



Research of logistics costs in the ceramic and tile industry, Case study is Khayyam tile industry

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Abstract: During past decade, following the increase in the diversity of the patterns of client expectations and its consequent rise of industrial competition for better productions and services, organizations increasingly paved the ground for higher flexibility in production lines and product development to meet the costumers' needs. But managers of many industries learned that in order to survive in the market, improving internal procedures and company's flexibility is not solely enough but material and parts suppliers must also match the company's market development policies. Competitive environment faced companies with several challenges such as reduction of production cycles, decrease in distribution time, decrease in inventories and also waiting time, which are all of high importance to maintain profitability in the market. In order to solve these problems, the process which is now referred to as Supply Chain Management was introduced; meanwhile the notion was soon spread that the real competition was not between companies but was between supply chains indeed and logistic as a part of it was remarked. In the first step, through a critical review of the literature the constituent elements of logistics costs were integrally identified and content classified. The output of this stage developed a model that represents the main structural constituent of logistics costs with associated variables. By using a questionnaire and interviewing elites the general model was then turned into a native model in the ceramic and tile industry. Then based on conceptual cost model, consisting of structures and variables, a case study on Khayyam Ceramic and Tile Company was conducted and using financial statements and interviewing relevant units within the company, a cost framework was extracted and following results were obtained. According to the study, 11% of the total costs of the company accounted for logistics costs of which, 33% was transportation costs, 39% inventory costs, 16% storage and handling costs, and 12% customer related services and order processing.

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Introduction:

In today's world, economic conditions change rapidly and countries are discovering that globalization makes the world smaller and more competitive. Also, customers seek for products and services that meet their specific needs and companies try to create competitive advantage for themselves in order to maintain their profitability and market share. All these tends push companies and countries to more focus on the supply chain and integrated logistics (Zanjirani *et al.*, 2010).

Increasing the productivity and efficiency of the supply chain activities is considered a competitive advantage for countries. One of the most important parts of such activities is logistics which can cause dramatic reduction in costs. Efficient management of logistic activities is a complete source for creating competitive advantages. In addition, it allows companies to meet their customers' specific needs which can lead to customer satisfaction.

Lack of information about the logistics costs is an important constraint on understanding the integrated logistics. Optimization of currents and integration of resources are the main objectives of integrated logistics. Therefore, managers need clear information on the logistics costs in all stages of production. Without such information, it is not possible to measure the effect of decisions on costs across the supply chain.

Distribution of products and services from the sources to the destination is a major part of gross domestic production (GDP) of any country which shows that how much money has been produced by any country. Hence, logistics activities means money for a country. When logistics activities are more integrated, they can be more efficient and productive. However, lack of detailed information on costs is an obstacle to the full implementation of integrated logistics operations (Zanjirani *et al.*, 2010).

Previous studies:

Lambert (1999) proposed a total cost model based on logistics activities that which deal with assessment of different logistics costs in order to optimizing the output of logistics system that is customer services. In this model, logistics costs include costs of transport, warehousing, inventory maintenance, order size, order processing, and customer services (Froderberg, 2006).

Transport costs include depreciation of equipment and operational costs of transport. Operational costs include cost of fuel, salary of personnel, managers, and supporting forces, and toll and insurance (Yang *et al.*, 2011). Rent and maintenance of vehicles are also considered as transport costs (Huang, 2010). Transport costs in the road, rail, sea, and air transport sectors and also pipeline are considerable. Customs costs include cost of clearance, customs workers brokerage, and costs of warehousing, loading, and unloading.

The costs of order processing and information systems are related to customer order processing, distribution, communication, and demand forecast. Information systems costs include the costs of investment in information technologies, equipment maintenance, and training of staff forces.

Displacement costs include the costs of movement of materials between production lines, movement into or out of the organization, and returned goods handling. The costs of order size are related to purchase and production. With changes in the order size, the costs related to production preparation, capacity, and displacement of material are also changed. Purchase costs also vary depending on the different amount of purchase. The costs associated with customer service level are influenced by customer expectations. In the case of direct distribution of products from the warehouse to the retailers, logistics costs include transport and inventory costs. In the case of using intermediary distribution centers, the cost of transport from the warehouse to distribution centers and from distribution centers to the retailers and also the costs of distribution centers are added to logistics costs.

