CHAPTER 1

INTRODUCTION AND RESEARCH DESIGN
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1.1 Introduction

Large product varieties and shortening customer response times have placed a tremendous emphasis on the ability to establish smooth and efficient logistics operations. Warehouses play a vital role in determining the effectiveness and efficiency of these operations because they function as nodes that direct the flow of materials within a distribution network. The effects of organizing warehousing activities can directly be seen in customer service levels, lead times, and the cost structure of a company. In other words, warehousing influences the performance of an entire supply chain. Warehousing has also been recognized throughout the scientific literature as one of the main operations where companies can provide tailored services for their customers and gain competitive advantage.

Cycle time reduction is one of the most important elements of successful warehousing. More and more customers are demanding that their suppliers quickly respond to their needs and deliver perfect quality products on time. This trend has led companies to focus more attention on their order processing capabilities. On the practical level, cycle time improvement requires finding a good set of policies to organize warehouse processes for functionality and effectiveness. Reducing order processing cycle times can improve customer satisfaction and internal operations of a company but in order to do so there is a need to understand the relationship between warehouse complexity and control structure.

Over the past decade, logistic industry has come across many philosophies on supply chain that essentially focuses on eliminating excess flab in the chain, or stock or inventory as it is commonly known and therefore eradicate the need for

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1 Tommy Blomqvist (2010), A warehouse design framework for order processing and materials handling improvement - Case Etra Oy, Logistics Master's thesis, Department of Business Technology, Aalto University, School of Economics.
having a warehouse. These philosophies have largely changed, and will continue changing in the years to come as can be seen with the changing nature of supply chain with the advent of e-commerce, Just – In - Time production and delivery, quick response systems and supply chain integration. In fact, the need for good quality warehouses has never been better appreciated and desired. From being just a stocking point, they have increased their utility portfolio and have become consolidation centers for multiple sourcing locations, a cross docking center for retail distribution a sorting center for customer docking center for retail distribution, a sorting center for customer door deliveries and an assembly facility for final fabrication, kitting and bundling. The increasing initiatives in supply chain are bound to increase the importance of zero-defect, high speed warehouses which handle a high number of small transactions with more product variety and more value-added services in far less time than they were doing a decade ago. There will be fewer warehouses, but each of them will be bigger, faster and more technologically advanced than their prototypes in the past.

Traditionally, warehousing in India has been made up of small unit sizes. Most warehouses were looked upon as mere godowns. The lack of world-class infrastructure has always hindered the growth of other industries that rely on warehousing and logistics. India is now witnessing a paradigm shift in warehousing due to the growth of organized warehousing and simplification of tax structure as well as other government aids. The demand for warehousing space is expected to grow from 391 million sq. ft. in the year 2010 to about 476 million sq. ft. in the year 2013 i.e. at a rate of 6.80per cent compound annual growth rate (CAGR) during this time frame. There are quite a few major logistics parks coming up around major hubs of Mumbai, Delhi, Bangalore, Chennai, Hyderabad and NCR. Specialty logistics parks are under construction catering to various industries such as agriculture, electronic hardware, automotive and aero-industry. There are also several rail-linked and multi-modal logistics parks. The central
government has identified about 861 acres of land as Free Trade Warehousing Zones (FTWZs). These FTWZs are governed by the SEZ (Special Economic Zone) Act 2005 and SEZ Rules 2006 and 100 per cent FDI (Foreign Direct Investment) have been allowed in these FTWZs.

In spite of these growth factors, till recently, little importance was given to the efficiency aspect of the warehouse. However, more businesses are now realizing various purposes such as storing, retrieving and cross-docking for which warehouses can be used. They have also realized that India lacks world class infrastructure when it comes to the global stage\(^2\).

