

PROJECT REPORT  
on  
“WAREHOUSE EFFICIENCY EVALUATION USING DATA  
ENVELOPMENT ANALYSIS”

Submitted as Partial Fulfillment of the Requirement of the Degree of  
**Master of Operational Research**

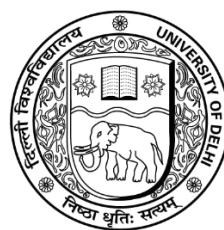
Session 2021-2023

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(NCUBATE INDIA SERVICES PVT. LTD.)

Plot No 221, Udyog Vihar Phase 1, Sector 20, Gurugram, Haryana 122016



**UNIVERSITY OF DELHI**

**DEPARTMENT OF OPERATIONAL RESEARCH**

*Submitted By*

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# **CERTIFICATE**

This is to certify that the project entitled "**WAREHOUSE EFFICIENCY EVALUATION USING DATA ENVELOPMENT ANALYSIS**" is my original work carried out at "**Ncubate India Services Pvt. Ltd.**" in the year 2023, and has been submitted for the partial fulfilment of the course Master of Operational Research (MOR).

The Project report has not been submitted earlier or in full or in part for any other diploma or degree to any other University or Institute to the best of my knowledge.

**Sahil Nasa**

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Head of the Department

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## **ACKNOWLEDGEMENT**

I would like to thank all those sincerely, who have helped me in successful completion of this project. I would like to express my sincere thanks and appreciation to **Prof. (Dr.) Pankaj Gupta** and **Prof. Mukesh Kumar Mehlawat** for providing me with an opportunity to do the project under their valuable supervision. Without their assistance, I would not have been able to complete my project successfully.

I express my sincere gratitude to our benevolent professors Prof. (Dr.) Prakash C. Jha, Prof. (Dr.) Chandra K. Jaggi, Prof. (Dr.) Preeti Wanti Srivastava, Prof. (Dr.) K. K. Aggarwal, Prof. (Dr.) Anu Gupta Aggarwal, Dr. Ompal Singh, Dr. Vandana Khaitan, Dr. Kaushal Kumar, Dr. Adarsh Anand, Dr. Sameer Anand, Dr. Gurjeet Kaur, Dr. Abhishek Tandon, Dr. Shipali Verma, Dr. Jagvinder Singh .

I would also like to thank Ph.D. and M. Phil students for their guidance and co-operation throughout my project. I also would like to thank my family and friends for their kind assistance and silent motivation.

I am grateful to Mr. Santosh Kumar who's the manager of the company, Mr. Ashish Kumar, and Mr. Manish Kumar at Ncubeate India Services Pvt. Ltd., without whose help this project would have never materialized.

### **SAHIL NASA**

Master of Operational Research  
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Date 14/2/2023

To,  
The Head of Department  
Department of Operational Research  
Faculty of Mathematical Sciences  
University of Delhi  
Delhi – 110007

Date:

Subject: Regarding Assignment of Project at SAR Group.

Dear Ma'am,

This is with reference to your request letter received regarding permission to do a project in our company SAR Group.

We are pleased to inform you that your request has been accepted and the company hereby give permission to Sahil Nasa from Department of Operational Research, University of Delhi to do a project on Supply Chain Management from 14<sup>th</sup> February 2023 – 30<sup>th</sup> April 2023.

I would like to inform you that the project assignment is for academic purpose only. The data will be kept strictly confidential and will be used solely for academic purpose. Sahil Nasa will be associated with us until the completion of the project and will be provided with all the relevant inputs.

Thanking you

For Ncubate India Services Pvt. Ltd.



Authorized Signatory

**Ncubate India Services Pvt. Ltd.**

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To,  
The Head of Department  
Department of Operational Research  
Faculty of Mathematical Sciences  
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Date: 1<sup>st</sup> May 2023

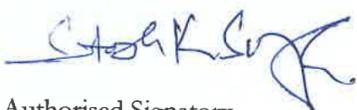
Subject: Completion of Academic Project

Dear Ma'am,

This is to certify that Mr. Sahil Nasa, student of Master of Operational Research, University of Delhi, has successfully completed his academic project for Ncubate India Services Pvt. Ltd. and submitted the project titled "WAREHOUSE EFFICIENCY EVALUATION USING DATA ENVELOPMENT ANALYSIS".

Best Regards,  
Ncubate India Services Pvt. Ltd.

**For Ncubate India Services Pvt. Ltd.**



Authorised Signatory  
Ncubate India Services Pvt. Ltd

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## **ABSTRACT**

Warehouses play a significant role in logistical operations and significantly influence the pace and cost of supply chains. Although order picking and other specific warehouse tasks have generally acknowledged standards, little is known about the technological efficiency of warehouses as a whole. The industry's capacity to pinpoint the greatest chances for enhancing warehouse performance is constrained by a lack of a general grasp of warehouse technical efficiency and the related cause variables.

In this study, we make use of DEA models as a tool to evaluate the efficiencies of twenty-nine (29) homogeneous warehouses of the company. DEA is a linear programming technique used to evaluate the efficiency of decision-making units (DMUs) where multiple inputs and outputs are involved.

The CCR and BCC models were both utilised to identify efficient and inefficient warehouses, and the efficient warehouses were then graded using the Anderson and Peterson super efficiency model. Peer warehouses and slacks were identified as efficient operations that inefficient DMUs may adapt to attain the efficient frontier.

The model effectively detects the relative efficiencies of efficient and inefficient decision-making units (DMUs), indicating the possibility for saving areas for future improvement action by the warehouse's operations department. The study also provided some intriguing and relevant management insights and ramifications.

# CHAPTER 1: INTRODUCTION TO OPERATIONS RESEARCH

## OPERATIONAL RESEARCH: “The science of better”

As the name implies, operational research involves “research on operations”. Thus, operations research is applied to problems that concern how to conduct and coordinate the operations (i.e., the activities) within the organization.

Operational Research (OR) is a science which deals with problem, formulation, solutions and finally appropriate decision making. In the decades after the two world wars, the tools of operational research (OR) were more widely applied to problems in business, industry and society. It is often concerned with determining the extreme values of some real-world objective: the maximum (of project, performance, or yield) or minimum (of loss, risk, or cost). Originating in military efforts before World War II, its techniques have grown to concern problems in a variety of industries. Since that time operational research has expanded into a field widely used in industries ranging from airlines, finance, logistics, and government, moving to a focus on the development of mathematical models that can be used to analyse and optimize complex systems, and has become an area of active academic and industrial research.

Operational Research encompasses the development and use of a wide range of problem-solving techniques and methods applied in the pursuit of improved decision making and efficiency. It is often considered as a sub-field of applied mathematics.

### 1.1 DEFINITIONS

Defining OR is a difficult task as its boundaries and contents are not yet fixed. It can be regarded as use of mathematical and quantitative techniques to substantiate the decision being taken. Further, it is multidisciplinary which takes tools from subjects like mathematics, statistics, engineering, economics, psychology etc. and uses them to score the consequences of possible alternative actions. Today it has become professional discipline that deals with the application of scientific methods to decision-making. Salient aspects related to definition stressed by various experts on the subject are as follows:

*“The high-tech field of OR offers numerous excellent opportunities to boost performance immediately. Yet OR Practitioner time remains to skim the cream before everyone wakes up to the projects. When most do wake up, USA companies that are not taking full advantage of OR will leave serious money on the table and be outflanked competitors.”*

-Randy Robinson

*“Operations Research is the systematic application of quantitative methods, techniques and tools to the analysis of problems involving the operations of systems.”*

-Daellenbach and George 1978

*“OR is a scientific knowledge through interdisciplinary team effort for the purpose of determining the best utilizations of limited resources.”*

-H A Taha

*“OR is the application of scientific methods, techniques and tools to problems involving the operations of a system so as to provide those in control of the system with optimum solutions to the problem.”*

-C W Churchman, R L Ackoff & E L Arnoff

*“Operations Research may be described as a scientific approach to decision-making that involves the operations of organizational system.”*

-F. S. Hiller and G.J. Lieberman, 1980

*“OR is the art of giving bad answers to the problems which otherwise have worse answers.”*

-T L Satty

*“OR is the scientific approach to problem solving for executive management.”*

-H M Wagner

Some other definitions are as follows:

- Operational Research is the application of the methods of science to complex problems in the direction and management of large systems of men, machines, materials and money in industry, business, government and defence. The distinctive approach is to develop a scientific model of the system incorporating measurements of factors such as chance and risk, with which to predict and compare the outcomes of alternative decisions, strategies or controls. The purpose is to help management in determining its policy and actions scientifically.
- Operations Research is the systematic application of quantitative methods, techniques and tools to the analysis of problems involving the operation of systems.
- Operations Research can be characterized as the application of scientific methods, techniques and tools, to problems involving the operations of a system to provide those in control of the operations with optimum solutions to the problems
- Operations Research is the professional discipline that deals with the application of information technology for informed decision-making. It aims to provide a rational base for decision making by seeking to understand and structure complex situations and to use this understanding to predict system behaviour and improve system performance. Much of this work is done using analytical and numerical techniques to develop and manipulate mathematical and computer models of organizational systems composed of people, machines, and procedures.

## 1.2 OPERATIONS RESEARCH SOCIETY OF INDIA

The Operational Research Society of India was founded in 1957 to provide a forum for the Operational Research Scientists as well as an avenue to widen their horizon by exchange of knowledge and application of techniques from outside the country. To further that end, the Society is affiliated to the International Federation of Operational Research Societies (IFORS). The objectives of the Society shall be the promotion and propagation of knowledge in Operational Research, publication of the journal with original, high quality and state-of-the art papers on Operational Research and allied disciplines and conducting courses /examinations to propagate the knowledge in Operational Research. The Society publishes a quarterly journal OPSEARCH, which brings out high quality and state of the art papers in Operational Research. The journal enjoys a wide spectrum of readership both in the India and abroad covering academics, professionals as well as industrial / service sector organizations.

## 1.3 FEATURES OF OPERATIONS RESEARCH

The objective of the operations research models is to attempt and to locate best or optimal solution under the specified conditions. For the above purpose, it is necessary that a measure of effectiveness has to be defined

which must be based on the goals of the organization. These measures can be used to compare the alternative courses of action taken during the analysis.

OR utilizes a planned approach following a scientific method and an interdisciplinary team, in order to represent complex functional relationship as mathematical models, for the purpose of providing a quantitative basis for decision-making and uncovering new problems for quantitative analysis. The broad features of OR approach any decision problem are:

- **Interdisciplinary Approach:** This is necessary because one person may not have the complete knowledge of all its aspects. Therefore, a team of individuals specializing in mathematics, statistics, economics, engineering, computer science, psychology, etc., should be organized in a way that each aspect of the problem can be analysed.
- **Scientific Approach:** This method consists of observing and defining the problem; formulating and testing the hypothesis; and analysing the results of the test.
- **Holistic Approach:** While arriving at a decision, an operations research team examines the relative importance of all conflicting and multiple objectives. It also examines the validity of claims of various departments of the organization from the perspective of its implication to the whole organization.
- **Objective – Oriented Approach:** An operations research approach seeks to obtain an optimal solution to the problem under analysis. For this, measure of desirability is defined, based on the objective of organization. A measure of desirability so defined is then used to compare alternative courses of action with respect to their possible outcomes.

#### 1.4 OBJECTIVES OF OPERATIONS RESEARCH

- Decision making and improving the objective.
- Identify optimum solutions.
- Integrating optimum solutions.
- Improving the objectivity of analysis.
- Minimizing cost and maximizing profit.
- Improving the productivity.
- Success in competition and market leadership.

#### 1.5 ROLE OF OPERATIONS RESEARCH IN DECISION-MAKING

The Operation Research may be considered as a tool which is employed to raise the efficiency of management decisions. OR is the objective complement to the subjective feeling of the administrator (decision maker). Scientific method of the OR is used to comprehend and explain the phenomena of operating system.

The benefits of OR study approach in business and management decision making may be categorize as follows:

- **BETTER CONTROL**

The management of large concerns finds it much expensive to give continuous executive supervisions over routine decisions. An OR approach directs the executives to dedicate their concentration to more pressing matters. For instance, OR approach handles production scheduling and inventory control.

- **BETTER COORDINATION**

Sometimes OR has been very helpful in preserving the law-and-order situation out disorder. For instance, an OR based planning model turns out to be a vehicle for coordinating marketing decisions with the restrictions forced on manufacturing capabilities.

- **BETTER SYSTEM**

OR study is also initiated to examine a particular problem of decision making like setting up a new warehouse. Later OR approach can be more developed into a system to be employed frequently. As a result, the cost of undertaking the first application may get better profits.

- **BETTER DECISIONS**

OR models regularly give actions that do enhance an intuitive decision making. Sometimes a situation may be so complex that the human mind can never expect to assimilate all the significant factors without the aid of OR and computer analysis.

## **1.6 METHODS OF OPERATIONS RESEARCH**

Most of the problems are solved using one of these three techniques:

- Simulation methods
- Optimization methods
- Data analysis methods

### **1.6.1 SIMULATION METHODS**

Simulation is the imitation of the operation of a real-world process or system over time. The act of simulating something first requires that a model be developed; this model represents the key characteristics or behaviour/functions of the selected physical or abstract system or process. The model represents the system itself, whereas the simulation represents the operation of the system over time. Simulation is used in many contexts, such as simulation of technology for performance optimization, safety engineering, testing, training, education, and video games. Often, computer experiments are used to study simulation models. Simulation is also used with scientific modelling of natural systems or human systems to gain insight. Simulation can be used to show the eventual real effects of alternative conditions and courses of action.

### **1.6.2 OPTIMIZATION METHODS**

In mathematics, computer science, economics, or management science, mathematical optimization (alternatively, optimization or mathematical programming) is the selection of a best element (with regard to some criteria) from some set of available alternatives.

In the simplest case, an optimization problem consists of maximizing or minimizing a real function by systematically choosing input values from within an allowed set and computing the value of the function. The generalization of optimization theory and techniques to other formulations comprises a large area of applied mathematics. More generally, optimization includes finding “best available” values of some objective function given a defined domain (or a set of constraints), including a variety of different types of objective functions and different types of domains.

### **1.6.3. DATA ANALYSIS METHOD**

Analysis of data is a process of inspecting, cleaning, transforming, and modelling data with the goal of discovering useful information, suggesting conclusions, and supporting decision-making. Data analysis has multiple facets and approaches, encompassing diverse techniques under a variety of names, in different business, science, and social science domains.

Data mining is a particular data analysis technique that focuses on modelling and knowledge discovery for predictive rather than purely descriptive purposes. Business intelligence covers data analysis that relies heavily on aggregation, focusing on business information. In statistical applications, some people divide data analysis into descriptive statistics, exploratory data analysis (EDA), and confirmatory data analysis (CDA). EDA focuses on discovering new features in the data and CDA on confirming or falsifying existing hypotheses. Predictive analytics focuses on application of statistical models for predictive forecasting or classification, while text analytics applies statistical, linguistic, and structural techniques to extract and classify information from textual sources, a species of unstructured data.

## **1.7. OUTLINES OF OR MODELS**

In OR the problem is expressed in the form of a model. Where, a model is a theoretical abstraction (approximation) of a real-life problem. It can be defined as a simplified representation of an operation or a process in which only the basic aspects or the most important features of a typical problem under investigation are considered. OR analysts have given special impetus to the development and use of techniques like, linear programming, waiting line theory, game theory, inventory controls and simulation. In addition, some other common tools are non-linear programming, integer programming, dynamic programming, sequencing theory, Markov process, network scheduling- PERT and CPM, symbolic logic, information theory and utility/value theory. The list, of course, is not exclusive.

The detailed discussion on above will be presented in appropriate chapters, however, brief explanation of these is given below:

**(i) Linear Programming (L.P.):**

Linear programming is basically a constrained optimization technique which tries to optimize some criterion within some constraints. It consists of an objective function which is some measure of effectiveness like profit, loss or return on investment and several boundary conditions putting restriction on the use of resources. Objective function and boundary conditions are linear in nature. There are methods available to solve a linear programming problem.