The results of a survey conducted on logistics costs in the U.S. in 2008 show that transport is the most important component of logistics costs. According to this study, transport, inventory maintenance, warehousing, customer services/order processing, and administrative costs, respectively, account for 50%, 20%, 20%, 7%, and 3% of total logistics costs (Roshton, 2010).

Significance and rationale:

In the course of the globalization of businesses, logistic facilities play an important role in the success of supply chains. In many developed countries,

distribution networks are changing in order to better meet customers' needs. Problems related to logistics systems in developing countries are very deep-rooted and their weakness is not only due to lack of facilities but the lack of a correct understanding of the importance and role of logistics in industry. Despite many problems of these countries, few studies have been carried out on this subject.

With a capacity of production of over 169 million square meters of different types of tiles and ceramic, Yazd Province covers about 45% of production of these products in Iran. Currently, there are 42 units if ceramic and tiles production in this province which have created job for 11842 people directly and over 8000 billion Rilas has been invested in this sector. In addition, there are 42 projects of ceramic and tiles production in this province with more than 20% of physical progress which can both create job for 14000 job applicants and increase the total production of tiles and ceramic in Yazd Province by 240000 square meters (Rahmani, 2011).

The liberalization of energy prices and consequently increased costs of transport and high levels of inventory due to problems with the supply of goods in Iran are of factors that increase logistics costs in the finished price of products. These issues have doubled the importance of logistics costs for companies.

Research questions:

- 1- What percentage of the finished production cost in the ceramic and tiles industry is accounted for logistics costs?
 - What are the transport cost items in the ceramic and tiles industry?
 - What are the inventory maintenance cost items in the ceramic and tiles industry?
 - What are the warehousing cost items in the ceramic and tiles industry?
 - What are the order processing cost items in the ceramic and tiles industry?
 - What are the order size cost items in the ceramic and tiles industry?
 - What are the displacement cost items in the ceramic and tiles industry?
 - What are the customer services cost items in the ceramic and tiles industry?
- 2- How the logistics cost are calculated in the ceramic and tiles industry?

Statistical population, sampling method, and sample size:

The present study was carried out in two stages, so two different statistical population were used. The first statistical population included the elite

financial experts of this industry for domestication and conversion of the general model into the logistics cost model for the ceramic and tiles industry and the second population included the financial managers and accountants of a company producing ceramic and tiles for calculating the total cost of logistics.

Research scope:

Thematic scope of research:

Logistics costs in the ceramic and tiles industry is the specialized area of this study. Hence, the constituent components of logistics costs in the ceramic and tiles industry were identified and calculated.

Leading countries in the ceramic and tiles industry:

Like previous years, China is still is the world's largest producer, consumer, and exporter of tiles and the only country with a two-digit growth in the production, consumption, and export of tiles in 2010 (a growth of 16.7% in production and 15.5% in consumption) [8]. In 2010, China had an increase of 63% in the imports of ceramic machinery from Italy which indicates the rapid growth of this country in production of tiles and ceramic. China's exports increased by 20.7% and reached 705 million square meters with a value of more than 3.85 billion dollar, according to China's Customs statistics. Asia and the Middle East (56.7%), North America (6.9%), Central and South America (9.2%), Europe (10%), and Pacific (2.5%) are the target markets of Chinese ceramic and tiles.

Top 10 countries in the industry of ceramic and tiles in 2010 and their 4-year trend

Number	Country	Production (million square meters)					% of world production
		2006	2007	2008	2009	2010	2010
1	China	3000	3200	3400	3600	4200	44.1
2	Brazil	594	637	713	715	753	7.9
3	India	340	385	390	490	550	5.8
4	Iran	210	250	320	350	400	4.2
5	Italy	569	559	513	368	387	4.1
6	Vietnam	199	254	270	295	375	3.9
7	Spain	608	585	495	324	366	3.8
8	Indonesia	170	235	275	278	287	3.0
9	Turkey	265	260	225	205	245	2.6
10	Egypt	122	140	160	200	220	2.3

Top 10 countries in consumption of the products of the industry of ceramic and tiles in 2010 and their 4-year trend

