

SIMULATION GAME FOR “OUTBOND LOGISTICS” BASED ON COLLABORATION IN CEMENT INDUSTRY

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ABSTRACT

Purpose: Logistics and distributions activities require high costs although these are non value added to products, but these activities for cement industry which has mature on production technology, influences the competition to struggle the market segment. Outbond logistics of cement industry, need to perform daily decisions either strategically or technically.

Design/methodology/approach: logistics and distribution aspects have to be managed effectively in order to avoid shortage or stockout in some market and overstock in others. A simulation approach will be run to imitate the competition of the Indonesian cement industry with multiplayer players to simulate the performance and cost of logistical decisions.

Findings: A new simulation game was developed to imitate the characteristics of outbond logistics on cement industry. This simulator simulates several companies that compete in the same market in some areas in which all player are decision makers. This model is expected to be used to perform various "what-if" scenarios to know the behavior of decision makers in the face of logistics and distribution problems.

Research limitations/implications (if applicable): We demonstrate the players as several companies which have some division of each company to compete the same region and market.

Practical implications (if applicable): This simulation game is expected to be used for academic in learning of logistics activities and can be used for new employees in training activities

Originality/value: The goal is simulate SCM collaboration performance and cost as results of logistics decision

Keywords: Logistics and Distribution, Logistics Simulation Game, SCM Collaboration, Outbond Logistics

Introduction

Logistics is generally a part of a supply chain process that plans, implements, and controls the storage and flow of goods, services, and all kinds of related information from the supply point to the point of demand in order to meet customer demands (Council of Logistics Management, 1998). According to Kwateng et al (2014) Supply Chain Management Council defines that Supply Chain Management covers the planning and management of all activities related to resource procurement, conversion and all logistics activities. Supply Chain Management includes coordination and collaboration with partners which includes suppliers, distributors, 3PL, consumers (Lambert et al., 2006). Logistics is closely related decisions and policies of the company which is necessary to simulate to see the most appropriate and profitable alternative.

Nowadays the need for simulators and games in the field of logistics, distribution and supply chain has developed quite rapidly with variations. Research on SCM simulation is done by Zee et. al (2005), Knolmayer et. al (2007), Dewi et. al (2007), Reimer (2008), Rochman et. al. (2010), which examines supply chain management by applying beer game simulation. Gumus and love (2013), Liu et al (2006),

Reimer (2008) and Rochman et. al. (2010) simulates SCM for learning and teaching. Van Horne (2004) mention the development is caused by several factors, including the need to balance the theory and practical in the field, helping simulator users to understand the concepts and problems faced in supply chain and give the user a big picture so that the root of the problem can be seen compared to the solution obtained. According to Vanany et al (2016) many lecturers in business and engineering school uses the games (e.g. Beer game and Supply Chain Simulator) to support their teaching and learning for SCM courses. Zeng and Johnson (2009) point out some SC games can be played on computer or with physical components and predominantly compute based and usually need relevant knowledge. Lee et al (1997) explain that the main benefit of the Beer Game is to help students understand the existence and characteristics of the bullwhip effect.

Effectiveness of logistics and distribution systems has been applied to simulators and games that attempt to mimic cement industry game by using Excel-based spreadsheet tools combined with Visual Basic Application (Siswanto et al, 2006; Dewi et al, 2007). In the game players are the company's decision makers who allocate a product to the distributor by direct route or through buffer warehouse. The observed market is only 7 areas on the island of Java, the demand of each city is aggregated to the province level and the distributor is assumed to be one in each province and the player is a single player with competitors already on scenario by moderators.

This research will apply outbound logistics to simulated cement based simulations with several teams to implement good collaboration and coordination functions to produce the right decision. The game presented in this paper was design to involve the users on managing the decision's trade off. The user usually spend amount of cost to expand the finished product in object to increase stock in warehouse for the favour of service to consumers, otherwise the cost is tend to reduce customer satisfaction. If the users manage good decision, the better expectation of obtaining optimal results.