**(ii) Waiting Line or Queueing Theory:**

Waiting line deals with the situation in which queue is formed or the customers have to wait for service or machines wait for repairmen and therefore concept of a queue is involved. If we assume that there are

costs associated with waiting in line, and if there are costs of adding more service facilities, we want to minimize the sum of costs of waiting and the costs of providing service facilities. Waiting line theory helps to make calculations like number of expected member of people in queue, expected waiting time in the queue, expected idle time for the server, etc. These calculations then can be used to determine the desirable number of service facilities or number of servers.

**(iii) Game Theory:**

Game theory is used for decision-making under conflicting situations where there are one or more opponents. The opponents, in game theory, are called players. The motives of the players are dictomized. The success of one player tends to be at the cost of others and hence they are in conflict. Game theory models, a conflict situation arises and helps to improve the decision process by formulating appropriate strategy.

**(iv) Inventory Control Models:**

Inventory control models deal with the quantities which are either to be purchased or stocked since each factor involves cost. The purchase and material managers are normally encounter such situations. Therefore, inventory models provide rational answer to these questions in different situations of supply and demand for different kind of materials. Inventory control models help managers to decide ordering time, reordering level and optimal ordering quantity. The approach is to prepare a mathematical model of the situation that expressed total inventory costs in terms of demand, size of order, possible over or under stocking and other relevant factors and then to determine optimal order size, optimum order level etc. using calculus or some other technique.

**(v) Simulation:**

It is basically data generating technique, where sometimes it is risky, cumbersome, or time consuming to conduct real study or experiment to know more about situation or problem. The available analytical methods cannot be used in all situations due to large number of variables or large number of interrelationships among the variables and the complexity of relationship; it is not possible to develop an analytical model representing the real situation. Sometimes, even building of model is possible but its solution may not be possible. Under such situations simulation is used. It should be noted that simulation does not solve the problem by itself, but it only generates the required information or data needed for decision problem or decision making.

**(vi) Non- Linear Programming:**

Non-Linear models may be used when either the objective function or some of the constraints are not linear in nature. Non-linearity may be introduced by such factors as discount on price of purchase of large quantities and graduated income tax etc. Linear programming may be employed to approximate the non-linear conditions, but the approximation becomes poorer as the range is extended. Non-linear methods may be used to determine the approximate area in which a solution lies, and linear methods may be used to obtain a more exact solution.

**(vii) Integer Programming:**

Integer programming method can be used when one or more of the variables can only take integer values. Examples are the number of trucks in a fleet, the number of generators in a power house and so on. Approximate solutions can be obtained without using integer programming methods, but the

approximation generally becomes poorer as the number becomes smaller. There are techniques to obtain solution of integer programming problems.

**(viii) Dynamic Programming:**

This is a method of analysing multistage decision processes, in which each elementary decision is dependent upon those preceding it as well as upon external factors. It drastically reduces the computational efforts otherwise necessary to analyse results of all possible combinations of elementary decisions.

**(ix) Sequencing Theory:**

Sequencing theory is related to waiting line theory and is applicable when the facilities are fixed, but the order of servicing may be controlled. The scheduling of service or the sequencing of jobs is done to minimize the relevant costs and time.

**(x) Markov Process:**

Markov process is used for decision-making in situations where various states are defined. The probability of going from one state to another is known and depends on the present state and is independent of how we have arrived at that state. Theory of 18 Markov process helps us to calculate long run probability of being in a particular state (steady state probability), which is used for decision-making.

**(xi) Network Scheduling:**

PERT and CPM These techniques are used to plan, schedule and monitor large projects such as building construction, maintenance of computer system installation, research and development design etc. The technique aims at minimizing trouble spots, such as, delays, interruptions and production bottlenecks, by identifying critical factors and coordinating various parts of overall job/project. The project/job is diagrammatically represented with the help of network made of arrows representing different activities and interrelationships among them. Such a representation is used for identifying critical activities and critical path. Two basic techniques in network scheduling are Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM). CPM is used when time taken by activities in a project are known for sure and PERT is used when activities time is not known for sure—only probabilistic estimate of time is available to the users.

**(xii) Symbolic Logic:**

Symbolic logic deals with substituting symbols for words, classes of things or functional systems. Symbolic logic involves rules, algebra of logic and propositions. There have been only limited attempts to apply this technique to business problems; however, has had extensive application in the design of computing machinery.

**(xiii) Information Theory:**

Information theory is an analytical process transferred from the electrical communications field to operations research. It seeks to evaluate the effectiveness of information flow within a given system. Despite its application mainly to communication networks, it has had an indirect influence in simulating the examination of business organizational structures with a view to improving information or communication flow

#### **(xiv) Utility/Value Theory:**

Utility/Value theory deals with assigning numerical significance to the worth of alternative choices. To date, this has been only a concept and is in the stage of elementary model formulation and experimentation and can be useful in decision making process.

### **1.8 PHASES OF OPERATIONS RESEARCH STUDY**

#### **1.8.1 FORMULATE THE PROBLEM:**

This is the most important phase of study and is generally the most time consuming. The activities that constitute this phase are visits, research, observations etc. With the help of such activities, the OR scientists get sufficient information and support to proceed and is better prepared to formulate the problem. This process starts with understanding of organizational climate, its objectives and expectations. Further, the alternative courses of action are discovered in this step.

#### **1.8.2 DEVELOP A MODEL:**

Once a model is formulated, the next step is to express the model into mathematical model that represents systems, processes or environment in the form of equations, relations or formulas. We have to identify both static and structural elements and device mathematical formulas to represent interrelationships among elements. The proposed model may be field tested and modified in order to work under stated environmental constraints. A model may also be modified if the management is not satisfied with the answer that it gives.

#### **1.8.3 SELECT APPROPRIATE DATA INPUT:**

Garbage in and garbage out is a famous saying. No model will work appropriately if data input is not correct. The purpose of this step is to have proper input to test the model appropriately.

#### **1.8.4 SOLUTION OF THE MODEL:**

After finding appropriate data input for the model, the next step is to find a solution. If the model is not working properly then modification and update are considered in this step

#### **1.8.5 VALIDATION OF THE MODEL:**

A model is said to be validated if it can provide a reliable prediction of the system's performance. A model must be applicable for a long time and can be updated from time to time taking into consideration the past, present and future aspects of the problem.

#### **1.8.6 IMPLEMENTATION OF THE MODEL:**

Implementation of the solution many behavioural issues and the implementing society is responsible for resolving these issues. The gap between who solves the model and who wishes to use it should be eliminated. To achieve this, OR scientist and the management will play a positive role. A properly working solution obtained through OR techniques result in improved working and managerial support.

### **1.9 SCOPE OF OPERATIONS RESEARCH**

As presented in the earlier paragraphs, the scope of OR is not only confined to any specific agency like defence services but today it is widely used in all industrial organizations. It can be used to find the best solution to any problem be it simple or complex. It is useful in every field of human activities, where optimization of resources is required in the best way. Thus, it attempts to resolve the conflicts of interest among the components of organization in a way that is best for the organization as a whole. The main fields where OR is extensively used are given below, however, this list is not exhaustive but only illustrative.

**(i) NATIONAL PLANNING AND BUDGETING:**

Operation Research is used for the preparation of Five-Year Plans, annual budgets, forecasting of income and expenditure, scheduling of major projects of national importance, estimation of GNP, GDP, population, employment and generation of agriculture yields etc.

**(ii) DEFENCE SERVICES BASICALLY FORMULATION OF OR:**

Started from USA army, so it has wide application in the areas such as: Development of new technology, optimization of cost and time, tender evaluation, setting and layouts of defence projects, assessment of “Threat analysis”, strategy of battle, effective maintenance and replacement of equipment, inventory control, transportation and supply depots etc.

**(iii) INDUSTRIAL ESTABLISHMENT AND PRIVATE SECTOR UNITS:**

Operation Research can be effectively used in plant location and setting finance planning, product and process planning, facility planning and construction, production planning and control, purchasing, maintenance management and personnel management etc. to name a few.

**(iv) R & D AND ENGINEERING:**

Research and development being the heart of technological growth, OR has wide scope for and can be applied in technology forecasting and evaluation, technology and project management, preparation of tender and negotiation, value engineering, work/method study and so on.

**(v) BUSINESS MANAGEMENT AND COMPETITION:**

Operation Research can help in taking business decisions under risk and uncertainty, capital investment and returns, business strategy formation, optimum advertisement outlay, optimum sales force and their distribution, market survey and analysis and market research techniques etc.

**(vi) AGRICULTURE AND IRRIGATION:**

In the area of agriculture and irrigation also OR can be useful for project management, construction of major dams at minimum cost, optimum allocation of supply and collection points for fertilizer/seeds and agriculture outputs and optimum mix of fertilizers for better yield.

**(vii) EDUCATION AND TRAINING:**

Operation Research can be used for obtaining optimum number of schools with their locations, optimum mix of students/teacher student ratio, optimum financial outlay and other relevant information in training of graduates to meet out the national requirements.

### **(viii) TRANSPORTATION:**

Transportation models of OR can be applied to real life problems to forecast public transport requirements, optimum routing, forecasting of income and expenses, project management for railways, railway network distribution, etc. In the same way it can be useful in the field of communication.

### **(ix) HOME MANAGEMENT AND BUDGETING:**

OR can be effectively used for control of expenses to maximize savings, time management, work study methods for all related works. Investment of surplus budget, appropriate insurance of life and properties and estimate of depreciation and optimum premium of insurance etc.

## **1.10 USES OF OPERATIONAL RESEARCH**

Formulation of industrial problems may be generalized into different groups of classical problems, the package program for which is available for mechanization and manual solutions. Various problem of optimization can be brought to the model of linear program for which solution is available? While formulating the problem, the class of the problem is to be decided and the parameters are to be defined accordingly. Inventory control, production planning, product mix, transportation problem, etc. are very common to the industries. The cost reduction with the help of these tools is very much powerful in comparison to any other conventional method. We can enumerate the advantages of these techniques as:

### **(i) Optimum use of production factors:**

Linear programming techniques indicate how a manager can most effectively employ his production factors by more efficiently selecting and distributing these elements.

### **(ii) Improved quality of decision:**

The computation table gives a clear picture of happenings within the basic restriction and the possibilities of compound behaviour of the elements involved in the problems. The effect on the profitability due to changes in the production pattern will be clearly indicated in the table e.g., simplex table.

### **(iii) Preparations of future managers:**

These methods substitute a means for improving knowledge and skills of your manager.

### **(iv) Modification of mathematical solution:**

Operation Research presents a possible practical solution when one exists, but it is always a responsibility of the manager to accept or modify the solution before its use. The effects of these modifications may be evaluated from the computational steps and tables.

### **(v) Alternative solution:**

Operational Research techniques will suggest all the alternative solution available for the same profit so that the management may decide based on its strategies.

## **1.11 LIMITATIONS OF OPERATIONAL RESEARCH**

Operational Research has certain limitations. These limitations are as follows: -

**(i)      Magnitude of computations:**

Operation Research tries to find out the optimal solution taking all the factors into account. In the modern society, these factors are numerous and expressing them in quantity and establishing relationship among these requires huge calculations. All these calculations cannot be handled manually and require electronic computers which bear a very heavy cost. Thus, the use of OR is limited to only very large organizations.

**(ii)     Absence of qualification:**

Operation Research provides solution only when all the elements related to a problem can be quantified. The tangible factors such as product, price, etc., can be expressed in terms of quantity, but intangible factors such as human relations etc. cannot be quantified. Thus, these intangible elements of the problem are excluded from the study, though these might be equal or more important than quantifiable intangible factors as far as possible.

**(iii)    Distance between managers and operations research:**

Operation Research being specialist job requires a mathematician or a statistician, who might not be aware of business problems. Similarly, a manager may fail to understand the complex working of OR. Thus, there is a gap between one who provides the solution and one who uses a solution. This problem is mainly of training. Both the persons should have a working knowledge of each other's job to have better understanding of insights of the problem and its optimal solution.

# ABOUT COMPANY



## **2.1) COMPANY PROFILE**

Ncubate India Services Pvt. Ltd. (NISPL) is an enterprise in India, with the registered office in Delhi and corporate in Gurugram. It operates in the Transportation and Warehousing industry. The company was established on July, 2011. Today, the company has pan India presence with more than 29 warehouses across India.

Ncubate India Services Pvt. Ltd. is leading warehouse and logistics company.



## **2.2) NCUBATE SERVICES**

The company is operating across country and their objective is to build a strong logistics and supply chain network to support global and multinational customer in across India. To this end, the company will have a very strong focus on “quality” and “Automation” to establish one of the innovative supply chain solution providers.

- WAREHOUSING AND DISTRIBUTION**

A specialist in the warehousing services with a wide experience, NISPL is pioneers of numerous ideas in the logistics vertical in India particularly when the world is simply awakening this dawn part. Their experts deal with the capacity, sacking, emptying and stock service in a very productive way and with the assistance of innovative devices intended for this reason. Offered services are exceptionally good and are made accessible by the clients at standard business costs.

- **TRANSPORTATION SERVICES**

Transportation solutions are operationally sound and function on the strong backbone of state-of-the-art technology and Transport Management System. The track and Trace mechanisms and efficient management and monitoring systems ensure transparency and step by step feedback about the status of customer's consignment.

- **3PL LOGISTICS**

NISPL has their logistics professionals' team and many companies are availing their services in logistics solutions. They are getting hassle free logistics services enable them to concentrate on their competitors.

### **2.2.1) NCUBATE INDIA SERCIVES PVT. LTD STRENGTHS**

- **INFRASTRUCTURE FACILITIES**

NISPL has their own Infrastructure- on role staff, well develop warehouses. They have 27 number of warehouses across Pan India.

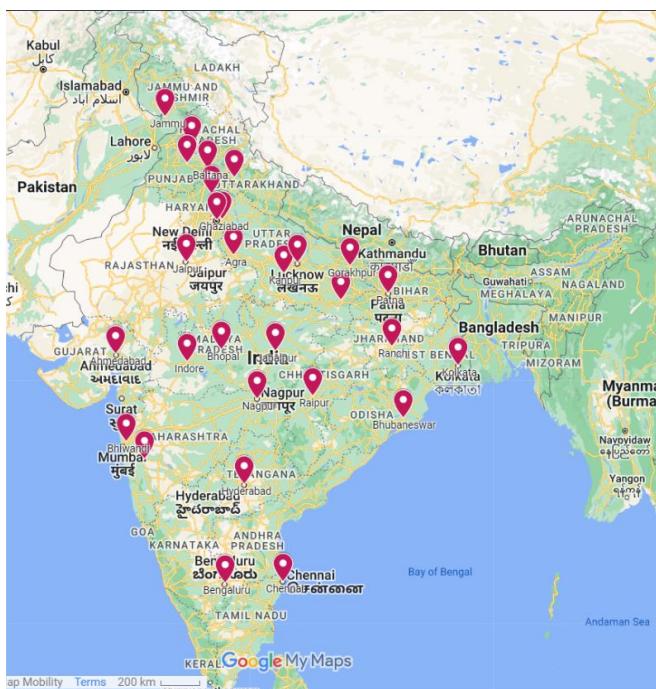
- **OPERATIONS**

NISPL has control tower in HP from where a team monitors and control all operations for quick solutions. They share MIS and Modified report to their business partners as per their requirements.

- **TRANSPORTATION**

NISPL has fixed lease vehicles in each and every warehouse for primary and secondary distribution. They are using latest technologies and implement as per business/Client requirement.

### **2.3) WAREHOUSE LOCATIONS ACROSS PAN INDIA**



## **2.4) ABOUT PARENT ORGANISATION**



### **SAR STORY**

SAR Group, a 30+ year young entrepreneurial organisation has a journey of starting and growing businesses and winning the trust of millions of consumers over the years.

Their founders, Mr. Rakesh Malhotra and Mr. Navneet Kapoor established the Luminous brand in 1988. In 2011, Luminous became the market leader in its category.

Luminous inked a Joint Venture between Schneider Electric and the founders of SAR group between 2011 and 2016. In January 2017, founders of SAR group divested all their shares to Schneider Electric.

Starting 2012, SAR 2.0 began with mission 555 (5000 Happy Employees, 5000 crore Revenue and 500 crore Profit) by the year 2022 and is successful in continuing its vision of impacting consumer's lives, not just in India but globally as well, along with making a positive contribution towards a sustainable planet.