Number	Country	Consumption (million square meters)					% of world consumption
		2006	2007	2008	2009	2010	2010
1	China	2450	2700	2830	3030	3500	37.4
2	Brazil	486	535	605	645	700	7.5
3	India	350	397	403	494	557	6.0
4	Iran	182	236	265	295	335	3.6
5	Vietnam	145	210	220	240	330	3.5
6	Indonesia	148	178	262	297	277	3.0
7	Egypt	103	105	140	180	200	2.1
8	The U.S.	308	248	211	173	186	2.0
9	Saudi Arabia	100	110	136	166	182	1.9
10	Mexico	164	173	176	163	168	1.8

Top 10 countries in exports of the products of the industry of ceramic and tiles in 2010 and their 4-year trend

Number	Country	Exports (million square meters)					% of world exports
		2006	2007	2008	2009	2010	2010
1	China	450	500	570	584	705	36.8
2	Italy	396	379	355	281	289	15.1
3	Spain	336	333	306	235	248	12.9
4	Turkey	93	104	92	67	84	4.4
5	Brazil	115	102	81	61	57	3.0
6	Iran	18.2	21.3	27	40	54	2.9
7	Mexico	55	56	62	51	52	2.7
8	Poland	21	30	34	35	42	2.2
9	United Arab Emirates	32	38	34	31	32	1.7
10	Thailand	27	25	25	36	32	1.7

Top 10 countries in imports of the products of the industry of ceramic and tiles in 2010 and their 4-year trend

Number	Country	Imports (million square meters)					% of world imports
		2006	2007	2008	2009	2010	2010
1	The U.S.	254	202	157	124	130	6.8
2	Saudi Arabia	89	77	99	116	129	6.7
3	France	110	108	112	101	103	5.4
4	Germany	87	83	80	78	80	4.2
5	South Korea	54	66	59	55	59	3.1
6	Iraq	3	10	23	40	57	3.0
7	United Arab Emirates	51	43	55	45	48	2.5
8	The U.K.	66	67	58	43	43	2.2
9	Israeli	26	30	30	30	39	2.0
10	Russia	42	47	54	30	38	2.0

Production of tiles and ceramic in Iran:

Changes in the culture of consumption and the use of high quality and proper materials in construction, involvement of government in construction of houses for those without housing, and prohibition on the exports of poor quality goods have caused the industry of ceramic and tiles to develop dramatically in Iran. According to the latest statistics released, ceramic and tiles production in Iran reached more than 250680000 square meters during the past 11 months which shows a growth of 22% compared to the same period last year. In addition, some factors such as population increase and rising rates of constructions have increased the per capita consumption of ceramic and tiles. China, the U.S., Brazil, Italy, Spain, France, Turkey, Malaysia, Saudi Arabia, and Iran are the largest consumers of ceramic tiles in the world. Currently, the per capita consumption of different types of tiles in Iran is 2.4 m², while this figure for the whole world is about 5.8 m².

According to the latest statistics of the Iranian Customs, more than 268 million dollar of different types of ceramic and tiles with a weight of more than 5101 million tons and value of three thousand billion Rials were exported to other countries during the 11 month of 2011. On the other hand, Iran’s ceramic and tiles industry has exported its products to 20 countries in recent year. Pakistan, Georgia, Azerbaijan, Armenia, Uzbekistan, Afghanistan, UAE, Tajikistan, Thailand, Turkmenistan, Zimbabwe, Turkey, Iraq, Saudi Arabia, Russia, Kyrgyzstan, Kazakhstan, Qatar, Macedonia, Spain, Ukraine, Bahrain, South Korea, Djibouti, and Kuwait are the countries that the products of Iran’s ceramic and tiles industry have been exported to in the current year.

According to the Iranian Association of Manufacturers of Ceramic and Tiles, production of ceramic and tiles in Iran reached a figure of 400 million m² in last year and after China, Spain, Italy, and India, Iran is the world’s fifth largest manufacturer of ceramic and tiles.

According to the President of the Iranian Association of Manufacturers of Ceramic and Tiles, about three billion dollars have been invested in this industry during the last decade. Currently, about 40000 people are directly working in the sector of ceramic and tiles production and about 200000 indirect jobs have been also created in this

industry. In exports of ceramic and tiles, Iran has the world’s seventh rank. In addition, due to the large volume of constructions and the demand for more housing, Iran is considered the eighth largest consumer of ceramic and tiles in the world. Currently, more than 100 companies in Iran are operating in the production of ceramic and tiles (Rahmani, 2011).