A major reason behind this growth is the changing perception of companies. An increasingly mature Indian industry is viewing supply chain not as a cost center, but as a profit center—a strategic arm which could be leveraged to increase revenue and the overall profitability of a company. In this supply chain, logistics is a crucial element holding the key to both better customer satisfaction as well as cost reduction. Modern logistics centers require better processes, technology, equipment a trained workforce and of course, better infrastructure. But for Indian companies, all this also comes with a rider—the need to justify the investment, increase in rentals and other costs, thus boosting the need for smart warehouses\(^3\). Based on the theoretical discussion researcher aims to conduct this study which will focuses on the nature of “Professional Infrastructure Influence on Effective and Efficient Operations in a World Class Warehousing with special reference to Indian Warehousing”.


\(^3\) Abhishek Roy (2012), Warehousing in India – The Smart Way, State of Industry, PP. 12-14
1.2 Definitions

(i) Warehousing

Warehousing is the storage of goods for profit. The warehouse is a storage facility that receives goods and products for the eventual distribution to consumers or other businesses. A large size warehouse is also called a distribution center. Warehouse management is the process of coordinating the incoming goods, the subsequent storage and tracking of the goods, and finally, the distribution of the goods to their proper destinations.

(ii) Warehouse Infrastructure

The infrastructure in a warehouse includes the general infrastructure, dock equipment, storage system, material handling equipment & the process equipment. These infrastructure facilities play a major role in the functioning of the warehouse.

(iii) Professional Infrastructure

Utilizing the available space by using ergonomics and latest equipment to avoid unnecessary delays, less manpower and their by passing on the benefits to ultimate customer is the focus of professional infrastructure.

(iv) Warehousing Operations

The warehousing operations include three major activities they are receipt of material, storage of material & retrieval / despatch of material.

(v) Effective Operation

An effective operation is receiving the cargo properly, storing & retrieving the materials as and when required.
(vi) Efficient Operation

An efficient operation is the accuracy and the speed with which the materials are received, stored & despatched with the shortest turnaround time.

1.3 Significance of the Study

World-Class Warehousing and Material Handling describes the processes and systems required for meeting the changing demands of warehousing. Filled with practices from proven to innovative, it will help all logistics professionals improve the productivity, quality, and cycle time of their existing warehouse operations. Not too long ago, effective warehousing was a relatively straightforward progression of receiving, storing, and shipping. But in today's age of e-commerce, supply chain integration, globalization, and just-in-time methodology, warehousing has become more complex than at any time in the past not to mention more costly.

World-Class Warehousing and Material Handling breaks through the confusing array of warehouse technology, buzzwords, and third-party providers to describe the principles of warehousing required for the implementation of world-class warehousing operations. Holding up efficiency and accuracy as the keys to success in warehousing, it is the first widely published methodology for warehouse problem solving across all areas of the supply chain, providing an organized set of principles that can be used to streamline all types of warehousing operations⁴.

India has an extremely limited supply of high quality industrial and logistics-related real estate. The two largest challenges facing the industrial real

estate industry are (i) the lack of experienced industrial real estate development professionals and (ii) the difficulties associated with acquiring large tracts of land in India. Based on this concept conduct of this study is considered as empirically significant\(^5\).

### 1.4 Statement of Problem

Warehousing forms a crucial link in the overall logistics value chain. It accounts for 5\% of the Indian logistics market (excluding inventory carrying costs, which amount to another 30\%). Warehousing in India has been evolving rapidly from being traditional “godowns” a mere four-wall-and-shed with sub-optimal size, inadequate ventilation and lighting, lack of racking systems, poor hygiene conditions and lack of inventory management or evolved solutions such as warehouse management systems into modern setups with storage and handling points where raw material, intermediate and manufactured goods are collected, assorted, stored and distributed to the point of consumption/sale. As key end users are increasingly outsourcing their warehousing services, warehousing players are recognizing the need to be a part of the customer’s logistics chain, as against being a landlord leasing out space.