The success of SAR group over the years is largely credited to 3 pillars – Innovation, Customer centricity and Enduring relationships built on mutual respect and trust with partners, consumers and employees.

Our focus is on providing consumers with Purity, Health and Wellness, Energy storage solutions, B2B e-commerce, IoT/Smart Homes, E Mobility, Cleantech and Venture Capital and Investments.

SAR group has 6 R&D centres, 5 state-of-the-art manufacturing sites, 3600+ employees, 35000+ Channel partners and is present in 28 overseas markets.

## **2.5) NCUBATE INDIA SERVICES PVT. LTD. STRATEGY:**

### **COMPANY PURPOSE:**

To be a technology-based leader in the service industry by providing enhanced and transparent solutions with global standards and benchmarks.

### **COMPANY VISION:**

To provide quality services, real time accessibility of transactions that exceeds the expectations of our esteemed customers.

### **COMPANY MISSION STATEMENT:**

To build long term relationships with their customers and provide exceptional customer services by pursuing business through innovation and advanced technology.

## 2.6) NCUBATE INDIA SERVICES PVT. LTD. CLIENTS:



# MULTI CRITERIA DECISION MAKING

**Multi-criteria decision-making** or **multiple-criteria decision analysis** (MCDA) or **Multi-criteria decision models** (MCDM) is a sub-discipline of operations research that explicitly considers multiple criteria in decision-making environments. Whether in our daily lives or in professional settings, there are typically multiple conflicting criteria that need to be evaluated in making decisions. Cost or price is usually one of the main criteria. Some measure of quality is typically another criterion that is in conflict with the cost. In purchasing a car, cost, comfort, safety, and fuel economy may be some of the main criteria we consider. It is unusual to have the cheapest car to be the most comfortable and the safest. In portfolio management, we are interested in getting high returns but at the same time reducing our risks. Again, the stocks that have the potential of bringing high returns typically also carry high risks of losing money. In a service industry, customer satisfaction and the cost of providing service are two conflicting criteria that would be useful to consider.

In our daily lives, we usually weigh multiple criteria implicitly and we may be comfortable with the consequences of such decisions that are made based on only intuition. On the other hand, when stakes are high, it is important to properly structure the problem and explicitly evaluate multiple criteria. In making the decision of whether to build a nuclear power plant or not, and where to build it, there are not only very complex issues involving multiple criteria, but there are also multiple parties who are deeply affected from the consequences.

Structuring complex problems well and considering multiple criteria explicitly lead to more informed and better decisions. There have been important advances in this field since the start of the modern multiple criteria decision-making discipline in the early 1960s. A variety of approaches and methods, many implemented by specialized decision-making software, have been developed.

## 3.1) DATA ENVELOPMENT ANALYSIS (DEA)

Data Envelopment Analysis (DEA) is a methodology based upon an interesting application of linear programming. It is originally developed for performance measurement. It has been successfully employed for assessing the relative performance of a set of firms that use a variety of identical inputs to produce a variety of identical outputs.

### 3.1.1) DECISION MAKING UNITS:

Data Envelopment Analysis is a linear programming- based technique for measuring the performance efficiency of organization units which are termed as Decision- Making units (DMUs). This technique aims to measure how efficiently a DMU uses the resources available to generate a set of outputs, according to Charnes et al. Decision-making units can include manufacturing units, departments of big organizations such as universities, schools, bank branches, hospitals, power plants, police stations, tax offices, prisons, defence bases, a set of firms or even practising individuals such as medical practitioners.

The performance of DMUs is assessed in DEA using the concept of efficiency or productivity, which is the ratio of total outputs to total inputs. Efficiencies estimated using DEA are relative, that is, relative to the best performing DMU (DMUs if there is more than one best-performing DMUs). The best-performing DMU is

assigned an efficiency score of unity or 100 percent, and the performance of other DMUs vary, between 0 and 100 per cent relative to this best performance.

### 3.1.2 BASIC CONCEPTS OF EFFICIENCY MEASUREMENT

The basic efficiency measure used in DEA is the ratio of total outputs to total inputs.

$$Efficiency = \frac{Output}{Input}$$

A fundamental assumption behind the computation of relative efficiency is that if a given DMU, A, is capable of producing  $Y(A)$  units of output using  $X(A)$  of inputs, then other DMUs should also be able to do the same if they were to operate efficiently.

We can set Performance Targets for inefficient DMUs to enable them to reach 100 per cent relative efficiency in comparison with the most efficient DMUs.

### Mathematical Formulation

Let  $x$  and  $y$  represent inputs and outputs, respectively. Let the subscripts  $i$  and  $j$  to represent particular inputs and outputs respectively. Thus  $x_i$  represents the  $i$ th input, and  $y_j$  represent the  $j$ th output of a decision-making unit. Let the total number of inputs and outputs be represented by  $I$  and  $J$  respectively, where  $I, J > 0$ .

The virtual input of a DMU is obtained as the linear weighted sum of all its inputs.

$$\text{Virtual Input} = \sum_{i=1}^I u_i x_i,$$

Where  $u_i$  is the weight assigned to input  $x_i$  during the aggregation.

Similarly, the virtual output of a firm is obtained as the linear weighted sum of all its outputs.

$$\text{Virtual output} = \sum_{j=1}^J v_j y_j$$

Where  $v_j$  is the weight assigned to output  $y_j$  during the aggregation.

Given these virtual inputs and outputs, the efficiency of the DMU in converting the inputs to outputs can be defined as the ratio of outputs to inputs.

$$Efficiency = \frac{\text{Virtual Output}}{\text{virtual Input}} = \frac{\sum_{j=1}^J v_j y_j}{\sum_{i=1}^I u_i x_i}$$

### FRACTIONAL DEA PROGRAMS

Let there be  $N$  DMUs whose efficiencies have to be compared. Let us take one of the DMUs, say the  $m$ th DMU, and maximize its efficiency according to the formula given above. Here the  $m$ th DMU is the reference DMU.

The Mathematical program now is,

$$\max E_m = \frac{\sum_{j=1}^J v_{jm} y_{jm}}{\sum_{i=1}^I u_{im} x_{im}}$$

Subject to,

$$0 \leq \frac{\sum_{j=1}^J v_{jm} y_{jn}}{\sum_{i=1}^I u_{im} x_{in}} \leq 1; \quad n = 1, 2, \dots, K, N$$

$$v_{jm}, u_{im} \geq 0; i = 1, 2, K, I; \quad j = 1, 2, K, J$$

Where,

$E_m$  is the efficiency of the  $m$ th DMU,

$y_{jm}$  is the  $j$ th output of the  $m$ th DMU,

$v_{jm}$  is the weight of that output,

$x_{im}$  is  $i$ th input of the  $m$ th DMU,

$u_{im}$  is the weight of that input

## OUTPUT MAXIMIZATION AND INPUT MINIMIZATION DEA PROGRAMS

It is generally difficult to solve fractional programs. If they are converted to simpler formulations, such as the linear programming (LP) formats, then they can be easily solved. The simplest way to convert these fractional programs to linear programs is to normalize either the numerator or the denominator of the fractional programming objective function.

### GENERAL FORM OF CCR DEA MODELS

A general output maximization CCR DEA model can be represented as follows

$$\max z = \sum_{j=1}^J v_{jm} y_{jm}$$

Subject to,

$$\begin{aligned} & \sum_{i=1}^I u_{im} x_{im} = 1 \\ & \sum_{j=1}^J v_{jm} y_{jn} - \sum_{i=1}^I u_{im} x_{in} \leq 0; \quad n = 1, 2, K, N \\ & v_{jm}, u_{im} \geq 0; \quad i = 1, 2, K, I; \quad j = 1, 2, K, J \end{aligned}$$

This program can be represented in matrix form as shown below.

$$\max z = V_m^T Y_m$$

Subject to,

$$\begin{aligned} & U_m^T X_m = 1 \\ & V_m^T Y - U_m^T X \leq 0 \\ & V_m^T, U_m^T \geq 0 \end{aligned}$$

Where  $X$  is the matrix of inputs and  $Y$  is the matrix of outputs.

Similarly, a general input minimization CCR DEA model can be represented as follows.

$$\min z' = \sum_{i=1}^I u'_{im} x_{im}$$

Subject to

$$\begin{aligned} & \sum_{j=1}^J v'_{jm} y_{jm} = 1 \\ & \sum_{j=1}^J v'_{jm} y_{jn} - \sum_{i=1}^I u'_{im} x_{in} \leq 0; \quad n = 1, 2, K, N \\ & v'_{jm}, u'_{im} \geq 0; \quad i = 1, 2, K, I; \quad j = 1, 2, K, J \end{aligned}$$

This program can be represented in matrix form as shown below.

$$\min z' = U'_m Y_m$$

Subject to,

$$\begin{aligned} V'_m X_m &= 1 \\ V'_m Y - U'_m X &\leq 0 \\ V'_m, U'_m &\geq 0 \end{aligned}$$

Where,  $X$  is the matrix of inputs and  $Y$  is the matrix of outputs.

### 3.2) DUAL DEA MODELS

The basic theory of linear programming states that every linear programming problem has another closely related linear program, called its dual. These duals play a very important role in DEA.

The matrix representation of dual DEA would be,

$$\min z = \theta$$

Subject to,

$$\begin{aligned} \theta U'_m - X \lambda &\geq 0 \\ Y \lambda &\geq V'_m \\ \lambda &\geq 0 \end{aligned}$$

### 3.3) INPUT AND OUTPUT ORIENTED ENVELOPMENT DEA PROGRAMS

Let us study the two envelopment versions, the version that involves to produce the observed outputs with minimum inputs, is often referred to as an input-oriented envelopment DEA program. The other version is referred to as an output-oriented envelopment DEA program as it aims to maximize output production, subject to the given resource level.

Now, this can be deduced that the dual of the output maximizing multiplier program is the input-oriented envelopment program. Similarly, the dual of the input minimizing multiplier program is the output-oriented envelopment program.

The general matrix representations of the four programs are given below.

Multiplier Versions Output Maximizing	Envelopment Versions Input Oriented
$\max z = V_m^T Y_m$ Such that $\begin{aligned} U_m^T X_m &= 1 \\ V_m^T Y - U_m^T X &\leq 0 \\ V_m^T, U_m^T &\geq 0 \end{aligned}$	$\min \theta_m$ Such that, $\begin{aligned} Y\lambda &\geq Y_m \\ X\lambda &\leq \theta_m X_m \\ \lambda &\geq 0; \theta_m \text{ free} \end{aligned}$
Input Minimizing	Output Oriented
$\min z = U'^T m X_m$ Such that $\begin{aligned} V'^T m Y_m &= 1 \\ V'^T Y - U'^T m X &\leq 0 \\ V'^T m, U'^T m &\geq 0 \end{aligned}$	$\max \phi_m$ Such that, $\begin{aligned} Y\mu &\geq \phi_m Y_m \\ X\mu &\leq X_m \\ \mu &\geq 0; \theta_m \text{ free} \end{aligned}$

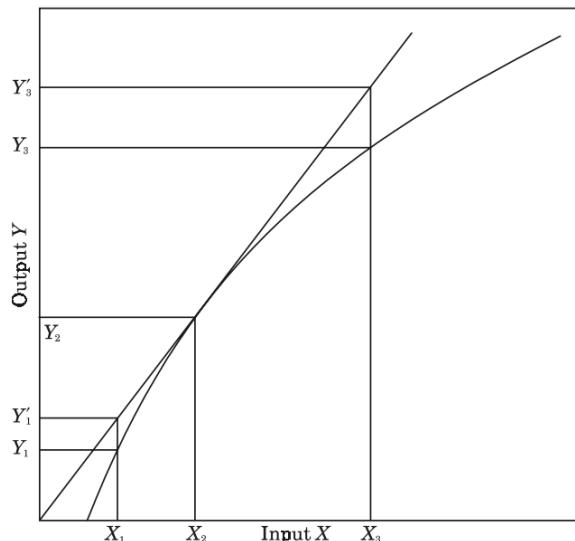
### **3.4) ECONOMIES OF SCALE**

In economics, the concept of production function specifies the output in an industry for all combinations of inputs. A production function can be depicted on a two-dimensional graph as shown in the figure. To facilitate depiction on a two-dimensional graph, aggregate inputs and outputs.

Suppose that a firm consumes inputs amounting to  $X_1$  and produces  $Y_1$  amounts of output. In automated operations, it is possible to consume a certain amount of inputs, and produce more than a proportional amount of output. For example, consider a manufacturer producing shock absorbers. If only a few shock absorbers need to be produced, they may prefer to do so manually. But, if they need to produce a large amount of shock absorbers, they may prefer to automate their process. Hence they will be able to produce a larger amount of output in proportion to the inputs. Therefore, they can consume a larger input  $X_2$ , and can produce the output  $Y_2$ , which is more than a proportional increase in output, i.e.,

$$\frac{Y_2}{Y_1} > \frac{X_2}{X_1}$$

This concept is termed Economy of Scale. Here, the manufacturer is operating under Increasing Returns to Scale as their returns will increase if they increase their production.



Increasing Returns to Scale (IRS) is a property of a production function such that changing all inputs by the same proportion changes the output by a greater extent than the proportional value. However, beyond a limit, IRS does not hold. If the manufacturer needs to produce billions of shock absorbers, they might find it difficult to produce that amount because of storage problems and limits on the supply of raw materials. In this case, they are said to be operating under Decreasing Returns to Scale (DRS).

Combining the two extremes (IRS and DRS) would necessitate Variable Returns to Scale (VRS). This property signifies that in a production process, the operations will follow IRS or DRS for different ranges of output.

Note that the IRS changes to DRS at a particular level of production, represented by  $(X_2, Y_2)$ . At this point a DMU is said to be operating at its Most Productive Scale Size (MPSS), because it enjoys the maximum possible economy of scale.

Another variant of economies of scale is Constant Returns to Scale (CRS). This property signifies that the manufacturer is able to scale the inputs and outputs linearly without increasing or decreasing efficiency. In such a case, they are able to obtain output  $Y'_1$  by consuming  $X_1$  of input,  $Y_2$  by consuming  $X_2$  and,  $Y_3'$  by consuming  $X_3$ . This is a significant assumption because this may be valid over limited ranges. Hence, if the CRS assumption is employed for a particular case, its use must be justified showing evidences for the existence of CRS.

### **3.4.1) RETURNS TO SCALE AND DEA**

It is important to note that the DEA models discussed so far assume that the operations follow constant returns to scale. This represented one of the most limiting factors for the applicability of DEA, at least in the early years. DEA has not received widespread attention for the analysis of production processes because of this limitation. Many economists viewed this assumption as over-restrictive and preferred alternative statistical procedures in spite of the advantages offered by DEA.

Modifications on DEA to handle VRS categories were first described in 1984, when Banker et al. (1984) came up with a simple yet remarkable modification to the CCR DEA models in order to handle variable returns to scale.

One thing that can be deduced is that, DMUs that are operating at the lower scale sizes are said to be operating under IRS because they can achieve greater economies of scale if they increase their volume of operating. Similarly, firms operating at higher scales sizes are said to be operating under DRS.

In other words, a useful test of returns to scale properties of DMUs can be obtained by observing the corresponding values given by Ganley and Cubbin in 1992.

$$\sum_{n=1}^N \lambda_n < 1 \Rightarrow \text{Increasing Returns to Scale, IRS}$$

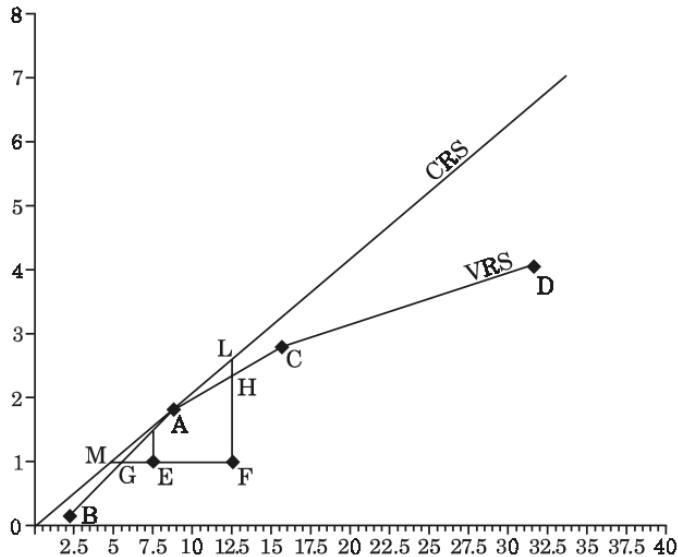
$$\sum_{n=1}^N \lambda_n > 1 \Rightarrow \text{Decreasing Returns to Scale, DRS}$$

Note that, for efficient DMUs,

$$\sum_{n=1}^N \lambda_n = 1$$

Note that some firms that are not efficient in the models considered so far become efficient if we assume variable returns to scale relaxing the assumption of CRS.