The research will be imitated the Indonesian cement industry characteristics that has been mature in terms of production technology and perfect competition that grab market share is highly dependent on the logistics and distribution aspects. For that the logistics and distribution system should be managed more effectively in order to avoid stock out or shortage in one market and over stock in other markets. Over stock will cause losses that can reduce profits while stock outs cause losses due to loss of opportunity to sell products (lose sales).

In section 2, the game design is presented to explore the game's model descriptions. Sections 3 is the player responsibility. In section 4, the rules of the game and the learning objectives. Finally in sections 5 presented the conclusions.

Game's Model Description

The game of this paper is simulate the perfect competition of the Indonesian cementing industry in the field of logistics and distribution from the finished product to the customer as retail level. This simulation model describes the competition system that occurs between the three major cement producers in maximizing their sales profit through effective logistics and distribution management. These three producers is a player as a decision maker who seizes the same market share and the same time. The products are shipped from factory using land transportation mode (truck) and marine transportation (Ship) and also delivery of product only in the form of package product (Zak).

This game's model uses a simple structure in supply chain and focus on outbound logistics which includes manufacturer, marketing planner, distribution planner, retail and customers (see Figure 1). A manufacture have four positions: manufacturer/production, marketing planner, distribution planner and transportation planner. During the game, the customer/market who triggers the order should be fulfilled by retail with a specific number of products and based on the game scenario of the order. This game, focus only on outbound logistics than the inbound logistics was not in scenario. The manufacture produce the cement zak, in order to fulfil marketing planner. In this case have no product defect, i.e. worse quality, broken package product. This game is set to be played by multiple team (3 team) to simulate all the step and scenario to win the competition. The game is designed to encourage each team to achieve the lowest total supply chain cost and obtain the high profit. The team in which successfully obtains the lowest

supply chain cost and the highest profit is the winner. Each entity in a team has responsibility which simplifies the real situation in a supply chain.

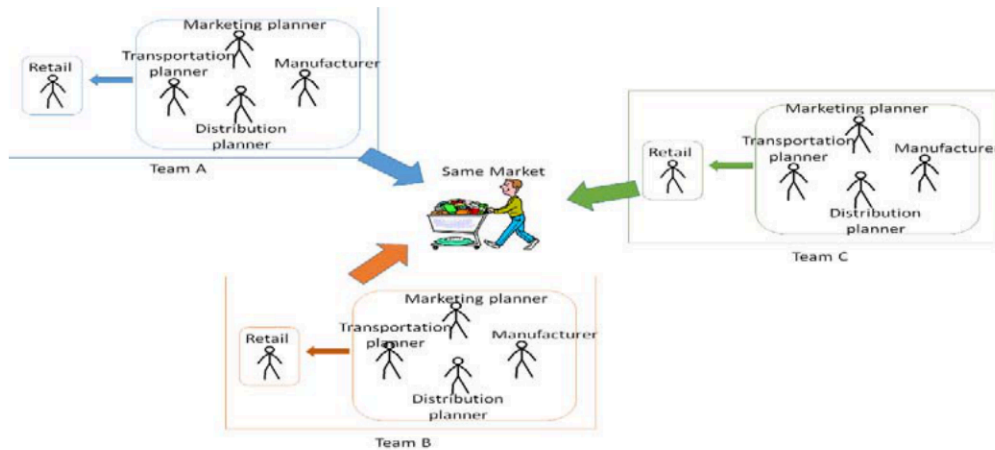


Figure 1. The composition of players to compete in the same market

This simulator model will simulate logistic and distribution decisions taken by 3 team in the distribution of products from the factory to the market, either through the buffer first or directly to the distributor. These three team as the decision makers who play simultaneously in seizing the same market and in the same time (real time) where the decision of each team ultimately affect each other in the internal team and so affect to other team (competitor). The general distribution system in this game's model can be seen in the following figure 2:

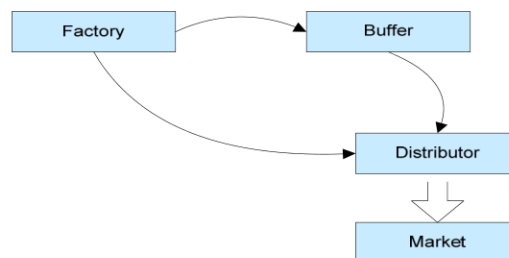


Figure 2. General distribution system in this game's model

This distribution system distributes the product from the factory to the buffer or to the distributor with the same lead time in the same city. While lead time delivery from buffer to distributor does not require lead time in terms of lead time = 0. After the product is delivered to the retail, the product can be sent to the market.