Components of logistics costs (Zanjirani *et al.*, 2010)

Classification of logistics costs	Description
Transport	Fare: Costs incurred for delivery due to the use of different methods of transport Integration: The cost of combining small packs and making larger packs Transfer cost: Costs incurred for transferring cargo between different methods of transport Taking and delivery: Transport costs incurred between the senders warehouses and integrator of air or rail terminals
Inventory maintenance	Maintenance of pipelines: Storage costs over the transfer Confidence reserve: The cost of keeping the confidence reserve
Management	Order process: The wages of the staff of sales and orders management unit Communication: The costs related to telephone, fax, and data transfer by international logistics Overhead: The rent paid by the international logistics groups
Customs	Customs clearance: The fees charged by local customs for clearance The broker right: The fee paid to the agent who receives the goods instead of the sender of the receiver Transfer costs: bills of each destination
Risk and damage	Damage / loss / delay: The value of each unit of submissions which may be lost, damaged or delayed Insurance: at least 25 or 0.5 \$ per hundred dollars of insured value
Handling and packing	Terminal handling: The costs of handling by transport company Displacement of materials: The costs of labor and equipment used for movement of goods between warehouses of the sender and receiver Displacement in/out: The cost of materials displacement for the forwarder due to the use of its facilities Packaging/preparation of materials: The costs of preparing the goods for sending Storage: The cost of renting the warehouse

Determining the constituent elements of the overall logistics costs in the ceramic and tiles industry:

The results of questionnaires and interviews with industry experts indicate that logistics costs can be divided into 7 categories of transport, inventory maintenance, warehousing, order processing and information system, displacement, order size, customer services.

Transport:

In this industry, all domestic and foreign materials are transported by trucks and pickup trucks. The items purchased from foreign countries in limited quantities are usually transferred into the country by airplane or container.

Transport costs

Description	Title of costs
Transport costs	Outsourcing transport cost
Rent of equipment	Transport equipment cost
Ownership costs (depreciation)	
Fuel costs	Operational cost of transport
Direct operating personnel salary	
Management and the staff salary	
Repair and maintenance costs	
Toll and insurance	
Clearance costs	Customs costs
Customs warehousing costs	
Customs loading and unloading	
Other customs costs	

- Outsourcing transport cost: 13,646,621,641 Rials
- Transport equipment cost: 447,459,164 Rials
- Operational costs of transport: 1,317,216,305 Rials
- Customs costs: -
- Total transport costs: 15,411,297,110 Rials

Inventory maintenance costs:

Tiles and ceramic are stored in the open area of workshops or manufacturing factories. Colors, glazes, laces, and cardboards are kept in roofed warehouses and away from moisture. Inventory control is done based on the warehousing system and determining the order point.

Inventory maintenance costs

Description	Title of costs
Capital expenditures of raw materials inventory	Capital expenditures of inventory
Capital expenditures of products inventory	
Capital expenditures of semi-produced inventory	
Insurance of inventory	Service related to inventory
Taxes related to inventory	
Rent	Variable costs of warehouse space
Cooling and heating cost and others	
Cost of obsolescence or abandonment	Inventory risk costs
Cost of failure or deterioration	

- Capital expenditure of inventory: 18.24 billion Rials
- Services related to inventory: 92,862,300 Rials
- Variable costs of warehouse space: -
- Inventory risk costs: -
- Total costs of inventory maintenance: 18,232,862,300 Rials

Warehousing and displacement costs:

Cardboard is needed for packing the tiles. Every square meters of tiles can be packed in a cardboard box. Tape is used for covering the door of cardboard box. On average, a roll of tape is enough for packing 50 boxes.

Warehousing and displacement costs

Description	Title of costs
Human resources cost	Packing costs
Packing technology cost	
Maintenance of packing equipment	
Equipment depreciation costs	
Cost of materials	
Fuel cost	
Packing materials costs	
Rent	Fixed costs of warehouse space
Heating costs	
Warehouse depreciation costs	
Warehouse maintenance costs	
Human resources cost	Loading and unloading costs
Forklift fuel cost	
Repair and maintenance costs	
Equipment depreciation costs	
-	Fixed costs of the warehouse staff
-	Fixed and variable costs warehouse workers

- Packing costs: 4,001,568,017 Rials
- Fixed costs of warehouse space: 1,296,961,518 Rials
- Loading and unloading costs: 915,467,758 Rials
- Fixed costs of the warehouse staff: 720 million Rials
- Fixed and variable costs of warehouse workers: 360 million Rials
- Total cost of displacement and warehousing: 7,293,997,293 Rials

Order processing and customer services costs:

Usually, no sales and after-sales services are provided for customers in ceramic products manufacturing companies and workshops. Only a few companies provide facilities for resolving any problem with the number of boxes sent or the quality of products after delivery of orders to customers.