Rating DMUs as efficient/inefficient depends upon the constraints imposed on a CCR DEA program. Suppose we force the condition  $\sum_{n=1}^N \lambda_n = 1$  in the CCR DEA program. The introduction of this additional constraint ensures that firms operating at different scales are recognised as efficient. Therefore, the envelopment is formed by the multiple convex linear combinations of best practice (incorporating VRS). The constraint  $\sum_{n=1}^N \lambda_n = 1$  is termed the *convexity constraint* in the mathematics literature.



### 3.4.2) VARIABLE RETURNS TO SCALE ENVELOPMENT DEA PROGRAMS

Thus, the DEA envelopment program for considering variable returns to scale is the following.

$$\min \theta_m$$

Such that,

$$Y\lambda \geq Y_m$$

$$X\lambda \leq \theta_m X_m$$

$$\sum_{n=1}^N \lambda_n = 1$$

$$\lambda \geq 0; \theta_m \text{ is unrestricted}$$

This modification was first suggested by Banker et al. (1984). Hence the foregoing DEA model is termed the BCC (Banker, Charnes and Cooper) model. In general, DEA programs incorporating the additional convexity constraint to take into account variable returns to scale are called BCC DEA models or VRS DEA models. In contrast, CCR DEA models are also called CRS DEA models.

### 3.4.3) TECHNICAL AND SCALE EFFICIENCIES

Given the fact that DMUs are assigned different efficiencies in case of CRS and VRS assumptions, i.e., using CCR models and BCC models, we can distinguish two different kinds of efficiencies—Technical and Scale Efficiencies.

The CCR model estimates the gross efficiency of a DMU. This efficiency comprises technical efficiency and scale efficiency. Technical efficiency describes the efficiency in converting inputs to outputs, while scale efficiency recognizes that economy of scale cannot be attained at all scales of production, and that there is one *most productive scale size*, where the scale efficiency is maximum at 100 per cent.

The BCC model takes into account the variation of efficiency with respect to the scale of operation, and hence measures pure *Technical Efficiency*.

### 3.4.4) WEIGHTS, PROJECTION AND SLACKS

Let us consider the input oriented CCR model and the BBC model for  $DMU_m$  are set up :

$$\min \theta_m$$

Such that,

$$Y\lambda \geq Y_m$$

$$X\lambda \leq \theta_m X_m$$

$$\lambda \geq 0; \theta_m \text{ free}$$

And

$$\min \theta_m$$

Such that,

$$Y\lambda \geq Y_m$$

$$X\lambda \leq \theta_m X_m$$

$$\sum_{n=1}^N \lambda_n = 1$$

$$\lambda \geq 0; \theta_m \text{ free}$$

Let  $(\theta^*, \lambda^*, s^{-*}, s^{+*})$  be an optimal solution to the CCR (BCC) model where  $s^-$  and  $s^+$  are the output and input slack vectors, respectively. Then, the optimal value  $\theta^*$  is denoted by  $\theta_m^{CCR}(\theta_m^{BCC})$  and is called CCR – (BCC-) efficiency score.

Moreover,  $DMU_m$  is said to be CCR-(BCC-) efficient if and only if  $\theta_m^{CCR} = 1$  ( $\theta_m^{BCC} = 1$ ), and  $s^{-*} = 0$  and  $s^{+*} = 0$ ; otherwise, it is called CCR- (BBC)- inefficient.

Note that if the evaluated DMU is assumed to be BCC-efficient; otherwise, it is replaced by its BCC-projection point defined by

$$(x_m^*, y_m^*) = (\theta_m^* x_m - s^{-*}, y_m + s^{+*})$$

## **3.5) SUPER-EFFICIENCY MODELS**

Data envelopment analysis was originated in 1978 by Charnes et al. and the first DEA model was called CCR (Charnes, Cooper and Rhodes) model. The objective of DEA models is to evaluate overall efficiencies of decision-making units (DMUs) that are responsible to convert a set of inputs into a set of outputs. Efficient DMUs are identified by an unity of 1.0 and inefficient DMUs have efficiency scores less than 1.0. When being evaluated, the efficiency score of a DMU is measured by the combination of a set of DEA efficient DMU(s), which form a part of the segments on the efficiency frontier. The efficient DMUs are not comparable among themselves in the CCR and other DEA models. In the last decade, some DEA researchers initiated a new area called super-efficiency to rank the DEA efficient DMUs and developed various models. Although the developed models are interesting and useful, in general, they have the drawbacks of lacking either stability or feasibility.

Researchers focused on ranking only DEA efficient DMUs based on the results obtained either from CCR or BCC models. The research in this area was first developed by Andesen and Petersen. In their research, they ranked DEA efficient DMUs in such a way that superior DEA efficient DMUs may have efficiency scores greater than unity.

### **3.5.1) INTRODUCTION**

In recent years, a substantial amount of scholarly effort has been devoted to the development of efficiency measures. These measures indicate whether the Decision Making is operating near the frontier of its production set is unknown.

Data Envelopment Analysis (DEA), as developed by Charnes et al. and extended by Banker et al. frontier analysis of inputs and outputs. The procedure does not require a priori weights on inputs and outputs. A weakness of DEA is that a considerable number of observations typically is characterized as efficient, unless the sum of the number of inputs and outputs is small relative to the number of observations. Specialized units may be rated as efficient due to a single input or output, even though that input or output may be seen as relatively unimportant.

Previously, DEA methods have been developed which can distinguish economically-viable units from units that are only technically efficient. The usual assumption is that the virtual dual multipliers assigned for the inputs and outputs in the BCC-model may not account for some a priori conditions. The issue is addressed by imposing a priori constraints on the virtual multipliers. One approach is the aggregation of inputs to a cost measure. Golany and Ali et al. extend DEA to include ordinal relationships among virtual multipliers to reflect the relative worth of inputs/outputs. The cone-ratio model, developed by Charnes et al., extends DEA by restricting the virtual dual multipliers to some closed convex cones which need not be the nonnegative orthants. The assurance region model, developed by Thompson et al., uses a similarly motivated approach.

Other methods involve ascertaining the ranges within which data may be varied without requiring a change in the optimal basis. Charnes et al. (1985a) identify a subset of efficient units which are influential in the sense that altering their outputs change the efficiency scores of a large number of inefficient units. Charnes et al. (1985b) characterize a unit as influential if it is frequently used in the calculation of efficiency scores.

DEA assigns an efficiency score less than one to inefficient units. A score less than one means that a linear combination of other units from the sample could produce the same vector of outputs using a smaller vector of inputs. The score reflects the radial distance from the estimated production frontier

to the DMU under evaluation, i.e., the minimum proportional decrease in inputs yielding efficiency. DEA thus provides an efficiency rating of inefficient units.

Thus, the basic idea is to compare the unit under evaluation with a linear combination of all other units in the sample, i.e., the DMU itself is excluded. It is conceivable that an efficient DMU may increase its input vector proportionally while preserving efficiency. The unit obtains in that case an efficiency score above one. The score reflects the radial distance from the DMU under evaluation to the production frontier estimated with that DMU excluded from the sample, i.e., the maximum proportional increase in inputs preserving efficiency. The approach provides an efficiency rating of efficient units similar to the rating of inefficient units above.

### **3.5.2) DEVELOPMENT OF THE EXTENDED DEA-MEASURE OF TECHNICAL EFFICIENCY**

Koopmans (1951) defines an input vector  $X$  efficient in producing an output vector  $Y$  if and only if a reduction in any component of  $X$  is not feasible for producing  $Y$ .

#### **3.5.3) MATHEMATICAL PROGRAMMING OF AP MODEL**

$$\theta_0^* = \min \theta_0$$

Subject to,

$$\sum_{n=1, n \neq 0}^N \lambda_m X_m \leq \theta_m X_0,$$

$$\sum_{n=1, n \neq 0}^N \lambda_m Y_m \geq Y_0,$$

$$\lambda_m \geq 0, \quad m = 1, 2, 3, \dots, N$$

# PROBLEM DEFINITION

One of the top businesses providing warehousing and logistics services is NCUBATE INDIA SERVICES PVT. LTD. NISPL has a distribution and warehousing network over all of India. And because of the fierce competition on the worldwide market, the corporation strives to implement the idea of Optimality by boosting the effectiveness of every warehouse. Considering last-mile delivery is crucial to the supply chain's overall success.

All items produced by the Livpure, Livfast, Livgaurd, LivGreen, Lectrix, Mooving, and other brand companies are part of the SAR group. Transporting the goods from the producing facility to the warehouse and from the warehouse to the final customer is the responsibility of NISPL. Therefore, it's crucial to ensure that the entire warehouse is operating smoothly.

According to its size, equipment, the volume of the products and turnover outcomes per year. These twenty nine warehouses represent the decision-making units (DMUs). In all warehouses, the picking process is done manually. With this order, workers are picking goods and set up pallets. After that, goods are wrapped in a special foil, also manually, the full pallet is carried to the front of the warehouse and the next action involves checking by the checkers. Management of the company from year to year closely monitors the picking process. Efficiency in these warehouses is not at the same level. Some warehouses have higher efficiency than others. In the rest of this project, the DEA method will be applied to find the most efficient unit.

This project presents an application of Multi -Criteria Decision making for calculating efficiency of all warehouses, which is concluded through data envelopment analysis (DEA) and implementing the suggestions provided.

# INPUT AND OUTPUT CRITERIAS

All of the critical components that impact operational efficiency should be incorporated in defining the necessary input and output factors, without having too many factors. The output components of the warehouses' internal operations are primarily to be monitored in terms of production (output), quality, and delivery.

## FIVE INPUT FACTORS

- 1) ***Size of the warehouse:*** Total Warehouse space used for receiving, storage, order consolidation, shipping, aisles, and offices. Warehouse space is mostly interpreted as the total floor area in total square feet.
- 2) ***Number of full-time employees:*** The total number of all full-time employees (FTEs) who are directly involved in all the inbound and outbound warehouse activities; these inbound activities include unloading and receiving product into the warehouse storage locations, and outbound activities include all activities involved in picking, packing, and shipping products to specific customers.
- 3) ***Number of pallets:*** Pallets are very important in the modern logistics. Even though they are cheap in price and requires simple maintenance. But, they need fumigation or heat treatment when one-time export packaging materials, so as to raise additional costs and extend the clearance time.
- 4) ***Number of IT Assets:*** Technology is making many warehouse processes more efficient by augmenting the work of humans or, in some cases, automating tedious, manual tasks, freeing up associates to focus on more complex tasks. Warehouse may have many IT assets like Bar code printer, scanner and laptops.
- 5) ***Warehouse Operating cost:*** Generally, the operational cost for a warehouse is a combination of various costs such as inventory cost, labour cost, maintenance cost, electricity cost, management cost. Inventory cost is a total storage cost per unit, which is major cost. Labour cost is salary paid to all personnel involved in warehouse operations. Maintenance cost is sum of costs of all maintenance activities such as building maintenance, equipment maintenance. Electricity cost is the cost of electricity consumption either by feeder or by any alternate source, that is, generator or invertors. The cost for managing warehouse smoothly and professionally by various activities such as pest control, sanitation, documentation, hospitality management cost.

## THREE OUTPUT FACTORS

- 1) ***Number of Orders (Sales):*** Warehouse total number of orders demanded by the end customers is usually measured as units, boxes or other meaningful units of measures.
- 2) ***Level of Value-Added Services:*** It can be measured by the number of VAL activities offered by the company and performed in warehouses. Level of value-Added logistics is measured on an increasing five-point ordinal scale. It is the kind of service a warehouse perform that is tailored to the wishes and needs of the customer. In most cases, it is an effort to create a more efficient supply chain.

	Value-added Services
NO VAS	1
Low-end VAS (include Labelling, Kitting, adding manuals).	2

High-end VAS (include final product assembly, product installation, handling of return shipments)	3
Very high-end VAS (include repair, shipment tracking)	4
Extremely high-end VAS (Same Day Delivery, On board Couriers for urgent and sensitive shipments)	5

- 3) **Error-free Order lines:** Error-free % is measured on an increasing nine-point ordinal scale. This measures what percentage of shipping order lines was error free on average. The example of errors are: faulty quantities, deliveries not on time (too early or too late), packing mistakes, product errors, incorrect component/modules.

	Error-free order lines
No information available/ not tracked	1
Below 90% error-free order lines	2
90 – 95% error-free order lines	3
95 - 97% error-free order lines	4
97 – 98% error-free order lines	5
98 – 99% error-free order lines	6
99 – 99.5% error-free order lines	7
99.5 – 99.9% error-free order lines	8
Over 99.9% error-free order lines	9

# DATA COLLECTION

Based on the input and output criteria described above. The information on 5 inputs and 3 outputs that was gathered from all 29 warehouses is listed below.

Warehouse Location (DMUs)	Warehouse storage capacity	No. of Full-time Employee	No. of pallet	No. of IT Assets	Warehouse Operating Cost	No. of orders (Sales)	Value Added Services	Error free (%)
Agra	13100	7	320	9	820931	229	3	4
Ahmedabad	2000	2	7	4	147596	354	3	3
Baltana	550	2	2	2	86404	115	3	1
Bangalore	9800	14	10	9	584300	5827	3	4
Bhiwandi	7500	4	7	4	238265	4776	3	3
Bhopal	550	2	2	3	147473	152	3	1
Bhubaneswar	4800	3	7	6	420908	661	3	3
Chennai	10250	5	20	7	239046	1019	3	4
Dehradun	2300	2	7	4	171183	278	3	2
Gagret	1000	1	30	4	86967	60	3	1
Ghaziabad	20700	21	200	11	142521	2155	3	4
Gorakhpur	1200	6	7	5	1372680	908	3	2
Hyderabad	11000	13	200	12	119500	2593	3	4
Indore	4100	2	7	3	247573	272	3	3
Jabalpur	2000	2	2	3	93157	64	3	2
Jaipur	21000	5	338	10	1994765	1053	3	4
Jammu	500	2	2	2	29538	137	3	1
Kanpur	2152	4	48	7	226845	138	3	2
Karnal	9700	5	7	5	117310	523	3	3
Kolkata	15000	15	200	12	955890	1222	3	4
Lucknow	9000	6	7	7	3333230	1674	3	3
Ludhiana	4600	5	7	5	2349633	554	3	3
Nagpur	2000	2	7	2	139434	197	3	2
New Delhi	37324	48	550	25	2090879	5794	3	4
Patna	11000	9	200	9	755723	1505	3	3
Pune	10000	4	7	5	374615	1347	3	4
Raipur	4000	2	2	2	224382	310	3	2
Ranchi	5500	2	50	5	194903	259	3	3
Varanasi	2000	8	2	6	173934	277	3	3

In order to determine the relative efficiency of all 29 warehouses, we will create CCR models based on the data provided above.

