



Warehouse Operations from Theory to Industry Best Practices in Thailand

Dr. Hermann Gruenwald

International College Burapha Univerity
Bangsaen, Chonburi Thailand

¹GruenwaldH@yahoo.com

Abstract— This quantitative study looks at warehouse management and operations from a logistics management standpoint, in terms of integrated supply chain management (SCM). Getting the right stuff, to the right people in the right amount in the right quality on time. Warehouses take on various functions from shipping and receiving, to storage sorting and assembly of orders. There are various types of warehouses from public to private, from manual to fully automated, from simple depots to distribution centers. The operations of warehouses combine the academic fields of logistics and operations management. The question is how to optimize the location and number of warehouses dependent of what items to provide to what customers where and when. The paper tries to provide an answer in terms of importance of the various operations to the young logistics professionals of today and tomorrow.

Keywords— Logistics Management, Material Handling, Supply Chain Management, Warehouse Design, Warehouse Operations

I. INTRODUCTION

Logistics is by many misunderstood as transportation only, but logistics deals with the total integration of the supply chain (SC) which includes warehousing. Warehousing is often seen as buffer between the manufacturer and the consumer. Nowadays the velocity of business had increased and many companies work on the just in time concept (JIT) where the amount in storage has been reduced but the flow of the items through the warehouse has increased. Overall the trend in warehousing is more variety of items which move through the warehouse at a higher speed. Warehousing is not only receiving, storage and shipping. Warehousing has the function of breaking and consolidating shipments and sorting the items. The warehouse as storage facility is moving to becoming a distribution center (DC). The distribution center services also as a hub for incoming and outgoing trucks. [1] Jinxiang Gu, Marc Goetschalckx, Leon F. McGinnis (2007). Historically the incoming trucks are from the manufacturer, while the delivering trucks may be company trucks shipping to the various stores. So a load of television (TV) sets come in but they are broken down into shipments to the stores along side with VCRs, AV cables, and blue ray players. As in the case of Wal-Mart, the Wal-Mart truck may pick-up shipments from the manufacturer as back-haul from the store, therefore optimizing the company fleet performance. Warehousing has not only been revolutionized in the shipping and receiving part of operations but also in the warehouse internal operations. Especially computerization and atomization of the

warehouse operations has changed the logistics profession from power to brains, where moving the paperwork and associated data is as important as moving the goods themselves. This paper looks at warehouse operations and how they are perceived by young logistics management professionals of today and tomorrow.

II. METHODOLOGY

This quantitative study looked at the performance of warehouse operations, from shipping and receiving, to storage, sorting and order assembly. The survey used an on-line survey instrument with a five (5) point likert scale. The instrument measured the perception of the respondents in terms of warehouse operations. The survey could be completed by the participants 24/7 any place any time and had a very high response rate of almost 50% The collected data from the on-line database was analysed using SPSS.

A. Participants

The survey included thirty young logistics management professionals average age 22 who has limited warehouse operations experience. This group was selected as a pre-measure to follow-up the study at a later time after they have gained more experience to see how the before and after aptitude has changed and how the gap was filled. The demographic of the respondents were as followed:

- Average Age 21
- Female 73%
- Male 27%

The study will be repeated after the participants have been exposed to actual warehouse operations experience in a real-world situation.

III. RESULTS/FINDINGS

The results of the study focused around the various aspects of warehouse operations. And reached from shipping and receiving to storage, sorting.

A. Warehouse Functions

When asked about warehouse operations in general, the respondents found that storage is the most important function of warehousing followed by transportation hub, as well as warehouse internal transportation also referred to as material handling. Product mixing was seen as was of the main functions especially if we talk of distribution centers (DC) as a form of warehousing. The security, safety and protection

function was almost seen as a given in the warehouse functions hierarchy.

TABLE I
WAREHOUSE FUNCTIONS

Warehouse Function	R%	% Correct Facility	Disc. Index	Disc. Coeff.
Product mixing	(7%)	40	0.2	0.415
Transportation consolidation	(40%)			
Storage	(40%)			
Protection	(3%)			
Demand buffer	(0%)			

B. Warehouse Operations

In terms of warehouse operations amazingly order picking was ranked higher than storage, which clearly indicated the importance of the warehouse as distribution center (DC). Shipping ranked higher than receiving, as it requires more involvement and responsibility of the in-house logistics management staff. Order picking is an important function.

TABLE III
WAREHOUSE OPERATIONS

Warehouse Operations	R%	% Correct Facility	Disc. Index	Disc. Coeff.
Receiving	(7%)	7	0	0.24
Put-Away	(7%)			
Order Picking	(37%)			
Shipping	(17%)			
Storage	(23%)			

C. Warehouse Space Requirements

The greatest demand on warehouse space requirements naturally is storage with 70% of the total space. Shipping, receiving, and put-away are equally rated with 6% while order picking accounted for 12%. These numbers deviate somewhat from industry standards. Again there is a focus on distribution centers (DC) rather than purely storage facilities.

TABLE IIIII
WAREHOUSE SPACE REQUIREMENTS

Warehouse Space Requirement	R%	% Correct Facility	Disc. Index	Disc. Coeff.
Receiving	(6%)	17	0	0.087
Put-Away	(6%)			
Order Picking	(12%)			
Shipping	(6%)			
Storage	(70%)			

D. Order Picking

Pallet racks are most popular both for storage and order picking. Drive in Rack which are easily accessible for forklifts rank second with 17%. Cantilever racks are less popular and gravity lane racks enjoy also a 17% share. Horizontal carousels are very popular with 23% which depends on the type of product to be sorted. Horizontal carousels are among the oldest order picking arrangements. Vertical Carousels are popular with smaller items such as pharmaceutical products. Mini load AS/R are gaining in popularity, while drawer cabinets are declining over time which goes along with the literature[2] Felix T.S.Chan &H.K.Chan (2011).