Order processing and customer services costs

Description	Title of costs
Cost of ordering to suppliers	Costs of order processing
Cost of receiving the order from customers	
Order processing costs	
IT investment costs	Information systems costs
Logistic communications costs	
Costs of training the staff	
Equipment maintenance costs	

- Costs of order processing: 2,072,660,947 Rials
- Information systems costs: 3,214,971,120 Rials
- Total costs of order processing and customer services: 5,287,632,067 Rials

Order size costs:

Order size costs

Description	Title of costs
Cost required to set up the production lines	Costs of production order size
Cost of waste of production line setup	
Costs of the loss of production capacity	
-	Costs of purchase order size

- Costs of production order size: 360,000,000 Rials

- Costs of purchase order size: 360,000,000 Rials

Analysis of logistics costs in Khyam Meybod Ceramic and Tiles Company

% of finished price	% of total group	Fee	Description of cost group
%3.63	%33	15.411.297.110	Transport
%4.29	%39	18.232.862.300	Inventory maintenance
%1.76	%16	7.293.997.293	Warehousing and displacement
%1.32	%12	5.287.632.06	Order processing and customer services
-	-	360.000.000	Order size
11%	100%	46.585.788.770	Total

Recommendations:

Practical recommendations:

1- One of the ways of fault finding and improving logistics activities in enterprises is to use logistics costs index. Hence, analysis of logistics costs can be considered as part of the logistics management tasks. Cost analysis can be done for getting familiar with the amount of resources required for logistic activities in order to maximize the performance of activities and minimize the cost if consumption resources.

2- One of the reasons that makes it difficult for organizations to adopt an integrated approach to the management of logistic costs is the lack of appropriate and adequate information on costs. Proper management of logistics activities within a comprehensive system warrants the use of a special type of costing system. Traditional costing systems consider the costs in general and cumulative groups which does not provide the possibility for more detailed analysis in order to identify the costs of logistic activities. In this case, it would be very difficult to find faults and discover the opportunities of improvement and modification in logistic systems. Hence, there is a need for a particular costing approach for analyzing the components of a logistic system. Such an approach provides the possibility for calculation of logistics costs by the constituent components. Logistic activities of an organization is classified as supportive measures, so the costs related to these activities are considered as indirect and overhead costs. Traditional costing systems usually prorate the indirect costs in the output produced unit equally. The point that should be taken

into account is that introduction of traditional costing systems goes back to the nineteenth century and at the time, due to primary methods of production and management and low level of technologies, overhead costs accounted for a small portion of the total cost of production. By contrast, in the manufacturing organization of the twenty-first century, because of many reasons such as the competitive conditions of the market, technological developments, and reduced role of human resources in production, many supportive units have been formed around productive activities and the share of the direct costs of production has fallen sharply. Therefore, calculation of logistic costs that are classified as overhead costs is not easy by the traditional approaches.

3- Activity-based costing system is one of the modern methods of costing which aims to resolve the problem of non-separability of indirect costs. This method emphasizes on the analysis of activities and their costs and is based on defining a relationship between product, activity, and cost resource. In fact, activities are presented as an intermediate that products consume cost resources through which. In a nutshell, in this approach, costs are allocated to activities and activities are allocated to products. Thus, both the costs can be calculated more accurately and all activities can be analyzed thoroughly.

Recommendations for future studies:

It is recommended that the same study to be carried out after the implementation of the second phase of Targeted Subsidies Program and also at the end of the 5-year Development Program and compare

the results with each other in order to find appropriate strategies and solutions for moderating the effects of this programs on the logistic costs. It is also recommended that the factors affecting the increase in logistics costs obtained in these present study to be combined with large-scale factors in future studies in order to propose solutions to address the high cost of logistics.

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2021/25/4