## WAREHOUSE 1 (AGRA)

### Primal Problem formulation

```

!Objective Function;
MAX = 229*VF1 + 3*VG1 + 4*VH1;

!Subject to;
13100*UA1 + 7*UB1 + 320*UC1 + 9*UD1 + 820931*UE1 = 1;
(229*VF1 + 3*VG1 + 4*VH1) - (13100*UA1 + 7*UB1 + 320*UC1 + 9*UD1 + 820931*UE1) <=0;
(354*VF1 + 3*VG1 + 3*VH1) - (2000*UA1 + 2*UB1 + 7*UC1 + 4*UD1 + 147596*UE1) <=0;
(115*VF1 + 3*VG1 + 1*VH1) - (550*UA1 + 2*UB1 + 2*UC1 + 2*UD1 + 86404*UE1) <=0;
(5827*VF1 + 3*VG1 + 4*VH1) - (9800*UA1 + 14*UB1 + 10*UC1 + 9*UD1 + 584300*UE1) <=0;
(4776*VF1 + 3*VG1 + 3*VH1) - (7500*UA1 + 4*UB1 + 7*UC1 + 4*UD1 + 238265*UE1) <=0;
(152*VF1 + 3*VG1 + 1*VH1) - (550*UA1 + 2*UB1 + 2*UC1 + 3*UD1 + 147473*UE1) <=0;
(661*VF1 + 3*VG1 + 3*VH1) - (4800*UA1 + 3*UB1 + 7*UC1 + 6*UD1 + 420908*UE1) <=0;
(1019*VF1 + 3*VG1 + 4*VH1) - (10250*UA1 + 5*UB1 + 20*UC1 + 7*UD1 + 239046*UE1) <=0;
(278*VF1 + 3*VG1 + 2*VH1) - (2300*UA1 + 2*UB1 + 7*UC1 + 4*UD1 + 171183*UE1) <=0;
(60*VF1 + 3*VG1 + 1*VH1) - (1000*UA1 + 1*UB1 + 30*UC1 + 4*UD1 + 86967*UE1) <=0;
(2155*VF1 + 3*VG1 + 4*VH1) - (20700*UA1 + 21*UB1 + 200*UC1 + 11*UD1 + 142521*UE1) <=0;
(908*VF1 + 3*VG1 + 2*VH1) - (1200*UA1 + 6*UB1 + 7*UC1 + 5*UD1 + 1372680*UE1) <=0;
(2593*VF1 + 3*VG1 + 4*VH1) - (11000*UA1 + 13*UB1 + 200*UC1 + 12*UD1 + 119500*UE1) <=0;
(272*VF1 + 3*VG1 + 3*VH1) - (4100*UA1 + 2*UB1 + 7*UC1 + 3*UD1 + 247573*UE1) <=0;
(64*VF1 + 3*VG1 + 2*VH1) - (2000*UA1 + 2*UB1 + 2*UC1 + 3*UD1 + 93157*UE1) <=0;
(1053*VF1 + 3*VG1 + 4*VH1) - (21000*UA1 + 5*UB1 + 338*UC1 + 10*UD1 + 1994765*UE1) <=0;
(137*VF1 + 3*VG1 + 1*VH1) - (500*UA1 + 2*UB1 + 2*UC1 + 2*UD1 + 29538*UE1) <=0;
(138*VF1 + 3*VG1 + 2*VH1) - (2152*UA1 + 4*UB1 + 48*UC1 + 7*UD1 + 226845*UE1) <=0;
(523*VF1 + 3*VG1 + 3*VH1) - (9700*UA1 + 5*UB1 + 7*UC1 + 5*UD1 + 117310*UE1) <=0;
(1222*VF1 + 3*VG1 + 4*VH1) - (15000*UA1 + 15*UB1 + 200*UC1 + 12*UD1 + 955890*UE1) <=0;
(1674*VF1 + 3*VG1 + 3*VH1) - (9000*UA1 + 6*UB1 + 7*UC1 + 7*UD1 + 3333230*UE1) <=0;
(554*VF1 + 3*VG1 + 3*VH1) - (4600*UA1 + 5*UB1 + 7*UC1 + 5*UD1 + 2349633*UE1) <=0;
(197*VF1 + 3*VG1 + 2*VH1) - (2000*UA1 + 2*UB1 + 7*UC1 + 2*UD1 + 139434*UE1) <=0;
(5794*VF1 + 3*VG1 + 4*VH1) - (37324*UA1 + 48*UB1 + 550*UC1 + 25*UD1 + 2090879*UE1) <=0;
(1505*VF1 + 3*VG1 + 3*VH1) - (11000*UA1 + 9*UB1 + 200*UC1 + 9*UD1 + 755723*UE1) <=0;
(1347*VF1 + 3*VG1 + 4*VH1) - (10000*UA1 + 4*UB1 + 7*UC1 + 5*UD1 + 374615*UE1) <=0;
(310*VF1 + 3*VG1 + 2*VH1) - (4000*UA1 + 2*UB1 + 2*UC1 + 2*UD1 + 224382*UE1) <=0;
(259*VF1 + 3*VG1 + 3*VH1) - (5500*UA1 + 2*UB1 + 50*UC1 + 5*UD1 + 194903*UE1) <=0;
(277*VF1 + 3*VG1 + 3*VH1) - (2000*UA1 + 8*UB1 + 2*UC1 + 6*UD1 + 173934*UE1) <=0;

UA1 >=0;
UB1 >=0;
UC1 >=0;
UD1 >=0;
UE1 >=0;
VF1 >=0;
VG1 >=0;
VH1 >=0;

```

### Solutions/Weights of primal problem



Global optimal solution found.

Objective value:	0.444444
Infeasibilities:	0.000000
Total solver iterations:	6

Variable	Value	Reduced Cost
VF1	0.000000	144.1111
VG1	0.000000	1.666667
VH1	0.1111111	-0.4440892E-15
UA1	6.2061889E-21	844.4444
UB1	4.2803398E-17	0.000000
UC1	0.000000	131.3333
UD1	0.1111111	0.2220446E-15
UE1	0.000000	51837.33

### Dual programming problem

```

!Dual Objective Function;

MIN = X1;

!Subject to;

13100*Y11 + 2000*Y21 + 550*Y31 + 9800*Y41 + 7500*Y51 + 550*Y61 + 4800*Y71 + 10250*Y81 + 2300*Y91
+ 1000*Y101 + 20700*Y111 + 1200*Y121 + 11000*Y131 + 4100*Y141+ 2000*Y151 +
21000*Y161 + 500*Y171 + 2152*Y181 + 9700*Y191 + 15000*Y201+ 9000*Y211 + 4600*Y221 + 2000*Y231 +
37324*Y241 + 11000*Y251 + 10000*Y261 + 4000*Y271 + 5500*Y281 + 2000*Y291 -13100*X1 <=0;

7*Y11 + 2*Y21 + 2*Y31 + 14*Y41 + 4*Y51 + 2*Y61 + 3*Y71 + 5*Y81 + 2*Y91 + 1*Y101 + 21*Y111 +
6*Y121 + 13*Y131 + 2*Y141 + 2*Y151 + 5*Y161 + 2*Y171 + 4*Y181 + 5*Y191 + 15*Y201
+ 6*Y211 + 5*Y221 + 2*Y231 + 48*Y241 + 9*Y251 + 4*Y261 + 2*Y271 + 2*Y281 + 8*Y291 -7*X1 <=0;

320*Y11 + 7*Y21 + 2*Y31 + 10*Y41 + 7*Y51 + 2*Y61 + 7*Y71 + 20*Y81 + 7*Y91 + 30*Y101 + 200*Y111 +
7*Y121 + 200*Y131 + 7*Y141 + 2*Y151 + 338*Y161 + 2*Y171 + 48*Y181 + 7*Y191 + 200*Y201 + 7*Y211 +
7*Y221 + 7*Y231 + 550*Y241 + 200*Y251 + 7*Y261 + 2*Y271 + 50*Y281 + 2*Y291 - 320*X1 <=0;

9*Y11 + 4*Y21 + 2*Y31 + 9*Y41 + 4*Y51 + 3*Y61 + 6*Y71 + 7*Y81 + 4*Y91 + 4*Y101 + 11*Y111 +
5*Y121 + 12*Y131 + 3*Y141 + 3*Y151 + 10*Y161 + 2*Y171 + 7*Y181 + 5*Y191 +
12*Y201 + 7*Y211 + 5*Y221 + 2*Y231 + 25*Y241 + 9*Y251 + 5*Y261 + 2*Y271 + 5*Y281 + 6*Y291 - 9*X1
<=0;

820931*Y11 + 147596*Y21 + 86404*Y31 + 584300*Y41 + 238265*Y51 + 147473*Y61 + 420908*Y71 +
239046*Y81 + 171183*Y91 + 86967*Y101 + 142521*Y111 + 1372680*Y121 + 119500*Y131 +
247573*Y141 + 93157*Y151 + 1994765*Y161 + 29538*Y171 + 226845*Y181 + 117310*Y191 + 955890*Y201 +
3333230*Y211 + 2349633*Y221 + 139434*Y231 + 2090879*Y241 + 755723*Y251 +
374615*Y261 + 224382*Y271 + 194903*Y281 + 173934*Y291 - 820931*X1 <=0;

229*Y11 + 354*Y21 + 115*Y31 + 5827*Y41 + 4776*Y51 + 152*Y61 + 661*Y71 + 1019*Y81 + 278*Y91 +
60*Y101 + 2155*Y111 + 908*Y121 + 2593*Y131 + 272*Y141 + 64*Y151 +
1053*Y161 + 137*Y171 + 138*Y181 + 523*Y191 + 1222*Y201 + 1674*Y211 + 554*Y221 + 197*Y231 +
5794*Y241 + 1505*Y251 + 1347*Y261 + 310*Y271 + 259*Y281 + 277*Y291 >= 229;

3*Y11 + 3*Y21 + 3*Y31 + 3*Y41 + 3*Y51 + 3*Y61 + 3*Y71 + 3*Y81 + 3*Y91 + 3*Y101 + 3*Y111 + 3*Y121
+ 3*Y131 + 3*Y141 + 3*Y151 + 3*Y161 + 3*Y171 + 3*Y181 + 3*Y191 + 3*Y201 +
3*Y211 + 3*Y221 + 3*Y231 + 3*Y241 + 3*Y251 + 3*Y261 + 3*Y271 + 3*Y281 + 3*Y291 >= 3;

4*Y11 + 3*Y21 + 1*Y31 + 4*Y41 + 3*Y51 + 1*Y61 + 3*Y71 + 4*Y81 + 2*Y91 + 1*Y101 + 4*Y111 + 2*Y121
+ 4*Y131 + 3*Y141 + 2*Y151 + 4*Y161 + 1*Y171 + 2*Y181 + 3*Y191 + 4*Y201 +
3*Y211 + 3*Y221 + 2*Y231 + 4*Y241 + 3*Y251 + 4*Y261 + 2*Y271 + 3*Y281 + 3*Y291 >= 4;

!Non-negativity constraints;

@Free(X1);
Y11>=0; Y21>=0; Y31>=0; Y41>=0; Y51>=0; Y61>=0; Y71>=0; Y81>=0; Y91>=0; Y101>=0; Y111>=0;
Y121>=0; Y131>=0; Y141>=0; Y151>=0; Y161>=0; Y171>=0; Y181>=0; Y191>=0; Y201>=0;
Y211>=0; Y221>=0; Y231>=0; Y241>=0; Y251>=0; Y261>=0; Y271>=0; Y281>=0; Y291>=0;

```

## Dual programming problem



```

Global optimal solution found.
Objective value: 0.4444444
Infeasibilities: 0.000000
Total solver iterations: 9

```

Variable	Value	Reduced Cost
X1	0.4444444	0.000000
Y11	0.000000	0.5555556
Y21	0.000000	0.1111111
Y31	0.000000	0.1111111
Y41	0.000000	0.5555556
Y51	0.000000	0.1111111
Y61	0.000000	0.2222222
Y71	0.000000	0.3333333
Y81	0.000000	0.3333333
Y91	0.000000	0.2222222
Y101	0.000000	0.3333333
Y111	0.000000	0.7777778
Y121	0.000000	0.3333333

Y131	0.000000	0.8888889
Y141	0.8888889	-0.5028671E-16
Y151	0.000000	0.1111111
Y161	0.000000	0.6666667
Y171	0.000000	0.1111111
Y181	0.000000	0.5555556
Y191	0.000000	0.2222222
Y201	0.000000	0.8888889
Y211	0.000000	0.4444444
Y221	0.000000	0.2222222
Y231	0.2444444	-0.2775558E-17
Y241	0.000000	2.333333
Y251	0.000000	0.6666667
Y261	0.000000	0.1111111
Y271	0.4222222	0.000000
Y281	0.000000	0.2222222
Y291	0.000000	0.3333333

## SUMMARY

Efficiency score of Warehouse 1 (Agra) = 0.4444

Hence, Warehouse 1 (Agra) is an inefficient warehouse.

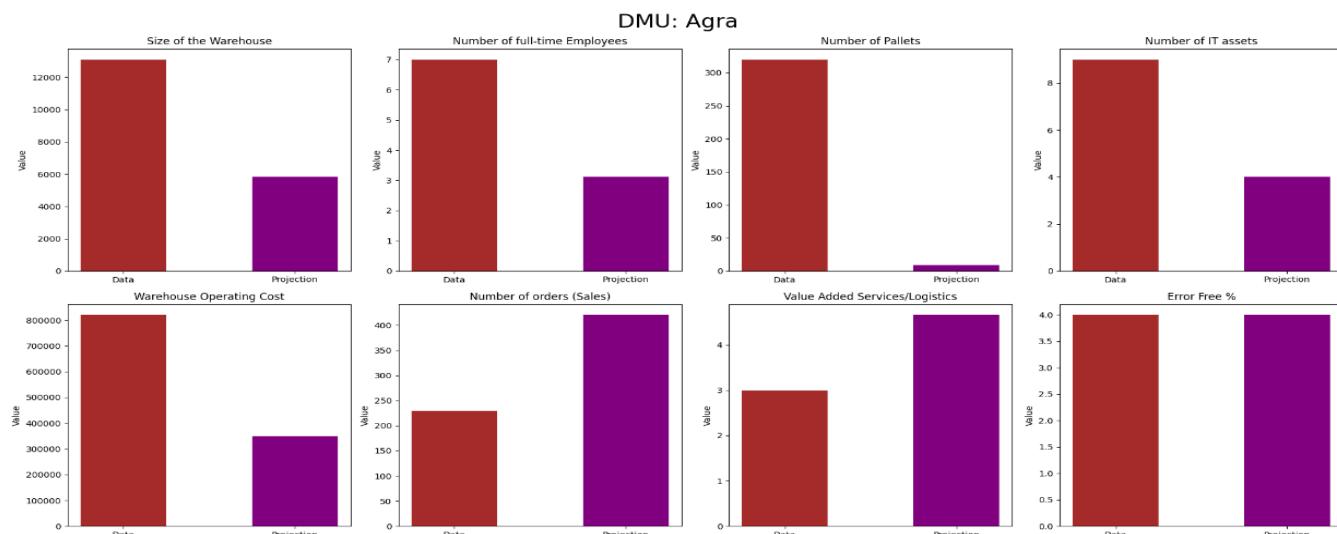
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	13100	5822.22	0
No. of Full-time Employees	7	3.111	0
No. of Pallets	320	8.7778	133.444
No. of IT assets	9	4	0
Warehouse Operating Cost	820931	348888	15970.4
No. of Orders (Sales)	229	420.765	191.822
Level of Value-Added Services	3	4.667	1.667
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 14 (Indore)	0.889
Warehouse 23 (Nagpur)	0.244
Warehouse 27 (Raipur)	0.422

In order to make warehouse 1 (Agra) efficient, they need to decrease size of the warehouse by 55.556%, No of full-time employees by 55.556%, number of pallets by 97.257%, operating cost by 57.501%, whereas no. of orders needs to be increased by 83.822% and value-added logistics by 55.556%.