Moreover, changing business dynamics and the entry of global 3PLs have led to the re-modeling of logistics and warehousing services in India. From a mere combination of transportation and storage services, logistics is fast emerging as a strategic function that involves end-to-end solutions that improve efficiencies. The growth of organized industry sectors such as retail, automotive, manufacturing, pharma and agriculture in India is expected to give rise to more integrated supply chains, requiring better services, processes and storage facilities. Dynamic market requirements have made it imperative for Indian warehousing players to overcome

\(^5\) Brian Oravec (2013), India has a limited supply of logistics-related real estate', http://www.projectsmonitor.com/interviews/india-has-a-limited-supply-of-logistics-related-real-estate/.
challenges, as well as maintain, improve and sustain competitiveness. Competitiveness in the warehousing industry is driven by service/infrastructure providers’ ability to deliver value to their clients. Based on the theoretical discussion this study aims to analyse the whether professional infrastructure influence on effective and efficient operations in of world class warehousing across Indian. Importance of professional infrastructural influence and its impact on warehouse designers, operators and customers is a matter which forms the basis of the study. To empirically test the feasibility of the study the study have identified three analysing areas:

(i) Contribution of designers in structuring the layout of warehouse for effective, time saving and as per client demand of warehouse services.

(ii) Role of warehouse operational managers’ in executing inventory, receipt management and dispatches as per the product category and as per client demand.

(iii) End users’ decision in selecting the warehouse for their organization.

1.5 Scope for the Study

The study aims to find out the benefits of the world class warehousing facility with respect to the warehouse designers, operators & the customers in Indian scenario. It also aims to find out and test the parameters for professional infrastructure. Finding out the parameters for effective & efficient operations falls within the scope of study. It covers the opinion of warehouse designers, operators and end users about the presence of identified parameters towards warehouse efficiency on the ground of world class standard. Thus, it is believed that current

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study will be useful to the experts in the field of warehouse management, warehouse designers, operators, end-users and researcher in understanding the importance of professional infrastructural influence and its impact on warehouse designers, operators and customers.

1.6 Objectives of the Study

Based on the theoretical and conceptual discussion following objectives are framed for the effective conduct of this study.

- To define study understands the structure of world class warehouse in India.

- To study the need for strengthening world class professional infrastructure at the warehouse.

- To identify the nature of world class warehouse infrastructure facilities available in India from designers, operational managers and end-users perspective.

- To highlight the nature of steps to be taken by the warehouse designers, operational mangers and end-users for efficient and effective warehouse management.

1.7 Hypotheses of the Study

Warehouse layout design models attempts to achieve warehouse optimization objectives. Therefore, in order to eliminate the inefficiencies in warehouse functions and make them reliable in terms of cost, the importance of warehouse layout design arises. The objectives of the layout design in this study are to use the warehouse space efficiently while providing most economical storage location for each item type to minimize the handling cost. Similarly, it has
been understood that warehousing can be defined by three functions: i) receiving goods from a source; ii) storing goods until they are needed by a customer (internal or external); iii) retrieving the goods when requested. Based on these conceptual understanding following hypotheses are framed and tested with appropriate statistical tools.

- There exists close association between warehouse design managers’ efficiency in layout designing and their work experience.

- Warehouse design managers’ are very efficient in designing the warehouse layout as per the industrial sector of the end-users.

- Warehouse design managers’ are very efficient in designing the warehouse layout as per the service consumer category of the end-users.

- Warehouse operational managers’ are very efficient in executing inventory, receipt management and dispatches as per the industrial segments.

- Warehouse operational managers’ are very efficient in executing inventory, receipt management and dispatches as per the product category.

- Nature of industry significantly influences the end users’ decision of the factors that are critical while selecting the warehouse for their organization.

- Nature of business significantly influences the end users’ decision of the factors that are critical while selecting the warehouse for their organization.
1.8 Research Methodology

Research methodology deals with the different steps included for solving the research problem. Research is a process through which an attempt is to make achieve a systematic resolution of the problem or a greater understanding of a phenomenon. The current study is both explorative and descriptive in nature.

Stage I: The initial phase was to undertake detailed secondary search literature survey on research issues. In order to explore the standards of warehousing efficiency in terms of world class warehousing and comparison with the traditional warehousing exploratory research had been conducted. The exploratory research of this particular study aimed towards identifying the apt parameters for bringing modern warehousing standards in warehousing with respect to different categories of industry. This exploratory search was also form basis for preparing the questionnaire for the next stage.