Player Responsibility

The game is simulate by three team which each team consist of 5 players in the entities mentioned earlier as: manufacturer/production, marketing planner, distribution planner, transportation planner and retailer. The responsibility of each player are described in table 1.

No	Position	Responsibility
1	Manufacturer	Order material and calculation the cost of good manufacturing
2	Marketing planner	Arranges a strategy how to meet the demand from the market including promotions
3	Distribution planner	Arranges a strategy when and how much the product send to the

		market
4	Transportation planner	Arranges a strategy how to transport the product including multimode transportation
5	Retailer	Manage and monitor the inventory and calculation the inventory and procurement cost

Table 1. The players' responsibility

Each player on each team have responsibility to calculate the cost that related to the position. The performance of each team is measured by the total cost of supply chain. The type of cost is expected represent the supply chain performance and adopted from the concept of Supply Chain Operations Reference model. The cost in this game is: cost of good manufacturing (COGM), promotions cost, opportunity cost, transportation cost, holding cost, backorder cost. COGM is cost of production, the penalty cost for the manufacturer if the player produce under or exceeds the capacity. Opportunity cost is a penalty charged to the marketing planner if they could not fulfil the market order. The marketing planner be able to determine the price to the market including promotion cost. Transportation cost contain the truck and/or shipment cost including driver and distance cost. The cost related with a retailer is holding cost for product in the warehouse and backorder cost as a penalty if retail cannot fulfil the order by the market's due date.

The rules of the game and the learning objectives

The game start with login for each team and each person. The first data is started by market demand all location which show the first order. The order quantity and due date have been design randomly to represent uncertainty of time and quantity. The uncertainty scenarios are expected to encourage player on develop their own strategy to fulfil all the order. Generally, the design of framework system can be seen in figure 3. Retail receive the demand of the customer and inform to the marketing planner, distribution planner and transportation planner. The result will inform to manufacturer to show the characteristics of the game. All the team must order the product and the orders are sent to the manufacturer by using a standardized purchase order form which also states due date. The amount of market orders and bill of materials for the product is important information which is used by the transportation, distribution, and marketing planner to decide the number of parts that will be ordered from the supplier.

