occurred in transportation activity. The results of this research can be used by exporters to improve and reduce the problems in their supply chain which can increase the national competitiveness of exporting Nam-Dok-Mai mangoes from Thailand.

Steps of designing ABC system

Activity-Based Costing (ABC) is a costing methodology that identifies activities in an organization and assigns the cost of each activity with resources to all products and services according to the actual

consumption by each. This model assigns more indirect costs (overhead) into direct costs compared to conventional costing. Onsanit S. [5] analyzed cost reduction on logistics using Activity- Based Costing (ABC) of Johnson Control & Summit Interiors Limited. The research results were found that the organization structure in accordance with job description, including managing directors and managers of each of total 11 departments, and then analyzed activity of each department divided into 3 steps: identifying activity, reporting activity, and cost driver. Moreover, in applying this Activity-Based Costing (ABC), it allowed the company to know the actual cost of logistics activities, which the use of the traditional cost system could not provide the details of each cost. The guideline in cost reduction in this research were proposed 3 approaches: reducing resource cost, reducing cost of plastic packaging, and reducing cost by integrating activities, and all these would enable the company to reduce the cost and increase profits.

The type of cost information needed and the scope of interest (company, production, plant, and department) should define before creating an ABC system. [6] The steps of designing an ABC-system are presented in Fig. 1. Starting the creation with documenting the material flows provides useful knowledge for identifying activities and resources. The existing cost information system can be used for identifying resources and costs, because ABC does not change costs themselves, but the allocation of costs. The identification of first-stage cost drivers is connected with identification of resources. The first-stage cost drivers are used for assigning cost of resources to activities. The unit price for a cost driver is calculated by dividing the resource costs by total output or capacity of the resource. Finally, the costs of objects can be calculated [7].

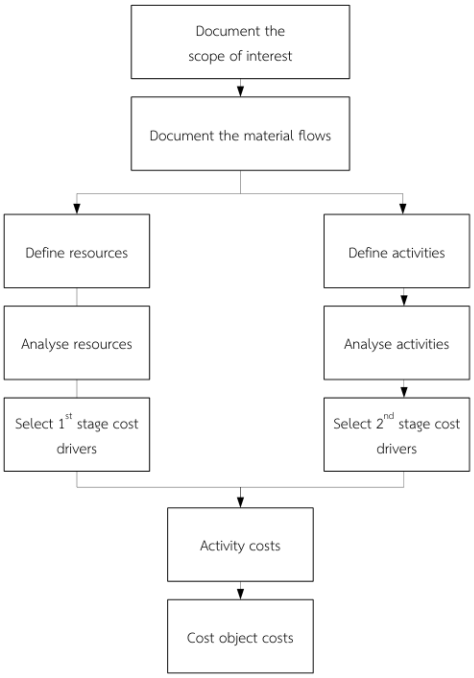

Fig. 1. The steps of designing an ABC-system.

Logistics Activities

Sudtivardnarupud K.[8] defines logistics activities as activities supporting internal operation of an organization in order to connect different departments and units as well as connecting outside the organization in terms of both demand and supply. Besides, Banomyong R.[9] divided logistics activities into 2 groups: 8 main activities of the organization and 5 supporting activities of the organization as shown in table 1.

main activities	sub activities
1.Customer service 2.Order processing 3.Demand forecasting 4.Inventory management 5.Transportation 6.Warehousing and storage 7.Reverse logistics 8.Purchasing	9.Part and service support 10.Plant and warehouse site selection 11.Material handling 12.Package and packaging 13.Logistics communications

Table1 shows main activities and sub activities

Customer Service is the provision of service to customers before, during and after a purchase. According to Turban et al.[10], "Customer service is a series of activities designed to enhance the level of customer satisfaction– that is, the feeling that a product or service has met the customer expectation."

Order Processing the flow of materials into an organization is usually initiated by a purchase order sent to a supplier. To prepare this a purchasing and does everything needed to get materials into the organization.

Demand Forecasting is the activity of estimating the quantity of a product or service that consumers will purchase.

Inventory Management sets the policies for inventory. It considers the materials to store, overall investment, customer service, stock levels, order sizes, order timing, and so on.

Transportation moves materials from suppliers to an organization's receiving area. For this, managers have to choose the type of transport (road, rail, air, etc.), find the best transport operator [11].

Warehousing and Storage moves materials from the receiving area into storage and makes sure that they are available when needed.

Reverse Logistics even when products have been delivered to customers, the work of logistics may not be finished. Sometimes there are problems with delivered materials and they have to be collected and brought back.

Purchasing refers to a business or organization attempting to acquiring goods or services to accomplish the goals of its enterprise.