Stage II: A descriptive research was carried out at the second stage by applying a survey method. The nature of this study demands survey method. The study is focused on effective and efficient warehouse management practices adhered by prominent warehouses in India. The data collection tool used is a questionnaire. Cross Sectional interview methodology was used by the researcher in the second stage of research work. The in-depth interview had been conducted among the cross sectional group of respondents including field experts, warehouse consultants, senior level managers of various industries directly involved with warehousing operations. Since the researcher is directly employed in the current industry, the self-exploratory case study (experience survey) and observational methodology helped him to undertake the pilot study.
1.8.1 Area of the Study

India covers a vast area of 3.3 million sq.km and has a coastline of 7,517 km. However, the entire land mass is not conducive for locating a warehouse due to different geographic, demographic and economic disparities. “Proximity” of the warehouse always carries utmost importance. According to the Jones Lang LaSalle Meghraj–CII (Confederation of Indian Industries) Warehousing Survey (Nov 2010), proximity to the supply-demand hubs and quality infrastructure were ranked the most important factors for choosing a location than the availability of manpower, skilled labour, proximity to ports and warehousing space costs. In India, large scale warehouse operations are carried out in a few hubs in, Mumbai, Delhi, Bangalore, Chennai, Hyderabad and NCR. Thus, these regions are considered for conduct of the study.
1.8.2 Sampling Framework

The current research work is based on the multi-stage random sampling technique. In the first stage of the research adopted cluster based random sampling technique for identification of warehouses spread across India and its regional office spread. In the second stage of the study researcher adopted convenience sampling technique for collection of primary data from the samples i.e., warehouse designers, operators and end-users.
TABLE: 1.1
MAJOR WAREHOUSE HUBS IN INDIA AND SAMPLING FRAMEWORK

<table>
<thead>
<tr>
<th>Hubs</th>
<th>Regional Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>North &amp; East India Warehouse Hubs</td>
<td>Mumbai, Pune, Faridabad, Pataudi, Medinipur, New Capital Region (NCR Okhla, Manesar, Ghaizabad),</td>
</tr>
<tr>
<td>South &amp; West India</td>
<td>Bangalore, Bhavnagar, Mysore, Chennai, Hyderabad, Kolkata</td>
</tr>
</tbody>
</table>

Source: Miebach Research

In India there are twelve warehouse centers i.e., six Tier I cities and sixty nine Tier II cities. Out of the twelve warehouse hubs functioning in India, seven regional areas were selected as sample (58 per cent) of the actual geographical regional warehouses.

TABLE: 1.2
SAMPLING FRAMEWORK

<table>
<thead>
<tr>
<th>Samples</th>
<th>Location</th>
<th>Number of Samples</th>
<th>Total Respondent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warehouse Designers</td>
<td>7 (Mumbai, Kolkata, Chennai, NCR, Bangalore, Hyderabad, Pune)</td>
<td>6</td>
<td>42</td>
</tr>
<tr>
<td>Warehouse Operators</td>
<td>7 (Mumbai, Kolkata, Chennai, NCR, Bangalore, Hyderabad, Pune)</td>
<td>20</td>
<td>140</td>
</tr>
<tr>
<td>End Users</td>
<td>7 (Mumbai, Kolkata, Chennai, NCR, Bangalore, Hyderabad, Pune)</td>
<td>(Mumbai- 9, Kolkata-9, Chennai-9, NCR-9, Bangalore-8, Hyderabad-8, Pune-8)</td>
<td>60</td>
</tr>
</tbody>
</table>

Total                               | 242
From the selected seven geographical regions six warehouse designers, 20 logistic service providers and 9-8 end users i.e., manufacturers, retailers and other industry related customers were chosen as sample in each area, the sample distribution of sample is presented in the above Table:1.2. Out of the 42 questionnaires distributed to the warehouse designers only 40 were found to return by the sample subjects. Similarly, out of 140 questionnaire distributed to warehouse operators i.e., logistic service providers only 120 were found to returned by the sample subjects. Thus, only 40 warehouse designers, 120 warehouse operators and 60 end-users were considered as sample population, eliminating the unfilled or not-returned questionnaires.

