

Warehouse Modeling in Strategic Planning Model

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Abstract: As a critical point in the supply chain, warehouse facility must be managed in good way, started from planning and design becomes important, this research using modeling tool to make and ensure the warehouse to be more effective and efficient. This paper to analyze the concepts of modeling for managing warehouse facility, from strategic level to operational level, for future research to provide a conceptual references also contribute to project management. The Problem in this analysis formulated as: 1). how modeling in designing and planning warehouse in action, and 2) how modeling in designing and planning warehouse as classified. The findings of this research with a modeling project: a model of classification for managing efficient warehouse, especially in strategic planning model.

Keywords: modeling, warehouse management, supply chain

A. BACKGROUND

In the highly competition, and to response the business situation recently, the business organization can compete and success with the most important sources, namely; dynamic capability, flexibility, agility, speed and adaptation. In carrying out business activities, operational activities are described as a basic unit of competitive advantage by Porter (1996), so that the operational effectiveness of a business directly contributes to competitiveness and market leadership.

According to La Londe et al. (1997) that organizations must be fast, agile, and flexible to compete efficiently which cannot be obtained without the coordination and collaboration of companies in the supply chain (Vokurka et al., 1998). La Londe et al., (1997) argues that companies can compete if they develop and manage partnership collaboration. According to Mentzer et al., (2004) that competitive advantage can be obtained not only through products sold, but also through the way in which we manage, stream and supply chains. An impor-

tant role of operations management and operating strategies for Supply Chain Competitiveness has been conducted by Fuller et al. 1993; Hayes et al. 1984; Fisher et al. 1997 and Levi, DS et al., (2005). Supply chain management, the focus has shifted from the “market share” paradigm to the “part of the customer” paradigm, where the aim is to create “customer value” that leads to increased sustainable corporate profits, shareholder value and long-term competitive advantage (Evans and Danks, 1998).

Warehousing and distribution According to Coyle, et al., (2008) is one of the critical facilities in the supply chain, some 3PL research proves the dominant role of carrying out logistic distribution activities (warehousing, packaging and labeling, transportation), so that management practices supply chain is mostly done by 3PL companies (Watson and Pitt, 1989; Sheffi, 1990; Foster and Muller, 1990; Bardi and Tracey, 1991).

Planning and warehouse design are important, because of the potential risks from high investment to build warehouse facilities. Tho-

mas W. Speh (2009) reminds that warehousing is nothing more than the management of space and time. The space management portion, storage, has a cost per month, because there is a monthly cost for warehouse space. How manage the time also has important component, includes labor involved in handling materials as they move in and out. To ensure better planning in warehouse planning and design, where one tool is, is; modeling is an option, such as a simulation model consisting of several alternative designs Levi, et al. (2008) to ensure the management of warehouses and supply chains in a broader sense to be more effective and efficient.

1. Problem Formulation

The problem formulation in this analysis is (1) how is the action plan from warehouse planning and design modeling and (2) how to classify warehouse planning and design.

2. Research Purposes

This study aims to define the modeling concept in warehouse management applications, both at a comprehensive strategy level, so that it can provide conceptual references for future research and contribute to project planning in the warehouse management field. It is expected that the findings from this study with the modeling project, determine the classification of models for warehouse management, especially in planning and design aspects are; strategy planning model.

B. CONCEPT & THEORY

The concept of a warehouse according to Coyle, et al. (2003) acts as a point in the

logistics system, where a company has raw materials, semi-finished goods, or finished goods for various periods of time. Meanwhile, according to Mulcahy (1994), the warehouse is defined as a function of storing various types of product items or stock keeping units (SKUs) in small or large quantities from the time after production to the time the product is needed by consumers. Warehouse with more complex functions in the supply chain paradigm is called a distribution center (DC), according to Waller (2003) DC as a facility in the supply chain that receives, stores, and sends final goods to consumers, the stages of activity that occur in the distribution center (Waller, 2003) among others: Reception, Stocking, Picking and Dispatching.

In business practice, the warehouse facility is managed by Third Party Logistics (3PL) as an external supplier that carries out all parts of the company's logistics function. Coyle, et al. (2003) explained that the existence of 3PL provides solutions to logistical or supply chain problems, which are classified into 5 categories as core businesses, namely: (1) Transportation, (2) Warehouse or distribution center, (3) Forwarding, (4) Finance and (5) Information.

1. Modeling

The modeling application in warehousing management analysis in the early stages requires a clear conceptual explanation, although it is a strong analytical technique, few companies have used warehouse planning modeling because modeling is thought to contain long mathematical equations and very large computer codes. Whereas on the contrary, modeling can be made as simple as groups of circles and arrows that represent the sequence of processing steps or choose commands. Napolitano

(1998) describes modeling as a powerful analytical technique and uses close representation, duplicating existing systems or designs, as powerful analytical techniques, using representations that duplicate an existing system or design proposals on computer or computerized. So that modeling can also be made in a spreadsheet consisting of rows and columns that only require addition and subtraction, or are made in the form of warehouse layouts or network diagrams.