Part and Service Support logistics activities are usually spread over many locations. For instance, stocks of finished goods can be held at the end of production, moved to nearby warehouses, sent to regional depots, put into stores near to customers, passed on to third parties, or a range of alternatives.

Plant and Warehouse Site Selection is a general term for the activities that deliver finished goods to customers, including outward transport. It is often aligned with marketing and forms an important link with downstream activities.

Material Handling is the general term for moving materials within an organization. Every time that materials are moved around operations, it uses materials handling, whose aim is to give efficient movements, with short journeys, using appropriate equipment, with little damage, and using special packaging and handling where needed [12] .

Package and Packaging wraps materials to make sure that they are properly protected during movements so that damage is kept to a minimum.

Logistics Communications Alongside the physical flow of materials is the associated flow of information. This links all parts of the supply chain, passing information about products, customer demand, materials, movements, schedules, stock levels, availability, problems, costs, service levels, and so on.

Company case
The research studied in a wooden furniture factory. Because the cost of wooden furniture was very high, the research objectives were to find where or which activity originated that high cost. Products chose to be studied was the most productive one; i.e. night table. The cost examined contained 10 categories and the activities were divided into 27 activities. Only inbound logistics activities were studied.

Research Methodology
Data correction
The activities flow in furniture industry was studied. The costs and the order of production activities were examind. 10 categories and 27 activities were closely examined by gathering data about the cost for one month period.

Resources identification
Four types of resources were identified as. 1. Labor cost 2. Land cost 3. Machinery cost 4. Material cost and cost identifications were calculated as followed.

Distribution of labor costs
Cost per month of salary of employee A = salary of employee A × % ratio of operational logistics of the staff's A.

Cost per month of salary of employee B = salary of employee B× % ratio of operational logistics of the staff's B.

All labor cost is the sum of the cost of all staffs involved.

Distribution of land costs
Monthly cost of land use = land cost paid per month × (land used in the operation's logistics ÷ land where the building is located)

The cost per month of building use = Land cost to pay per month × (area of the building used for logistics work ÷ all space within buildings).

Distribution of machine costs
The depreciation per month = (Price possession - depreciation deducted) ÷ number of years left ÷ 12.

Maintenance costs = Maintenance of all equipment used per year ÷ 12.

Distribution of material costs
The costs of material usage per month = Purchasing value of materials used per year ÷ 12.

Cost per month = Price per unit × consumption volume per month.

Activity-Based Costing (ABC)
Distribute four type of resources (5.2) to each activities and summation the total cost were find cost of each activities.

Logistics Cost
Divide 13 costs of logistics activities from all cost in 5.3

Conclusion
Conclude logistics cost of each activity and propose guidelines to reduce logistics cost

Result

Activities identification

Using Activity-Based Costing to calculate activities related to logistics, researchers examined the process flow of wooded furniture industry in order to find out the relationship between the function of different units related to logistics as shown in table 2

Activities in wooden furniture			
1	**Data information**	**5**	**Production process**
1.1	Purchasing	5.1	Woods section
1.2	Order received	5.2	Colours section
1.3	Finished good	5.3	Assembly section
1.4	Production ordered	**6**	**Checking process**
1.5	Product designed	6.1	Checking process
1.6	Make an invoice	**7**	**Packaging process**
2	**Receiving material**	7.1	Stock checking
2.1	Wood inspection	7.2	Packaging
2.2	Material inspection	**8**	**Transportation**
2.3	Moving the product by hand lift	8.1	Prepare product for loading
2.4	Bringing wooden to oven	8.2	Loading product
3	**Inventory management**	**9**	**Reverse logistics**
3.1	Wooden shaving	9.1	After sales service
3.2	Storing wooden on the shelf	9.2	Repairing product
3.3	Storing wooden on the floor	**10**	**Administration management**
3.4	Material inventory	10.1	Cleaning
4	**Material Handling**		
4.1	Distribute materials		
4.2	Distribute woods		

Table2. Shows all activities in wooden furniture

Table 2 shows all activities in wooded furniture factory, which can be categorized into 10 units and have 27 activities. After specifying logistics activities to be studied, the next step is to identify relevant resources

Resource identification

Resource costs of wooden furniture industry are evaluated by the following categories: material cost, machinery cost, land cost and labor cost. The costs to be calculated are costs incurred in one month. The collected data comes from the expenses of a company.

Cost type	Cash	%
Labor cost	78433.13	50.28
Land cost	43,665.13	27.99
Material cost	22,037.23	14.13
Machinery cost	11,851.31	7.60

Table3. Shows Resources identification

Table3. shows the cost of Resources identification. Labor cost was the highest value (50.28%) and land cost, material cost and machinery cost ,the value reduced accordingly.