1.8.3 Data Source

Data for the study includes both primary and secondary data. Primary data were collected using a well-structured questionnaire, and were collected from the targeted customers’ while they were dining in fast food outlets. The questionnaires were handed over to them with a request to fill it on the spot. The secondary data required for the study have been collected from journals, research thesis, published documents, and website articles on fast food.

1.9 Data Validity and Reliability Results

The reliability of an indicator can be defined as its overall quality, i.e. its consistency and its ability to give the same results in repeated measurement. The most outstanding feature of reliability is the test-retest correlation of the specific measure under scrutiny. Correspondingly, the test-retest correlation for most single-item measures is presented following table.
TABLE: 1.3
DATA VALIDITY & RELIABILITY TEST

<table>
<thead>
<tr>
<th>General Variables</th>
<th>Number of items</th>
<th>Range</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Designer</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employees’ opinion on factors considered in location selection</td>
<td>7</td>
<td>1-5</td>
<td>.794</td>
</tr>
<tr>
<td>Employees’ opinion on factors considered in warehouse designing</td>
<td>11</td>
<td>1-5</td>
<td>.726</td>
</tr>
<tr>
<td>Employees’ opinion on importance of layout, process &amp; material flow in warehouse designing</td>
<td>9</td>
<td>1-5</td>
<td>.629</td>
</tr>
<tr>
<td>Employees’ opinion on importance of material handling equipment in warehouse designing</td>
<td>8</td>
<td>1-5</td>
<td>.661</td>
</tr>
<tr>
<td>Employees’ opinion on importance of it integration in warehouse designing</td>
<td>7</td>
<td>1-5</td>
<td>.655</td>
</tr>
<tr>
<td><strong>Operation team</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employees’ opinion on facilities that are essential for warehouse receipt system</td>
<td>9</td>
<td>1-5</td>
<td>.714</td>
</tr>
<tr>
<td>Employees’ opinion on facilities that are essential for warehouse storage system</td>
<td>6</td>
<td>1-5</td>
<td>.763</td>
</tr>
<tr>
<td>Employees’ opinion on facilities that are essential for retrieval / despatch of goods</td>
<td>8</td>
<td>1-5</td>
<td>.723</td>
</tr>
<tr>
<td><strong>End Users</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employees’ opinion on critical factors that influence their warehouse selection behavior</td>
<td>5</td>
<td>1-5</td>
<td>.714</td>
</tr>
<tr>
<td>Overall Score for Sample Adequacy (Kaiser-Meyer-Olkin Measure of Sampling Adequacy)</td>
<td></td>
<td></td>
<td>.799</td>
</tr>
<tr>
<td>Overall Score for Data Reliability (Cronbach’s Alpha)</td>
<td></td>
<td></td>
<td>.797</td>
</tr>
</tbody>
</table>

Source: Computed from Primary Data

The most widely used measure to assess the internal consistency of constructs is Cronbach’s alpha. The generally agreed upon value of Cronbach’s alpha is 0.70, although it may decrease to 0.60 in case of exploratory research (Hair et al. 2006; pp.137). In this research the reliability measure for the whole scale is 0.797 which is acceptable. Again the reliability for all the constructs is shown in Table 1.1; the values for all the constructs range between 0.794 - 0.629, which is acceptable. Similarly, the value of KMO’s sample adequacy was rated at
.799. Hence, the construct reliability in this research is satisfactory. The result of Cronbach’s alpha draws a significant amount of correlation between the variables tested. The validity of a test is the extent to which differences in scores reflect differences in the measured characteristic. Predictive validity is a measure of the usefulness of a measuring instrument as a predictor. Proof of predictive validity is determined by the correlation between results and actual behaviour. Construct validity is the extent to which a measuring instrument measures what it intends to measure.