C. ANALYSIS

The potential utilization of warehouse modeling is to test the effect of a warehouse's dynamic behavior, supported by the amount of information about warehousing with an unlimited number of input data. Problems that can be incorporated into warehouse modeling include: changes in demand items, addition of lines or new product SKUs, as well as new equipment.

1. Benefits of Modeling

The practice of warehousing management can benefit from modeling applications, Napolitano (1998), namely:

1. Modeling is a systematic thing and uses a logical approach, so it can reduce the level of risk. An example of a plan to add a new distribution center is one of the large investments that contain quite high risk. Modeling can reduce this risk by assessing the current situation and considering all feasible options before making a decision.
2. Modeling allows one to gain deeper insight and knowledge about the existing system. Modeling carries out supervision that is closer to operations, provides a comprehensive understanding of how the system works, and can reveal other problems that exist.
3. Modeling provides an opportunity to experiment. By modeling, the effect of design changes can be tested, theories will be validated, and potential disasters can be prevented.
4. Some modeling tools have the graphic ability to represent the proposed system before the system is created.

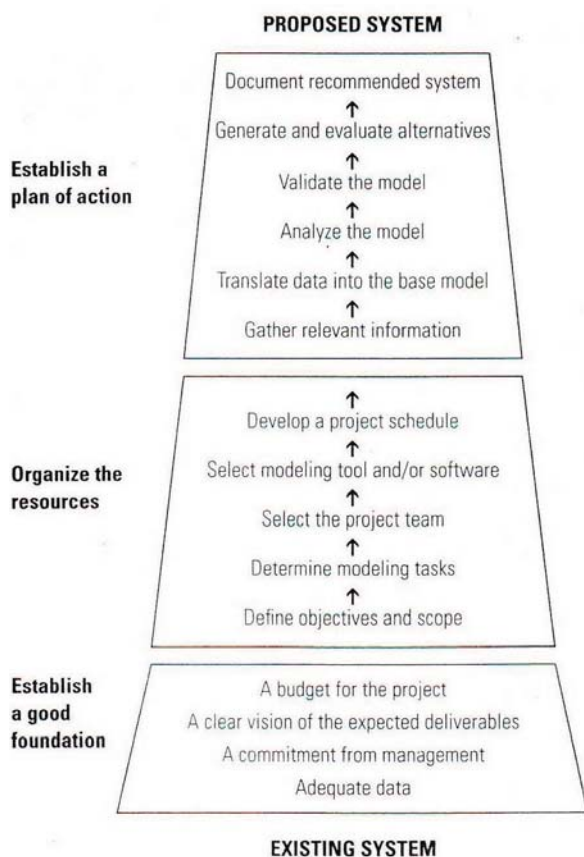
2. Modeling The Project

Warehousing modeling activities are part of a systematic, documented, and well-organized plan so that planning can be assured of success. Bowersox et al. (1986) predicting warehouse performance that is efficient and effective is the result of careful and thorough planning. Systematically, the stages of the Napolitano (1998) modeling process in the project format are as follows:

1. Building a good foundation; the company needs a clear vision of the expected delivery, as in Figure 1, commitment from top management.
2. Manage resources
 - The project's objectives and scope must be clearly defined in order to focus on relevant issues.
 - Assign tasks to achieve these goals.
 - Choose a project team.
 - Choose the right tools and/or software to carry out the tasks that have been set and provide solutions.
 - Develop a schedule, to keep the project on track and inform specific targets to be achieved.
3. Establish an action plan
 - Gather relevant information.
 - Translating data and creating basic models

- Analyze the model.
- Validate the model whenever possible.
- Evaluate data and alternatives produced.
- Document the system recommended by the project team and inform management.

**Exhibit 1
The Modeling Project**



Source: Gross & Associates (1998)

3. Modeling Classification

At the level of tactical planning, the application of the warehouse design model involves identifying the optimal configuration of a facility, equipment, personnel and other resources. In some cases, warehousing designs at this level

are like design or redesign, including how to accommodate a change in business conditions and also how to increase productivity.

Table 1 Classification of Modeling Strategies

Application	Model for Discussion	Central Themes	Scope	Level of Detail	Planning Horizon
Strategic Planning	Facility location, site selection, warehousing cost models	Supply chain planning & design, overall financial performance	Broad	Highly aggregated data	One or more years
Warehouse Design	Warehouse block layouts, models for storage analysis, ergonomic models, flow charts, system simulation	Layout design of physical warehouse, design of warehousing operations	Narrow to broad	Less aggregated more detailed	Less than a year
Operation Planning	Product location optimization, labor equipment planning & scheduling, load planning, activity routing	Resource routing & scheduling	Narrow	Highly detailed	Daily or weekly

Source: Napolitano (1998)

Examples of models used for facility layout, storage analysis, tracking of flow of resources, capacity planning and equipment design, where planning design evaluations are carried out periodically in a shorter planning horizon than strategic planning. The operation planning model application listed in table 1 enters a planning situation that requires continuous monitoring to ensure efficient operations, such as resource scheduling, optimizing storage, picking position and maximizing pallet setup.