TABLE IVV
ORDER PICKING

Order Picking	R%	% Correct Facility	Disc. Index	Disc. Coeff.
Pallet Racks	(27%)	7	0	0.24
Drive-In Racks	(17%)			
Cantilever Racks	(7%)			
Gravity Lane Racks	(17%)			
Horizontal Carrousel	(23%)			
Vertical Carrousel	(4%)			
Mini Load AS/R	(10%)			
Drawer Cabinets	(5%)			

E. Warehouse Productivity Measure

In terms of warehouse productivity measures, the orders picked correctly ranked the highest, quality was ranked higher than quantity of throughput. This may reflect the attitude of the employees while management may have a greater emphasize on the throughput or items picked or loaded/unloaded. It very clearly shows a different productivity measure focus between employees and management. Customers want both speed and accuracy. They focus on getting the right stuff at the right time, and often want it just in time (JIT), which impacts all aspects of the warehouse operations greatly. [3] Chris Caplice & Yossi Sheffi (1995),

TABLE V
WAREHOUSE PRODUCTIVITY MEASURE

Warehouse Productivity Measure	R%	% Correct Facility	Disc. Index	Disc. Coeff.
Items/kg loaded/unloaded	(23%)	30	0.2	0.502
Items/kg picked	(10%)			
Orders picked correctly	(30%)			
Throughput per hour/day	(20%)			
Employees per items	(7%)			

F. Warehouse Decisions

The location decision was ranked the highest and is number one in warehouse related decision making. Size of the warehouse was the second most important, even so it depends what items are kept where and in what quantities. This also influences the number of warehouses you need in a given geographic areas. The layout type was more a secondary factor which determined the type of warehouse operation. Ownership type appeared the least important as it was almost for given that the warehouse would be privately owned rather than the use of public warehouses like in the past.

TABLE VI
WAREHOUSE DECISIONS

Warehouse Decissions	R%	% Correct Facility	Disc. Index	Disc. Coeff.
Location of Warehouse	(37%)	37	0.2	0.441
Size of Warehouse	(17%)			
Number of Warehouses	(10%)			
Layout Type	(1o%)			
Ownership Type	(3%)			
Inventory Items	(10)			

IV. CONCLUSIONS

In conclusion the functions and operations of warehouses have been changed over time. Warehouses used to serve storage facilities to safeguard the goods and serve as a buffer between production and consumption. The velocity of business has increased and the number of items as well as the speed with which they move through the supply chain (SC) has increased dramatically. This in return requires a speed warehouse operation. To increase the movement of items through the warehouse various operations optimization measures need to be implements from the design of the storage to the material handling equipment. While the number of items require more storage space, urban land becomes more expensive and there the warehouses closest to the consumer need to have an optimized footprint, which often means that the warehouse is not expanded horizontally but vertically. As always the warehouse design question is where to locate the warehouse and how many to best serve the demands of the supply chain. And how big the warehouse has to be based on the number of items which move through it both in terms of variety and quantity of the individual shipments. The trend obviously is to more private warehouses as warehouses become and more customer specific. Private warehouses have user specific software solutions which are often created by customizing commercial off the shelf (COTS) software solutions. Third party logistics (3PL) is another phenomena whereby large logistics solution providers such as DHL manage the logistics efforts for their customers either in-house or as a consolidated effort in a new form of the public warehouse of the past. Thailand sees both a mix and trend from traditional Thai warehouse schemes to international

solution providers, whereby the warehouses are still under a minimum of 51% Thai ownership. In terms of location one has to be careful that the warehouses are located outside the flood zone, so elevation of the property becomes an important factor when choosing the site for a new warehouse [4] Faber, Nynke; De Koster, Rene B. M. (200



Fig. 1 Warehouse Operations

ACKNOWLEDGMENT

The author wishes to acknowledge all the contributors of this study for their daily operations knowledge and sharing their insights in operating warehouses in distribution centers in Asia, Europe and the USA. The principal investigator (PI) likes to thank the logistics management professionals who contributed to this research by providing their time and industry knowledge.

REFERENCES

- [1] Jinxiang Gu, Marc Goetschalckx, Leon F. McGinnis (2007), Research on warehouse operation: A comprehensive review, *European Journal of Operational Research*, Vol. 177(1), pages 1–21.
- [2] Felix T.S. Chan, H.K. Chan (2011), Improving the productivity of order picking of a manual-pick and multi-level rack distribution warehouse through the implementation of class-based storage, *Expert Systems with Applications*, Vol. 38(3), pages 2686–2700.
- [3] Chris Caplice and Yossi Sheffi (1995), A review and evaluation of logistics performance measurement systems, *The International journal of Logistics Management*, Vol. 6(1), pages 61-74.
- [4] Faber, Nynke; De Koster, Rene B. M. (2002), Linking warehouse complexity to warehouse planning and control structure: An exploratory study of the use of warehouse management information systems. *International Journal of Physical Distribution & Logistics Management* [online]. vol. 32,(5), pages. 381 – 395