## WAREHOUSE 2 (AHMEDABAD)

### Primal problem formulation

```

!Objective Function;
MAX = 354*VF2 + 3*VG2 + 3*VH2;

!Subject to;
2000*UA2 + 2*UB2 + 7*UC2 + 4*UD2 + 147596*UE2 = 1;
(229*VF2 + 3*VG2 + 4*VH2) - (13100*UA2 + 7*UB2 + 320*UC2 + 9*UD2 + 820931*UE2) <=0;
(354*VF2 + 3*VG2 + 3*VH2) - (2000*UA2 + 2*UB2 + 7*UC2 + 4*UD2 + 147596*UE2) <=0;
(115*VF2 + 3*VG2 + 1*VH2) - (550*UA2 + 2*UB2 + 2*UC2 + 2*UD2 + 86404*UE2) <=0;
(5827*VF2 + 3*VG2 + 4*VH2) - (9800*UA2 + 14*UB2 + 10*UC2 + 9*UD2 + 584300*UE2) <=0;
(4776*VF2 + 3*VG2 + 3*VH2) - (7500*UA2 + 4*UB2 + 7*UC2 + 4*UD2 + 238265*UE2) <=0;
(152*VF2 + 3*VG2 + 1*VH2) - (550*UA2 + 2*UB2 + 2*UC2 + 3*UD2 + 147473*UE2) <=0;
(661*VF2 + 3*VG2 + 3*VH2) - (4800*UA2 + 3*UB2 + 7*UC2 + 6*UD2 + 420908*UE2) <=0;
(1019*VF2 + 3*VG2 + 4*VH2) - (10250*UA2 + 5*UB2 + 20*UC2 + 7*UD2 + 239046*UE2) <=0;
(278*VF2 + 3*VG2 + 2*VH2) - (2300*UA2 + 2*UB2 + 7*UC2 + 4*UD2 + 171183*UE2) <=0;
(60*VF2 + 3*VG2 + 1*VH2) - (1000*UA2 + 1*UB2 + 30*UC2 + 4*UD2 + 86967*UE2) <=0;
(2155*VF2 + 3*VG2 + 4*VH2) - (20700*UA2 + 21*UB2 + 200*UC2 + 11*UD2 + 142521*UE2) <=0;
(908*VF2 + 3*VG2 + 2*VH2) - (1200*UA2 + 6*UB2 + 7*UC2 + 5*UD2 + 1372680*UE2) <=0;
(2593*VF2 + 3*VG2 + 4*VH2) - (11000*UA2 + 13*UB2 + 200*UC2 + 12*UD2 + 119500*UE2) <=0;
(272*VF2 + 3*VG2 + 3*VH2) - (4100*UA2 + 2*UB2 + 7*UC2 + 3*UD2 + 247573*UE2) <=0;
(64*VF2 + 3*VG2 + 2*VH2) - (2000*UA2 + 2*UB2 + 2*UC2 + 3*UD2 + 93157*UE2) <=0;
(1053*VF2 + 3*VG2 + 4*VH2) - (21000*UA2 + 5*UB2 + 338*UC2 + 10*UD2 + 1994765*UE2) <=0;
(137*VF2 + 3*VG2 + 1*VH2) - (500*UA2 + 2*UB2 + 2*UC2 + 2*UD2 + 29538*UE2) <=0;
(138*VF2 + 3*VG2 + 2*VH2) - (2152*UA2 + 4*UB2 + 48*UC2 + 7*UD2 + 226845*UE2) <=0;
(523*VF2 + 3*VG2 + 3*VH2) - (9700*UA2 + 5*UB2 + 7*UC2 + 5*UD2 + 117310*UE2) <=0;
(1222*VF2 + 3*VG2 + 4*VH2) - (15000*UA2 + 15*UB2 + 200*UC2 + 12*UD2 + 955890*UE2) <=0;
(1674*VF2 + 3*VG2 + 3*VH2) - (9000*UA2 + 6*UB2 + 7*UC2 + 7*UD2 + 3333230*UE2) <=0;
(554*VF2 + 3*VG2 + 3*VH2) - (4600*UA2 + 5*UB2 + 7*UC2 + 5*UD2 + 2349633*UE2) <=0;
(197*VF2 + 3*VG2 + 2*VH2) - (2000*UA2 + 2*UB2 + 7*UC2 + 2*UD2 + 139434*UE2) <=0;
(5794*VF2 + 3*VG2 + 4*VH2) - (37324*UA2 + 48*UB2 + 550*UC2 + 25*UD2 + 2090879*UE2) <=0;
(1505*VF2 + 3*VG2 + 3*VH2) - (11000*UA2 + 9*UB2 + 200*UC2 + 9*UD2 + 755723*UE2) <=0;
(1347*VF2 + 3*VG2 + 4*VH2) - (10000*UA2 + 4*UB2 + 7*UC2 + 5*UD2 + 374615*UE2) <=0;
(310*VF2 + 3*VG2 + 2*VH2) - (4000*UA2 + 2*UB2 + 2*UC2 + 2*UD2 + 224382*UE2) <=0;
(259*VF2 + 3*VG2 + 3*VH2) - (5500*UA2 + 2*UB2 + 50*UC2 + 5*UD2 + 194903*UE2) <=0;
(277*VF2 + 3*VG2 + 3*VH2) - (2000*UA2 + 8*UB2 + 2*UC2 + 6*UD2 + 173934*UE2) <=0;

UA2 >=0;
UB2 >=0;
UC2 >=0;
UD2 >=0;
UE2 >=0;
VF2 >=0;
VG2 >=0;
VH2 >=0;

```

### Solutions/weights of primal problem

Variable	Value	Reduced Cost
VF2	0.1537642E-04	0.000000
VG2	0.000000	0.000000
VH2	0.3151892	0.000000
UA2	0.000000	0.000000
UB2	0.850932E-02	0.000000
UC2	0.000000	0.000000
UD2	0.000000	0.000000
UE2	0.5622195E-05	0.000000

### Dual problem formulation

```

!Dual Objective Function;

MIN = X2;

!Subject to;
13100*Y12 + 2000*Y22 + 550*Y32 + 9800*Y42 + 7500*Y52 + 550*Y62 + 4800*Y72 + 10250*Y82 + 2300*Y92 + 1000*Y102
+ 20700*Y112 + 1200*Y122 + 11000*Y132 + 4100*Y142 + 2000*Y152 +
21000*Y162 + 500*Y172 + 2152*Y182 + 9700*Y192 + 15000*Y202 + 9000*Y212 + 4600*Y222 + 2000*Y232 + 37324*Y242
+ 11000*Y252 + 10000*Y262 + 4000*Y272 + 5500*Y282 + 2000*Y292 - 2000*X2 <=0;

7*Y12 + 2*Y22 + 2*Y32 + 14*Y42 + 4*Y52 + 2*Y62 + 3*Y72 + 5*Y82 + 2*Y92 + 1*Y102 + 21*Y112 + 6*Y122 + 13*Y132
+ 2*Y142 + 2*Y152 + 5*Y162 + 2*Y172 + 4*Y182 + 5*Y192 + 15*Y202
+ 6*Y212 + 5*Y222 + 2*Y232 + 48*Y242 + 9*Y252 + 4*Y262 + 2*Y272 + 2*Y282 + 8*Y292 - 2*X2 <=0;

320*Y12 + 7*Y22 + 2*Y32 + 10*Y42 + 7*Y52 + 2*Y62 + 7*Y72 + 20*Y82 + 7*Y92 + 30*Y102 + 200*Y112 + 7*Y122 +
200*Y132 + 7*Y142 + 2*Y152 + 338*Y162 + 2*Y172 + 48*Y182 + 7*Y192 +
200*Y202 + 7*Y212 + 7*Y222 + 7*Y232 + 550*Y242 + 200*Y252 + 7*Y262 + 2*Y272 + 50*Y282 + 2*Y292 - 7*X2 <=0;

9*Y12 + 4*Y22 + 2*Y32 + 9*Y42 + 4*Y52 + 3*Y62 + 6*Y72 + 7*Y82 + 4*Y92 + 4*Y102 + 11*Y112 + 5*Y122 + 12*Y132 +
3*Y142 + 3*Y152 + 10*Y162 + 2*Y172 + 7*Y182 + 5*Y192 +
12*Y202 + 7*Y212 + 5*Y222 + 2*Y232 + 25*Y242 + 9*Y252 + 5*Y262 + 2*Y272 + 5*Y282 + 6*Y292 - 4*X2 <=0;

820931*Y12 + 147596*Y22 + 86404*Y32 + 584300*Y42 + 238265*Y52 + 147473*Y62 + 420908*Y72 + 239046*Y82 +
171183*Y92 + 86967*Y102 + 142521*Y112 + 1372680*Y122 + 119500*Y132 +
247573*Y142 + 93157*Y152 + 1994765*Y162 + 29538*Y172 + 226845*Y182 + 117310*Y192 + 955890*Y202 + 3333230*Y212
+ 2349633*Y222 + 139434*Y232 + 2090879*Y242 + 755723*Y252 + 374615*Y262 + 224382*Y272 + 194903*Y282 +
173934*Y292 - 147596*X2 <=0;

229*Y12 + 354*Y22 + 115*Y32 + 5827*Y42 + 4776*Y52 + 152*Y62 + 661*Y72 + 1019*Y82 + 278*Y92 + 60*Y102 +
2155*Y112 + 908*Y122 + 2593*Y132 + 272*Y142 + 64*Y152 +
1053*Y162 + 137*Y172 + 138*Y182 + 523*Y192 + 1222*Y202 + 1674*Y212 + 554*Y222 + 197*Y232 + 5794*Y242 +
1505*Y252 + 1347*Y262 + 310*Y272 + 259*Y282 + 277*Y292 >= 354;

3*Y12 + 3*Y22 + 3*Y32 + 3*Y42 + 3*Y52 + 3*Y62 + 3*Y72 + 3*Y82 + 3*Y92 + 3*Y102 + 3*Y112 + 3*Y122 + 3*Y132 +
3*Y142 + 3*Y152 + 3*Y162 + 3*Y172 + 3*Y182 + 3*Y192 + 3*Y202 +
3*Y212 + 3*Y222 + 3*Y232 + 3*Y242 + 3*Y252 + 3*Y262 + 3*Y272 + 3*Y282 + 3*Y292 >= 3;

4*Y12 + 3*Y22 + 1*Y32 + 4*Y42 + 3*Y52 + 1*Y62 + 3*Y72 + 4*Y82 + 2*Y92 + 1*Y102 + 4*Y112 + 2*Y122 + 4*Y132 +
3*Y142 + 2*Y152 + 4*Y162 + 1*Y172 + 2*Y182 + 3*Y192 + 4*Y202 +
3*Y212 + 3*Y222 + 2*Y232 + 4*Y242 + 3*Y252 + 4*Y262 + 2*Y272 + 3*Y282 + 3*Y292 >= 3;

!Non-negativity constraints;

@Free(X2);
Y12 >=0; Y22 >=0; Y32 >=0; Y42 >=0; Y52 >=0; Y62 >=0; Y72 >=0; Y82 >=0; Y92 >=0; Y102 >=0;
Y112 >=0; Y122 >=0; Y132 >=0; Y142 >=0; Y152 >=0; Y162 >=0; Y172 >=0; Y182 >=0; Y192 >=0; Y202 >=0; Y212 >=0;
Y222 >=0; Y232 >=0; Y242 >=0; Y252 >=0; Y262 >=0; Y272 >=0; Y282 >=0; Y292 >=0;

```

## Dual problem solution

Variable	Value	Reduced Cost
X2	1.000000	0.2775558E-16
Y12	0.000000	3.885285
Y22	1.000000	0.000000
Y32	0.000000	0.3211190
Y42	0.000000	3.131913
Y52	0.000000	0.6785365
Y62	0.000000	0.6659721
Y72	0.000000	1.626644
Y82	0.000000	0.4328804
Y92	0.000000	0.4665278
Y102	0.000000	0.2410312
Y112	0.000000	1.220081

Y132	0.000000	0.4239470
Y142	0.000000	0.5645643
Y152	0.000000	0.2591946E-01
Y162	0.000000	10.34732
Y172	0.000000	-0.5551115E-16
Y182	0.000000	0.9473818
Y192	0.000000	0.7877766E-01
Y202	0.000000	5.313527
Y212	0.000000	18.32216
Y222	0.000000	12.68458
Y232	0.000000	0.2872430
Y242	0.000000	14.47055
Y252	0.000000	4.016927
Y262	0.000000	1.115164
Y272	0.000000	0.7669394
Y282	0.000000	0.2671399
Y292	0.000000	0.6483310

## SUMMARY

Efficiency score of Warehouse 2 (Ahmedabad) = 1

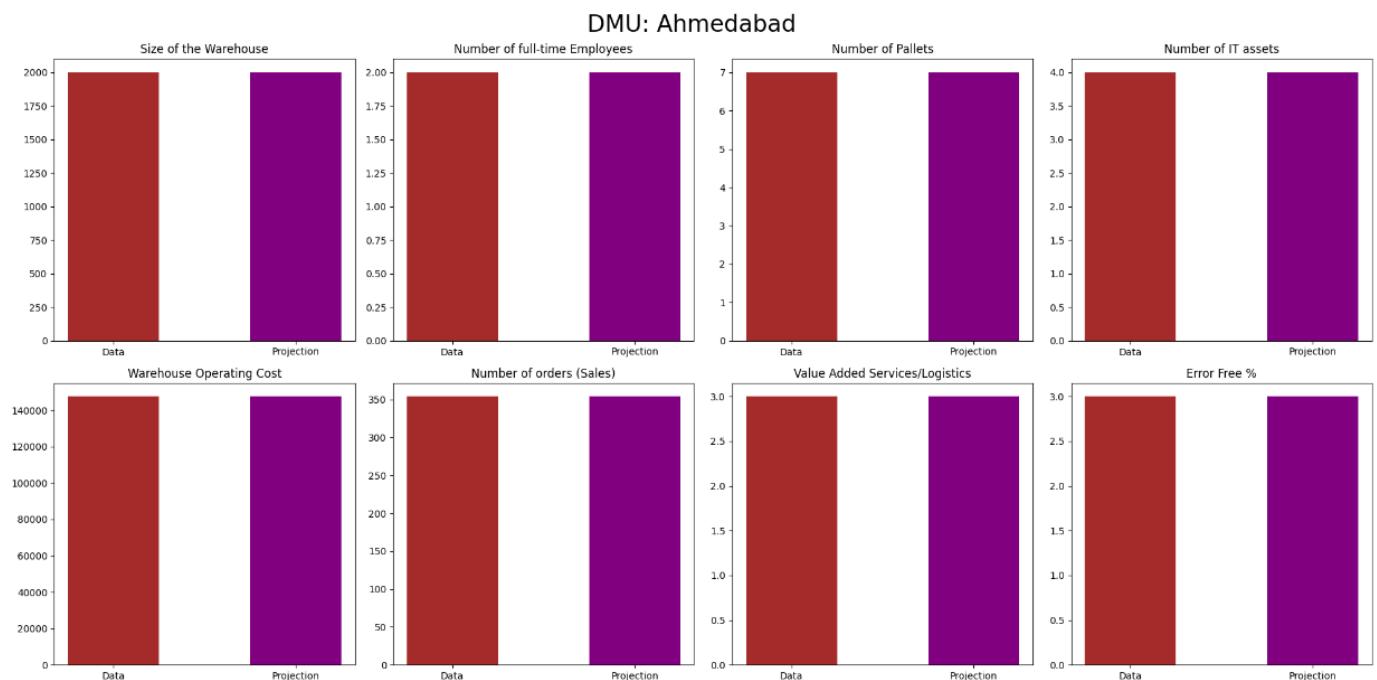
Warehouse 2 (Ahmedabad) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	2000	2000	0
No. of Full-time Employees	2	2	0
No. of Pallets	7	7	0
No. of IT assets	4	4	0
Warehouse Operating Cost	147596	147596	0
No. of Orders (Sales)	354	354	0
Level of Value-Added Services	3	3	0
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 2 (Ahmedabad)	1