The primary data for this research were collected through a structured questionnaire to answer the research questions and objectives. The structured questionnaire consists of three distinct sections: Warehouse Designers, Operation Team and End users. The secondary data needed for the study were sourced from various magazines, journals, internet and thesis works. The data collected are analysed and tabulated with help of SPSS package version 19.

1.10 Statistical Tools Applied

According to the nature of the data analysis and interpretations required, appropriate statistical tools have been applied. The following tools have been applied in the study: Frequency distribution, Weighted Average, Likert’s Scaling, one way ANOVA, two way ANOVA, Multiple Regression, Reliability and Rotation Factor Analysis.

- The frequency distribution of the variables has helped the researcher to calculate distribution value of variables tested.

- Weighted arithmetic mean and Likert’s Summated scales helped in interpreting the averages of the variable used in this study, like: Employees’ opinion on factors considered in location selection, Employees’ opinion on factors considered in warehouse designing, Employees’ opinion on
importance of layout, process & material flow in warehouse designing, Employees’ opinion on importance of material handling equipment in warehouse designing, Employees’ opinion on importance of it integration in warehouse designing, Employees’ opinion on facilities that are essential for warehouse receipt system, Employees’ opinion on facilities that are essential for warehouse storage system, Employees’ opinion on facilities that are essential for retrieval / despatch of goods and Employees’ opinion on critical factors that influence their warehouse selection behaviour.

- One Way ANOVA test was applied to measure whether there exists close association between warehouse design managers’ efficiency in layout designing and their work experience.

- Two Way ANOVA test has been applied to measure whether (i) Nature of industry significantly influences the end users’ decision of the factors that are critical while selecting the warehouse for their organization and (ii) Nature of business significantly influences the end users’ decision of the factors that are critical while selecting the warehouse for their organization.

- A set of four multiple regression analyses were constructed to measure:
  - Warehouse design managers’ are very efficient in designing the warehouse layout as per the industrial sector of the end-users.
  - Warehouse design managers’ are very efficient in designing the warehouse layout as per the service consumer category of the end-users.
  - Warehouse operational managers’ are very efficient in executing inventory, receipt management and dispatches as per the industrial segments.
 Warehouse operational managers’ are very efficient in executing inventory, receipt management and dispatches as per the product category.

- Rotation factor analysis with Kaiser-Meyer-Oklin (KMO) test and Reliability analysis were applied to test whether there establishes consistency in the (i) warehouse design managers’ efficiency in designing the warehouse layout as per the industrial sector of the end-users, (ii) warehouse design managers’ efficiency in designing the warehouse layout as per the service consumer category of the end-users, (iii) Warehouse operational managers’ efficiency in executing inventory, receipt management and dispatches as per the industrial segments and (iv) Warehouse operational managers’ efficiency in executing inventory, receipt management and dispatches as per the product category.

1.11 Limitations of the study

Though the researcher took utmost care and efforts to avoid shortcomings in the process of data collection and analysis, the study is prone to some limitations, which are mentioned below:

- The study is confined to the metros and tire two cities in the selected study area in India.
- The study completely focused only on the operational aspects of the warehouse operations across India.
- The opinion was obtained from the designers of the warehouse, operators of the warehouse and the end users of the warehouse and it may be based on
their exposure limits, which may affect the findings and conclusion drawn by the researcher.

1.12 Chapter Scheme

The framework of this research work has been structured to gain insights into the above purpose and thus includes five chapters namely the Introduction and Literature Review, Design, Theoretical discussion, Interpretation Analysis and summary, findings, Suggestion, Conclusion, and future research scope. A brief outline of each chapter is given below: This thesis is organised into five chapters.


Chapter II: The second chapter consists of an elaborate theoretical discussion on subject issues. This chapter is titled “Origin, Growth and Development of Warehouse in India:

Chapter III: The third chapter reviews selected literature relating to study concept and objectives framed.

Chapter IV: The fourth chapter consists of analysis and interpretation of the surveyed data.

Chapter V: The fifth chapter presents Summary of the study, findings of the research, conclusion, implication and scope for future research.