4. Strategic Planning Models

In the context of the strategic plan, warehouses are part of the Napolitano (1998) supply chain or logistics network, which is a collection of functions and activities involving acquisition, transportation, storage, distribution, handling, and management of products or services from source of creation to the point of demand.

Table 2 Classification Strategy Planning Models

Application	Modeling Tools	Key Questions	Scope	Level of Detail	Length of Study
Distribution Network	Mathematical, programming, simulation, heuristics	How many warehouse should there be in your network? Where should these warehouse be? What storage & throughput capacity should these warehouse have?	Broad, extending throughout the supply chain	Highly aggregated	Six months to a year
Site Selection	Decision matrix with weighting & grading system	Which specific community should the warehouse be located in? Which specific site or building should be selected?	Broad, with more emphasis on non-quantifiable factors	Depends on company requirements	60-90 days
Cost Analysis	Financial analysis using spreadsheets	How much does it cost to operate you warehouse?	Specific to the physical facility & the operations within the facility	Highly detailed in terms of costs & performance measures	30-60 days

Source: Gross & Associates (1998)

5. Warehouse Design Models

Applications for the design process in table 3 begin with the warehouse block layout model, which results in warehouse block layouts using both manual and computer-aided approaches. Napolitano (1998) then describes modeling storage requirements, with a spreadsheet approach,

which focuses on calculating storage requirements, which are based on historical profiles of activity data and estimates of business changes. Ergonomic model, which is defined as the study of how humans fit the workplace, places the design process of a work environment created to suit the workers.

Table 3 Classification of Warehouse Design Models

Application	Modeling Tools	Key Questions	Scope	Level of Detail	Length of Study
Warehouse block layout	Relationship diagramming, simulation, network analysis, mathematical programming, heuristics	How operating functions should be arranged within a warehouse? How should resources flow through the facility?	Specific to the operations within the facility, does not consider all aspects of the physical facility	Moderately aggregated	15–30 days
Storage analysis: spreadsheet approach	Data & cost analysis using spreadsheets	What is the cost per pallet for a storage module? What is the appropriate mix of storage modules?	Specific to storage requirements, does not consider all aspects of physical facility	Highly detailed in term of costs	15–30 days

Storage analysis: graphic approach	Data & cost analysis using spreadsheets & computer-aided design of storage area	What is the best arrangement of storage modules within the facility? What is the cost per pallet for a storage module? What is the appropriate mix of storage modules	Specific to storage requirements, considers most, if not all, aspects of physical facility	Highly detailed in term of costs & layout details	30–60 days
Ergonomic analysis	Ergonomic mathematical tools, simulation	What level of stress is exerted by a specific motion? How should work stations be ergonomically designed? What is the recommended weight limit for a lifting task?	Human & work site interface	Highly detailed in term of human & work site properties	15–30 days per process
Tracking the flow of products, people, resources, & information	Flow charting or process mapping	What is the most efficient way of handling warehouse resources? What non-value added steps can be eliminated in the handling of products?	Flow of all resources within the physical limits of the warehouse	Highly detailed	15–30 days per operating function
Overall system design	Simulation	Will the design satisfy projected throughput requirements? What are the limitations of the design? What aspects of the equipment, operation & software need to be corrected in the design?	Specific to all the events within the physical limits of the warehouse	Highly detailed	90–180 days

Source: Gross & Associates (1998)

The model for tracking flow from resources in a warehouse (product, equipment, labor or information) is a flow chart. Different types of flow charts are used for different uses, such as process design and development, capacity planning, development in information flows or product flows.

The simulation model in warehouse design that refers to many aspects, aims to create a more efficient system, which is tested before it is installed. As for distribution-oriented facilities, this simulation model is the main design process stage (Napolitan, 1998), because this model generates a process from the activities of a warehouse facility and designers can validate

the entire system design and analyze specific methods and equipment in bottleneck conditions, congestion, loss of utilization, insufficient capacity, and others.

D. SUMMARY & RECOMENDATION

The concept of modeling in warehouse management applications, both at a strategic level comprehensively, refers to a strong analytical technique and uses close representation, duplicating existing systems or designs, as powerful analytical techniques, using representations that duplicate an existing system or design proposal above paper or computerized. The

contribution in project planning in the warehouse management field is to build a good foundation; the company must arrange and ensure the right environment before the project starts. Then manage resources, which continue to set action plans, such as:

- Translating data and creating basic models
- Analyze the model.
- Validate the model whenever possible.
- Evaluate data and alternatives produced.
- Document the system recommended by the project team and inform management.

The warehouse strategy planning model is; Distribution Network, Site Selection and Cost Analysis. While the classification of models for warehouse management, especially in planning and design aspects are; Warehouse block layout, Storage analysis: spreadsheet approach, Storage analysis: graphic approach, Ergonomic analysis, Tracking the flow of products, people, resources, and information, and Overall system design.

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