# WAREHOUSE 3 (BALTANA)

## Primal Problem Formulation

```

!Objective Function;

MAX = 115*VF3 + 3*VG3 + 1*VH3;

!Subject to;

550*UA3 + 2*UB3 + 2*UC3 + 2*UD3 + 86404*UE3 = 1;
(229*VF3 + 3*VG3 + 4*VH3) - (13100*UA3 + 7*UB3 + 320*UC3 + 9*UD3 + 820931*UE3) <=0;
(354*VF3 + 3*VG3 + 3*VH3) - (2000*UA3 + 2*UB3 + 7*UC3 + 4*UD3 + 147596*UE3) <=0;
(115*VF3 + 3*VG3 + 1*VH3) - (550*UA3 + 2*UB3 + 2*UC3 + 2*UD3 + 86404*UE3) <=0;
(5827*VF3 + 3*VG3 + 4*VH3) - (9800*UA3 + 14*UB3 + 10*UC3 + 9*UD3 + 584300*UE3) <=0;
(4776*VF3 + 3*VG3 + 3*VH3) - (7500*UA3 + 4*UB3 + 7*UC3 + 4*UD3 + 238265*UE3) <=0;
(152*VF3 + 3*VG3 + 1*VH3) - (550*UA3 + 2*UB3 + 2*UC3 + 3*UD3 + 147473*UE3) <=0;
(661*VF3 + 3*VG3 + 3*VH3) - (4800*UA3 + 3*UB3 + 7*UC3 + 6*UD3 + 420908*UE3) <=0;
(1019*VF3 + 3*VG3 + 4*VH3) - (10250*UA3 + 5*UB3 + 20*UC3 + 7*UD3 + 239046*UE3) <=0;
(278*VF3 + 3*VG3 + 2*VH3) - (2300*UA3 + 2*UB3 + 7*UC3 + 4*UD3 + 171183*UE3) <=0;
(60*VF3 + 3*VG3 + 1*VH3) - (1000*UA3 + 1*UB3 + 30*UC3 + 4*UD3 + 86967*UE3) <=0;
(2155*VF3 + 3*VG3 + 4*VH3) - (20700*UA3 + 21*UB3 + 200*UC3 + 11*UD3 + 142521*UE3) <=0;
(908*VF3 + 3*VG3 + 2*VH3) - (1200*UA3 + 6*UB3 + 7*UC3 + 5*UD3 + 1372680*UE3) <=0;
(2593*VF3 + 3*VG3 + 4*VH3) - (11000*UA3 + 13*UB3 + 200*UC3 + 12*UD3 + 119500*UE3) <=0;
(272*VF3 + 3*VG3 + 3*VH3) - (4100*UA3 + 2*UB3 + 7*UC3 + 3*UD3 + 247573*UE3) <=0;
(64*VF3 + 3*VG3 + 2*VH3) - (2000*UA3 + 2*UB3 + 2*UC3 + 3*UD3 + 93157*UE3) <=0;
(1053*VF3 + 3*VG3 + 4*VH3) - (21000*UA3 + 5*UB3 + 338*UC3 + 10*UD3 + 1994765*UE3) <=0;
(137*VF3 + 3*VG3 + 1*VH3) - (500*UA3 + 2*UB3 + 2*UC3 + 2*UD3 + 29538*UE3) <=0;
(138*VF3 + 3*VG3 + 2*VH3) - (2152*UA3 + 4*UB3 + 48*UC3 + 7*UD3 + 226845*UE3) <=0;
(523*VF3 + 3*VG3 + 3*VH3) - (9700*UA3 + 5*UB3 + 7*UC3 + 5*UD3 + 117310*UE3) <=0;
(1222*VF3 + 3*VG3 + 4*VH3) - (15000*UA3 + 15*UB3 + 200*UC3 + 12*UD3 + 955890*UE3) <=0;
(1674*VF3 + 3*VG3 + 3*VH3) - (9000*UA3 + 6*UB3 + 7*UC3 + 7*UD3 + 3333230*UE3) <=0;
(554*VF3 + 3*VG3 + 3*VH3) - (4600*UA3 + 5*UB3 + 7*UC3 + 5*UD3 + 2349633*UE3) <=0;
(197*VF3 + 3*VG3 + 2*VH3) - (2000*UA3 + 2*UB3 + 7*UC3 + 2*UD3 + 139434*UE3) <=0;
(5794*VF3 + 3*VG3 + 4*VH3) - (37324*UA3 + 48*UB3 + 550*UC3 + 25*UD3 + 2090879*UE3) <=0;
(1505*VF3 + 3*VG3 + 3*VH3) - (11000*UA3 + 9*UB3 + 200*UC3 + 9*UD3 + 755723*UE3) <=0;
(1347*VF3 + 3*VG3 + 4*VH3) - (10000*UA3 + 4*UB3 + 7*UC3 + 5*UD3 + 374615*UE3) <=0;
(310*VF3 + 3*VG3 + 2*VH3) - (4000*UA3 + 2*UB3 + 2*UC3 + 2*UD3 + 224382*UE3) <=0;
(259*VF3 + 3*VG3 + 3*VH3) - (5500*UA3 + 2*UB3 + 50*UC3 + 5*UD3 + 194903*UE3) <=0;
(277*VF3 + 3*VG3 + 3*VH3) - (2000*UA3 + 8*UB3 + 2*UC3 + 6*UD3 + 173934*UE3) <=0;

UA3 >=0;
UB3 >=0;
UC3 >=0;
UD3 >=0;
UE3 >=0;
VF3 >=0;
VG3 >=0;
VH3 >=0;

```

## Solution/Weights of primal problem

LINGO 11.0 - [Solution Report - warehouse 3 PP]

File Edit LINGO Window Help

Global optimal solution found.

Variable	Value	Reduced Cost
VF3	0.000000	0.000000
VG3	0.333333	0.000000
VH3	0.000000	0.000000
UA3	0.000000	0.000000
UB3	0.4827586	0.000000
UC3	0.1724138E-01	0.000000
UD3	0.4163336E-16	0.000000
UE3	0.000000	0.000000

## Dual Problem Formulation

```

!Dual Objective Function;

```

```

MIN = X3;

!Subject to;
13100*Y13 + 2000*Y23 + 550*Y33 + 9800*Y43 + 7500*Y53 + 550*Y63 + 4800*Y73 + 10250*Y83 + 2300*Y93 + 1000*Y103
+ 20700*Y113 + 1200*Y123 + 11000*Y133 + 4100*Y143 + 2000*Y153 +
21000*Y163 + 500*Y173 + 2152*Y183 + 9700*Y193 + 15000*Y203 + 9000*Y213 + 4600*Y223 + 2000*Y233 + 37324*Y243
+ 11000*Y253 + 10000*Y263 + 4000*Y273 + 5500*Y283 + 2000*Y293 - 550*X3 <=0;

7*Y13 + 2*Y23 + 2*Y33 + 14*Y43 + 4*Y53 + 2*Y63 + 3*Y73 + 5*Y83 + 2*Y93 + 1*Y103 + 21*Y113 + 6*Y123 + 13*Y133
+ 2*Y143 + 2*Y153 + 5*Y163 + 2*Y173 + 4*Y183 + 5*Y193 + 15*Y203
+ 6*Y213 + 5*Y223 + 2*Y233 + 48*Y243 + 9*Y253 + 4*Y263 + 2*Y273 + 2*Y283 + 8*Y293 - 2*X3 <=0;

320*Y13 + 7*Y23 + 2*Y33 + 10*Y43 + 7*Y53 + 2*Y63 + 7*Y73 + 20*Y83 + 7*Y93 + 30*Y103 + 200*Y113 + 7*Y123 +
200*Y133 + 7*Y143 + 2*Y153 + 338*Y163 + 2*Y173 + 48*Y183 + 7*Y193 +
200*Y203 + 7*Y213 + 7*Y223 + 7*Y233 + 550*Y243 + 200*Y253 + 7*Y263 + 2*Y273 + 50*Y283 + 2*Y293 - 2*X3 <= 0;

9*Y13 + 4*Y23 + 2*Y33 + 9*Y43 + 4*Y53 + 3*Y63 + 6*Y73 + 7*Y83 + 4*Y93 + 4*Y103 + 11*Y113 + 5*Y123 + 12*Y133 +
3*Y143 + 3*Y153 + 10*Y163 + 2*Y173 + 7*Y183 + 5*Y193 +
12*Y203 + 7*Y213 + 5*Y223 + 2*Y233 + 25*Y243 + 9*Y253 + 5*Y263 + 2*Y273 + 5*Y283 + 6*Y293 - 2*X3 <= 0;

820931*Y13 + 147596*Y23 + 86404*Y33 + 584300*Y43 + 238265*Y53 + 147473*Y63 + 420908*Y73 + 239046*Y83 +
171183*Y93 + 86967*Y103 + 142521*Y113 + 1372680*Y123 + 119500*Y133 +
247573*Y143 + 93157*Y153 + 1994765*Y163 + 29538*Y173 + 226845*Y183 + 117310*Y193 + 955890*Y203 +
3333230*Y213 + 2349633*Y223 + 139434*Y233 + 2090879*Y243 + 755723*Y253 +
374615*Y263 + 224382*Y273 + 194903*Y283 + 173934*Y293 - 86404*X3 <= 0;

229*Y13 + 354*Y23 + 115*Y33 + 5827*Y43 + 4776*Y53 + 152*Y63 + 661*Y73 + 1019*Y83 + 278*Y93 + 60*Y103 +
2155*Y113 + 908*Y123 + 2593*Y133 + 272*Y143 + 64*Y153 +
1053*Y163 + 137*Y173 + 138*Y183 + 523*Y193 + 1222*Y203 + 1674*Y213 + 554*Y223 + 197*Y233 + 5794*Y243 +
1505*Y253 + 1347*Y263 + 310*Y273 + 259*Y283 + 277*Y293 >= 115;

3*Y13 + 3*Y23 + 3*Y33 + 3*Y43 + 3*Y53 + 3*Y63 + 3*Y73 + 3*Y83 + 3*Y93 + 3*Y103 + 3*Y113 + 3*Y123 + 3*Y133 +
3*Y143 + 3*Y153 + 3*Y163 + 3*Y173 + 3*Y183 + 3*Y193 + 3*Y203 +
3*Y213 + 3*Y223 + 3*Y233 + 3*Y243 + 3*Y253 + 3*Y263 + 3*Y273 + 3*Y283 + 3*Y293 >= 3;

4*Y13 + 3*Y23 + 1*Y33 + 4*Y43 + 3*Y53 + 1*Y63 + 3*Y73 + 4*Y83 + 2*Y93 + 1*Y103 + 4*Y113 + 2*Y123 + 4*Y133 +
3*Y143 + 2*Y153 + 4*Y163 + 1*Y173 + 2*Y183 + 3*Y193 + 4*Y203 +
3*Y213 + 3*Y223 + 2*Y233 + 4*Y243 + 3*Y253 + 4*Y263 + 2*Y273 + 3*Y283 + 3*Y293 >= 1;

@Free(X3);
Y13 >=0; Y23 >=0; Y33 >=0; Y43 >=0; Y53 >=0; Y63 >=0; Y73 >=0; Y83 >=0; Y93 >=0; Y103 >=0;
Y113 >=0; Y123 >=0; Y133 >=0; Y143 >=0; Y153 >=0; Y163 >=0; Y173 >=0; Y183 >=0; Y193 >=0; Y203 >=0; Y213 >=0;
Y223 >=0; Y233 >=0; Y243 >=0; Y253 >=0; Y263 >=0; Y273 >=0; Y283 >=0; Y293 >=0;

```

## Solution of Dual problem formulation

Variable	Value	Reduced Cost
X3	1.000000	0.000000
Y13	0.000000	2.833333
Y23	0.000000	0.333333
Y33	1.000000	0.000000
Y43	0.000000	5.166667
Y53	0.000000	1.000000
Y63	0.000000	0.1666667
Y73	0.000000	1.000000
Y83	0.000000	1.833333
Y93	0.000000	0.333333
Y103	0.000000	0.5551115E-16
Y113	0.000000	7.833333
Y123	0.000000	1.833333

Y133	0.000000	5.333333
Y143	0.000000	0.1666667
Y153	0.000000	0.1666667
Y163	0.000000	2.333333
Y173	0.000000	0.000000
Y183	0.000000	1.500000
Y193	0.000000	1.500000
Y203	0.000000	6.000000
Y213	0.000000	2.166667
Y223	0.000000	1.500000
Y233	0.000000	0.000000
Y243	0.000000	19.16667
Y253	0.000000	3.500000
Y263	0.000000	1.166667
Y273	0.000000	0.000000
Y283	0.000000	0.5000000
Y293	0.000000	2.666667

## SUMMARY

Efficiency score of Warehouse 3 (Baltana) = 1

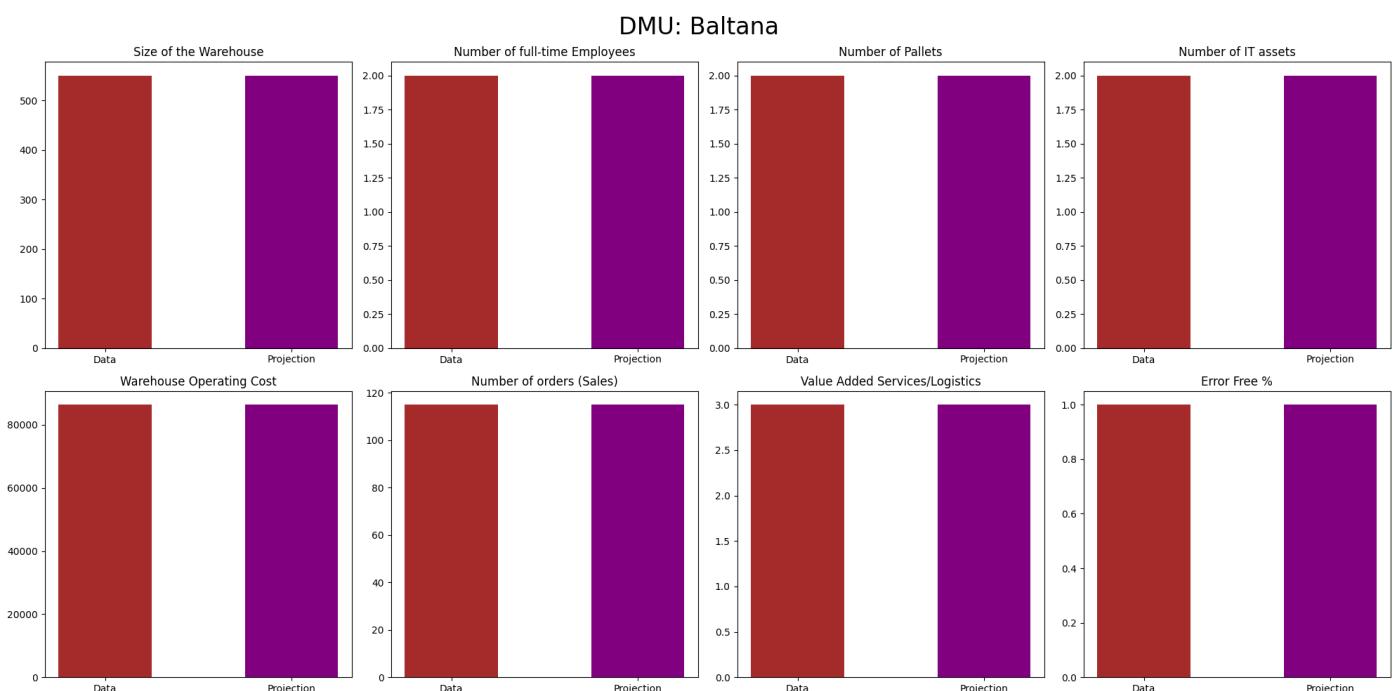
Warehouse 3 (Baltana) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	550	550	0
No. of Full-time Employees	2	2	0
No. of Pallets	2	2	0
No. of IT assets	2	2	0
Warehouse Operating Cost	86404	86404	0
No. of Orders (Sales)	115	115	0
Level of Value-Added Services	3	3	0
Error Free (%)	1	1	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 3 (Baltana)	1