Cost Distribution for Different Activities

Distribution of labor costs

Data information	Times	Labor	Salary(Baht)	Ratio(%)	Costs (Baht)
1.1Purchasing	3,120	1	10,000	25	2,500
1.2Order received	4,680	1	100,000	37.5	37,500
1.3Finished good	1,560	1	10,000	12.5	1,250
1.4Production ordered	130	1	100,000	1.04	1041.67
1.5Production designed	5,720	1	35,000	45.83	16041.67
1.6Make an invoice	480	1	18,000	3.85	692.31

Table4. Distribution of labor costs

Distribution of land costs

Activity	Land cost		electricity charge		Telephone bill		Internet cost		Total
	36316.96		25991.4		4323.88		1302.26		67934.5
	Ratio(%)	Costs (Baht)	Ratio(%)	Costs (Baht)	Ratio(%)	Costs (Baht)	Ratio(%)	Costs (Baht)	
Data information									
1.1Purchasing	0.17	61.01	14.30	3717.80	40.00	1729.55	40.00	520.90	6029.26
1.2Order received	0.24	87.16			60.00	2594.33	60.00	781.36	3462.84
1.3Finished good	1.82	660.31							660.31
1.4Production ordered	0.24	87.16							87.16
1.5Product designed	0.17	61.01	26.22	6815.96					6876.97
1.6Make an invoice	0.17	61.01	2.20	571.97					632.98

Table5. Distribution of land costs

Distribution of machine costs

When developed the activity cost from machine cost, the cost distributed calculated from the ratio of time the machine ran for that particular task. For example, some machines ran two activities equally, each activity cost gained from a half of machine cost.

Distribution of material costs

Data information	material	Ratio (%)	Costs (Baht)
1.1Purchasing	Office equipment	10.00%	29.20
1.2Order received	Office equipment	10.00%	29.20
1.3Finished good	Office equipment	10.00%	29.20
1.4Production ordered	Office equipment	10.00%	29.20
1.5Product designed	Office equipment	10.00%	29.20
1.6Make an invoice	Office equipment	10.00%	29.20

Table6. Distribution of material costs

Calculation of logistics activities costs

Can be done by using the ratio of cost distribution multiplied by the cost of that category. Then find the sum of all the costs resulting in activities costs.

	Activities	Resource identification				Total	Ratio %
		Labor cost	Land cost	Machinery cost	Material cost		
1	Purchasing	2500.00	6029.26	63.58	4.96	8597.80	5.51
2	Order received	37500.00	3462.84	13.12	-	40975.96	26.27
3	Finished good	1250.00	660.31	-	4.96	1915.27	1.23
4	Production ordered	1041.67	87.16	-	4.96	1133.79	0.73
5	Product designed	16041.67	6876.97	873.27	4.96	23796.87	15.26
6	Make an invoice	692.31	632.98	45.22	4.96	1375.47	0.88
7	Wood inspection	253.84	577.77	-	137.33	968.94	0.62
8	Material inspection	171.16	548.06	9.92	4.96	734.10	0.47
9	Moving the product by hand lift	15.38	858.40	2.48	-	876.27	0.56
10	Bringing wooden to oven	129.23	250.92	-	1345.72	1725.87	1.11
11	Wooden shaving	4410.00	6981.57	4433.33	2291.09	18115.99	11.61
12	Storing wooden on the shelf	588.00	247.62	921.65	-	1757.27	1.13
13	Storing wooden on the floor	575.00	779.16	-	-	1354.16	0.87
14	Material inventory	82.69	660.31	217.75	-	960.75	0.62
15	Distribute materials	541.67	31.69	52.41	-	625.77	0.40
16	Distribute woods	1365.00	148.57	131.02	-	1644.59	1.05
17	Woods section	3706.00	4832.35	4058.69	7702.15	20299.19	13.01
18	Colours section	3081.71	2212.78	787.63	4273.97	10356.09	6.64
19	Assembly section	796.85	1268.20	241.24	4869.96	7176.25	4.60
20	Checking process	1003.85	148.57	-	142.29	1294.71	0.83
21	Stock checking	112.93	277.33	-	4.96	395.22	0.25
22	Packaging	439.18	99.05	-	339.58	877.81	0.56
23	Prepare product for loading	118.27	277.33	-	-	395.60	0.25
24	Loading product	149.08	1122.52	-	-	1271.60	0.82
25	After sales service	76.07	1122.52	-	4.96	1203.55	0.77
26	Repairing product	291.58	578.74	-	663.92	1534.23	0.98
27	Cleaning	1500.00	2892.15	-	231.54	4623.69	2.96
	Total	78433.13	43665.13	11851.31	22037.23	155986.80	100.00

Table.7 Shows Cost of all activities in wooden furniture

Table 7 Shows Cost of all activities stating that order received highest value is 26.27% of the cost all activities, which is as high as 40,975.96 Baht. The second highest value is product designed, 23796.87 Baht, which is 15.26 % Costs of all activities can be presented by Pareto Chart with value 80% as shown in figure 4.