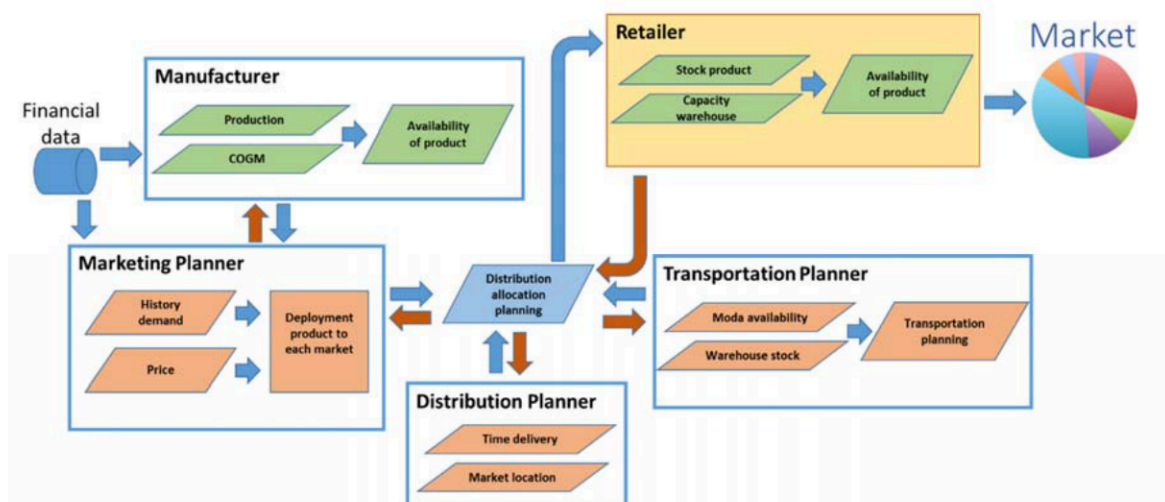


Figure 3. Framework system

General step in this game

(1). Start this simulator, each player must enter username and password. Each player can only be opened by one player. With the six cities to be simulated.

(2). The next step is each player initial initialization is to determine the contract of transport capacity and inventory capacity. The value includes the contract of the amount of product in zak cement and the contract value determines the minimum shipping cost and the minimum inventory cost in the buffer warehouse. In this simulator there are two types of cost per unit (zak) that is regular cost and premium cost. Minimum cost is the cost obtained from the multiplication of the number of products entered on the contract with regular cost.

(3). The next step is to determine the number of product shipments to each city in accordance with the number of production on the day of the order from market. Daily production (quota) has been determined by the system depend on the scenario. This total product shall not exceed the existing distribution quota and there shall be no remaining product that is not distributed or in other words the existing distribution quota must be completely distributed. The products allocated will arrive at the destination according to the lead time of each player and the player is given the demand forecast data on the day when the product reaches the destination.

(4). The number of products allocated to distributors will be allocated to the market. If the player wants to increase the amount of allocation in the market, they can deliver his products from buffer to distributor according to the player's wish (if inventory stock in buffer still exists), and this delivery will be charged regular transportation fee from buffer to distributor).

In determining the total product to be released to the market through distributors, players or decision makers will be exposed the risk of the possibility that the product released exceeds the actual demand (over supply) and the possibility of a lower supply of demand. This is because the delivered product can not be returned to the buffer or the distributor, otherwise there is a shortage of players can not send the product back.

The prices will be influenced by the number of players supply and the number of competitors' supply. If the over-supply condition occurs, the selling price of the player's product will decrease from the selling price yesterday but the player's share volume will increase. Conversely, if the product deficiency in the market, players get the risk of loss sales but the selling price of the product will rise compared to yesterday price and consequently the volume share of this team will decrease.

(5). Next the system will run the cost calculations and display the profit or loss and volume share of each player in each city.

(6). The players either get the profit or loss, in the next stage faced with the option to do promotion with a certain amount that has been set by the system.

(7). The choice of promotion will indicate the end of the player's decision in one day. The promotion will affect the demand in the next day. After a player runs several sessions, each player earns a total daily profit of six cities and a total profit from the first session until the last session. This stage is the final stage in a game period so that each player will be shown also the total profit of its competitors. The player with the highest total profit will come out as the winner of this game.

The Learning Objectives

The game was designed for undergraduate students to facilitate understanding of the basics of cement logistics. The game is focused to achieve some learning objectives: (1) task and responsibilities of each person in each team, (2) supply chain and logistics costs of performance (types of costs in the supply chain, calculate the supply chain cost, and reasons the supply chain results), (3) the goal of purchasing and promotion.

As players in the game, students must understand the role of game, activities/processes and the responsibility that should be adopted. The player should collect the data about supply chain cost performance (opportunity, back order, purchasing, holding costs) and calculate the total supply chain costs.

Conclusion

The conclusions that can be taken in this research are as follows:

- The results of the model design to imitate the competition of cement industry and multiplayer game which is played by some player on some team and can compete in the same time and the same.
- This game was developed to help student understand logistics and supply chain concept,
- This simulator can simulate the performance and cost resulting from logistical decisions. These decisions include:
 - o collaboration and coordination of each player to deal with concept of supply chain,
 - o Determination of production problem and the related cost,
 - o Determination of distribution cases,
 - o Determination of marketing planner and the risk of each decision,
 - o Determination of transportation decisions,
 - o Determination of promotion costs to increase share volume.

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