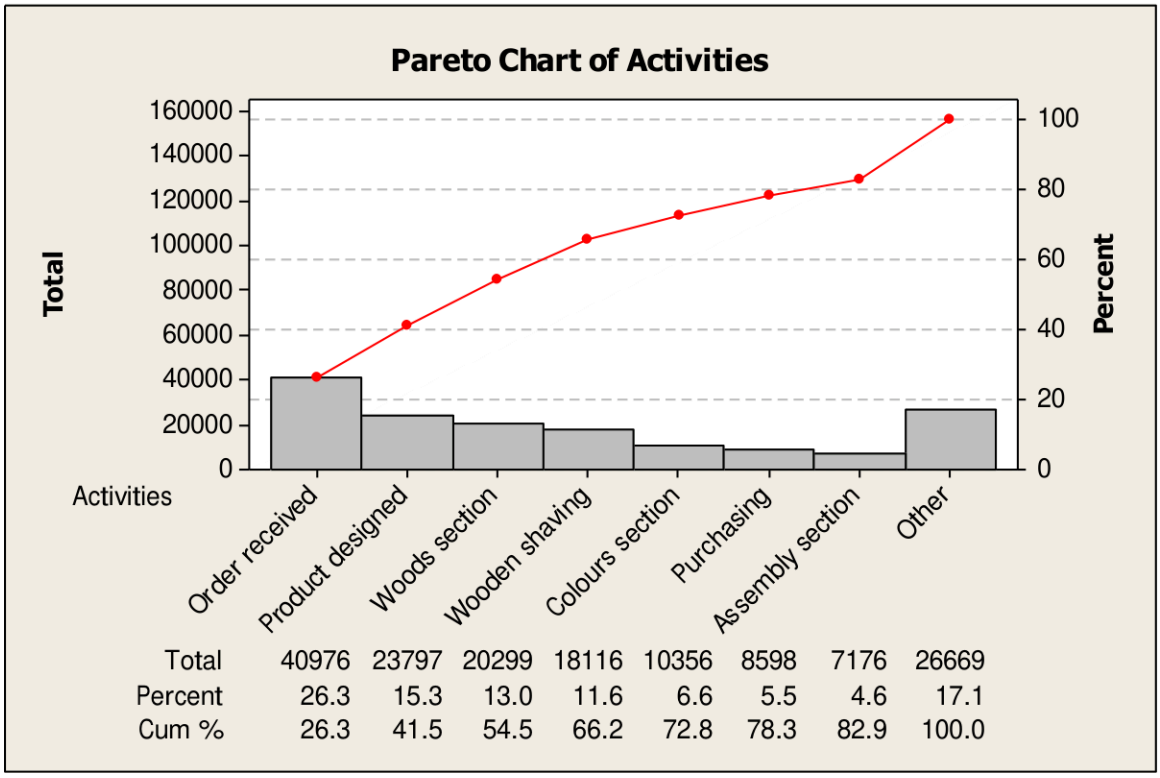

Fig.2. Shows pareto chart cost of each activities .

Gathering data costing of each activity to make Pareto Diagram as shown in fig.4.The Pareto diagram shows 80% of logistics cost that the highest cost is order received 26.27% , product designed 15.26%, woods section 13.01% wooden shaving 11.61% , colors section 6.64% , purchasing 5.51% and assembly 4.60 %

Considering 13 different logistics activities costs, we can find that 3 of them have value higher than 80% as shown in the Pareto Chart, including order received 26.27% , inventory management 11.61% and purchasing 5.51% If it is possible to decrease the cost of all 3 activities, the logistics cost of the industry will also decrease. Researcher uses industrial engineering technique to make the logistics cost lower.

Conclusion

According to the analysis of logistics cost in Wooden Furniture Industry applying the Activity-Based Costing (ABC) , the result shows that the highest logistics cost is order received 26.27% inventory management 11.61% and purchasing 5.51% of all activities in wooden industry. Researcher suggests that a way to improve logistics cost of the industry for more efficient and effective management is to use industrial engineering technique to adjust each activity such as problem of inventory management activity is formed into group by ABC Analysis and set new organization to improve working process for order received problem. Because current flow all of purchasing process was approve by top management.

Acknowledgements

This research was supported by the faculty of Engineering Chiangmai University , and also the cooperation shown by the case study company.

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