## WAREHOUSE 4 (BANGALORE)

### Primal Problem formulation

```

!Objective Function;

MAX = 5827*VF4 + 3*VG4 + 4*VH4;

!Subject to;

9800*UA4 + 14*UB4 + 10*UC4 + 9*UD4 + 584300*UE4 = 1;
(229*VF4 + 3*VG4 + 4*VH4) - (13100*UA4 + 7*UB4 + 320*UC4 + 9*UD4 + 820931*UE4) <=0;
(354*VF4 + 3*VG4 + 3*VH4) - (2000*UA4 + 2*UB4 + 7*UC4 + 4*UD4 + 147596*UE4) <=0;
(115*VF4 + 3*VG4 + 1*VH4) - (550*UA4 + 2*UB4 + 2*UC4 + 2*UD4 + 86404*UE4) <=0;
(5827*VF4 + 3*VG4 + 4*VH4) - (9800*UA4 + 14*UB4 + 10*UC4 + 9*UD4 + 584300*UE4) <=0;
(4776*VF4 + 3*VG4 + 3*VH4) - (7500*UA4 + 4*UB4 + 7*UC4 + 4*UD4 + 238265*UE4) <=0;
(152*VF4 + 3*VG4 + 1*VH4) - (550*UA4 + 2*UB4 + 2*UC4 + 3*UD4 + 147473*UE4) <=0;
(661*VF4 + 3*VG4 + 3*VH4) - (4800*UA4 + 3*UB4 + 7*UC4 + 6*UD4 + 420908*UE4) <=0;
(1019*VF4 + 3*VG4 + 4*VH4) - (10250*UA4 + 5*UB4 + 20*UC4 + 7*UD4 + 239046*UE4) <=0;
(278*VF4 + 3*VG4 + 2*VH4) - (2300*UA4 + 2*UB4 + 7*UC4 + 4*UD4 + 171183*UE4) <=0;
(60*VF4 + 3*VG4 + 1*VH4) - (1000*UA4 + 1*UB4 + 30*UC4 + 4*UD4 + 86967*UE4) <=0;
(2155*VF4 + 3*VG4 + 4*VH4) - (20700*UA4 + 21*UB4 + 200*UC4 + 11*UD4 + 142521*UE4) <=0;
(908*VF4 + 3*VG4 + 2*VH4) - (1200*UA4 + 6*UB4 + 7*UC4 + 5*UD4 + 1372680*UE4) <=0;
(2593*VF4 + 3*VG4 + 4*VH4) - (11000*UA4 + 13*UB4 + 200*UC4 + 12*UD4 + 119500*UE4) <=0;
(272*VF4 + 3*VG4 + 3*VH4) - (4100*UA4 + 2*UB4 + 7*UC4 + 3*UD4 + 247573*UE4) <=0;
(64*VF4 + 3*VG4 + 2*VH4) - (2000*UA4 + 2*UB4 + 2*UC4 + 3*UD4 + 93157*UE4) <=0;
(1053*VF4 + 3*VG4 + 4*VH4) - (21000*UA4 + 5*UB4 + 338*UC4 + 10*UD4 + 1994765*UE4) <=0;
(137*VF4 + 3*VG4 + 1*VH4) - (500*UA4 + 2*UB4 + 2*UC4 + 2*UD4 + 29538*UE4) <=0;
(138*VF4 + 3*VG4 + 2*VH4) - (2152*UA4 + 4*UB4 + 48*UC4 + 7*UD4 + 226845*UE4) <=0;
(523*VF4 + 3*VG4 + 3*VH4) - (9700*UA4 + 5*UB4 + 7*UC4 + 5*UD4 + 117310*UE4) <=0;
(1222*VF4 + 3*VG4 + 4*VH4) - (15000*UA4 + 15*UB4 + 200*UC4 + 12*UD4 + 955890*UE4) <=0;
(1674*VF4 + 3*VG4 + 3*VH4) - (9000*UA4 + 6*UB4 + 7*UC4 + 7*UD4 + 3333230*UE4) <=0;
(554*VF4 + 3*VG4 + 3*VH4) - (4600*UA4 + 5*UB4 + 7*UC4 + 5*UD4 + 2349633*UE4) <=0;
(197*VF4 + 3*VG4 + 2*VH4) - (2000*UA4 + 2*UB4 + 7*UC4 + 2*UD4 + 139434*UE4) <=0;
(5794*VF4 + 3*VG4 + 4*VH4) - (37324*UA4 + 48*UB4 + 550*UC4 + 25*UD4 + 2090879*UE4) <=0;
(1505*VF4 + 3*VG4 + 3*VH4) - (11000*UA4 + 9*UB4 + 200*UC4 + 9*UD4 + 755723*UE4) <=0;
(1347*VF4 + 3*VG4 + 4*VH4) - (10000*UA4 + 4*UB4 + 7*UC4 + 5*UD4 + 374615*UE4) <=0;
(310*VF4 + 3*VG4 + 2*VH4) - (4000*UA4 + 2*UB4 + 2*UC4 + 2*UD4 + 224382*UE4) <=0;
(259*VF4 + 3*VG4 + 3*VH4) - (5500*UA4 + 2*UB4 + 50*UC4 + 5*UD4 + 194903*UE4) <=0;
(277*VF4 + 3*VG4 + 3*VH4) - (2000*UA4 + 8*UB4 + 2*UC4 + 6*UD4 + 173934*UE4) <=0;

UA4 >=0;
UB4 >=0;
UC4 >=0;
UD4 >=0;
UE4 >=0;
VF4 >=0;
VG4 >=0;
VH4 >=0;

```

### Solutions/Weights of primal problem

Variable	Value	Reduced Cost
VF4	0.1223497E-03	0.1147527E-11
VG4	0.000000	1.135080
VH4	0.5649085E-01	0.1942890E-15
UA4	0.8408565E-04	-0.1421085E-13
UB4	0.000000	7.153280
UC4	0.1759607E-01	0.1665335E-15
UD4	0.000000	2.697711
UE4	0.000000	70284.73

### Dual Problem formulation

```

!Dual Objective Function;

MIN = X4;

!Subject to;
13100*Y14 + 2000*Y24 + 550*Y34 + 9800*Y44 + 7500*Y54 + 550*Y64 + 4800*Y74 + 10250*Y84 + 2300*Y94 +
1000*Y104 + 20700*Y114 + 1200*Y124 + 11000*Y134 + 4100*Y144 + 2000*Y154 +
21000*Y164 + 500*Y174 + 2152*Y184 + 9700*Y194 + 15000*Y204 + 9000*Y214 + 4600*Y224 + 2000*Y234 +
37324*Y244 + 11000*Y254 + 10000*Y264 + 4000*Y274 + 5500*Y284 + 2000*Y294 - 9800*X4 <=0;

7*Y14 + 2*Y24 + 2*Y34 + 14*Y44 + 4*Y54 + 2*Y64 + 3*Y74 + 5*Y84 + 2*Y94 + 1*Y104 + 21*Y114 + 6*Y124 +
13*Y134 + 2*Y144 + 2*Y154 + 5*Y164 + 2*Y174 + 4*Y184 + 5*Y194 + 15*Y204 +
+ 6*Y214 + 5*Y224 + 2*Y234 + 48*Y244 + 9*Y254 + 4*Y264 + 2*Y274 + 2*Y284 + 8*Y294 - 14*X4 <=0;

320*Y14 + 7*Y24 + 2*Y34 + 10*Y44 + 7*Y54 + 2*Y64 + 7*Y74 + 20*Y84 + 7*Y94 + 30*Y104 + 200*Y114 +
7*Y124 + 200*Y134 + 7*Y144 + 2*Y154 + 338*Y164 + 2*Y174 + 48*Y184 + 7*Y194 +
200*Y204 + 7*Y214 + 7*Y224 + 7*Y234 + 550*Y244 + 200*Y254 + 7*Y264 + 2*Y274 + 50*Y284 + 2*Y294 -
10*X4 <=0;

9*Y14 + 4*Y24 + 2*Y34 + 9*Y44 + 4*Y54 + 3*Y64 + 6*Y74 + 7*Y84 + 4*Y94 + 4*Y104 + 11*Y114 + 5*Y124 +
12*Y134 + 3*Y144 + 3*Y154 + 10*Y164 + 2*Y174 + 7*Y184 + 5*Y194 +
12*Y204 + 7*Y214 + 5*Y224 + 2*Y234 + 25*Y244 + 9*Y254 + 5*Y264 + 2*Y274 + 5*Y284 + 6*Y294 - 9*X4 <=0;

820931*Y14 + 147596*Y24 + 86404*Y34 + 584300*Y44 + 238265*Y54 + 147473*Y64 + 420908*Y74 +
239046*Y84 + 171183*Y94 + 86967*Y104 + 142521*Y114 + 1372680*Y124 + 119500*Y134 +
247573*Y144 + 93157*Y154 + 1994765*Y164 + 29538*Y174 + 226845*Y184 + 117310*Y194 + 955890*Y204 +
3333230*Y214 + 2349633*Y224 + 139434*Y234 + 2090879*Y244 + 755723*Y254 +
374615*Y264 + 224382*Y274 + 194903*Y284 + 173934*Y294 - 584300*X4 <= 0;

229*Y14 + 354*Y24 + 115*Y34 + 5827*Y44 + 4776*Y54 + 152*Y64 + 661*Y74 + 1019*Y84 + 278*Y94 + 60*Y104 +
2155*Y114 + 908*Y124 + 2593*Y134 + 272*Y144 + 64*Y154 +
1053*Y164 + 137*Y174 + 138*Y184 + 523*Y194 + 1222*Y204 + 1674*Y214 + 554*Y224 + 197*Y234 + 5794*Y244 +
1505*Y254 + 1347*Y264 + 310*Y274 + 259*Y284 + 277*Y294 >= 5827;

3*Y14 + 3*Y24 + 3*Y34 + 3*Y44 + 3*Y54 + 3*Y64 + 3*Y74 + 3*Y84 + 3*Y94 + 3*Y104 + 3*Y114 + 3*Y124 +
3*Y134 + 3*Y144 + 3*Y154 + 3*Y164 + 3*Y174 + 3*Y184 + 3*Y194 + 3*Y204 +
3*Y214 + 3*Y224 + 3*Y234 + 3*Y244 + 3*Y254 + 3*Y264 + 3*Y274 + 3*Y284 + 3*Y294 >= 3;

4*Y14 + 3*Y24 + 1*Y34 + 4*Y44 + 3*Y54 + 1*Y64 + 3*Y74 + 4*Y84 + 2*Y94 + 1*Y104 + 4*Y114 + 2*Y124 +
4*Y134 + 3*Y144 + 2*Y154 + 4*Y164 + 1*Y174 + 2*Y184 + 3*Y194 + 4*Y204 +
3*Y214 + 3*Y224 + 2*Y234 + 4*Y244 + 3*Y254 + 4*Y264 + 2*Y274 + 3*Y284 + 3*Y294 >= 4;

@Free(X4);
Y14 >=0; Y24 >=0; Y34 >=0; Y44 >=0; Y54 >=0; Y64 >=0; Y74 >=0; Y84 >=0; Y94 >=0; Y104 >=0; Y114 >=0;
Y124 >=0; Y134 >=0; Y144 >=0; Y154 >=0; Y164 >=0; Y174 >=0; Y184 >=0; Y194 >=0; Y204 >=0; Y214 >=0;
Y224 >=0; Y234 >=0; Y244 >=0; Y254 >=0; Y264 >=0; Y274 >=0; Y284 >=0; Y294 >=0;

```

## Solutions of Dual Problem

Global optimal solution found.			
Objective value:	0.9388952	Infeasibilities:	0.000000
Total solver iterations:	7		
Variable	Value	Reduced Cost	
X4	0.9388952	0.000000	
Y14	0.000000	6.478282	
Y24	0.000000	0.7855941E-01	
Y34	0.000000	0.1087817E-01	
Y44	0.000000	0.6110478E-01	
Y54	1.191367	-0.2220446E-15	
Y64	0.000000	0.6351232E-02	
Y74	0.000000	0.2764379	
Y84	0.000000	0.8631614	
Y94	0.000000	0.1695745	
Y104	0.000000	0.5481358	
Y114	0.000000	4.770159	
Y124	0.1350797	-0.4163336E-16	
Y134	0.000000	3.900939	
Y144	0.000000	0.2651719	
Y154	0.000000	0.8255134E-01	
Y164	0.000000	7.358472	

Y174	0.000000	0.3982195E-02
Y184	0.000000	0.8956976
Y194	0.000000	0.7053418
Y204	0.000000	4.405023
Y214	0.000000	0.5056573
Y224	0.000000	0.2727121
Y234	0.000000	0.1542592
Y244	0.000000	11.88139
Y254	0.000000	4.090547
Y264	0.000000	0.5732604
Y274	0.000000	0.2206246
Y284	0.000000	1.141113
Y294	0.5191343E-01	-0.2775558E-16

## SUMMARY

Efficiency score of Warehouse 4 (Bangalore) = 0.9388952 Warehouse 4 (Bangalore) is an inefficient warehouse.

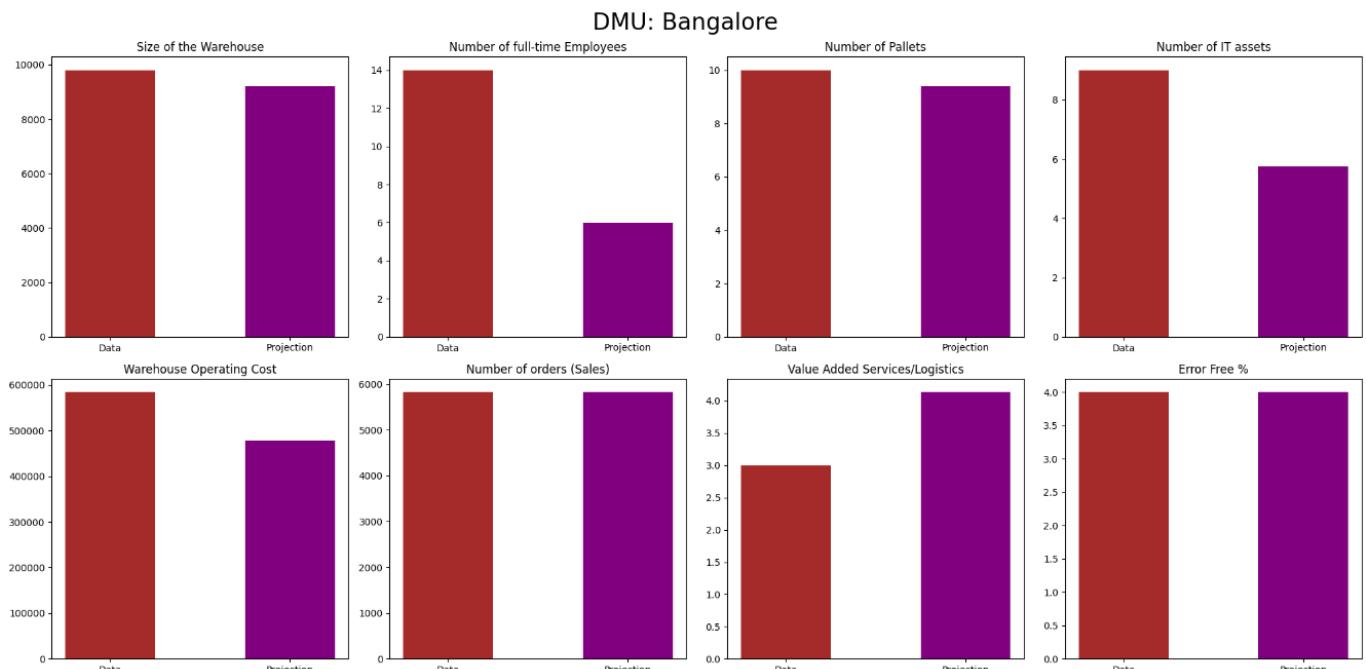
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	9800	9201.17	0
No. of Full-time Employees	14	5.99125	7.153
No. of Pallets	10	9.38895	0
No. of IT assets	9	5.75235	2.698
Warehouse Operating Cost	584300	478312	70284.7
No. of Orders (Sales)	5827	5827	0
Level of Value-Added Services	3	4.13508	1.135
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 5 (Bhiwandi)	1.191367
Warehouse 12 (Gorakhpur)	0.1350797
Warehouse 29 (Varanasi)	0.05191343

In order to make warehouse 4 (Bangalore) efficient, they need to decrease size of the warehouse by 6.11%, No of full-time employees by 57.205%, number of pallets by 6.11%, number of IT Assets 36.085% operating cost by 18.139%, whereas value-added logistics needs to increased by 37.836%.



# WAREHOUSE 5 (BHIWANDI)

## Primal Problem Formulation

```

!Objective Function;
MAX = 4776*VF5 + 3*VG5 + 3*VH5;

!Subject to;

7500*UA5 + 4*UB5 + 7*UC5 + 4*UD5 + 238265*UE5 = 1;
(229*VF5 + 3*VG5 + 4*VH5) - (13100*UA5 + 7*UB5 + 320*UC5 + 9*UD5 + 820931*UE5) <=0;
(354*VF5 + 3*VG5 + 3*VH5) - (2000*UA5 + 2*UB5 + 7*UC5 + 4*UD5 + 147596*UE5) <=0;
(115*VF5 + 3*VG5 + 1*VH5) - (550*UA5 + 2*UB5 + 2*UC5 + 2*UD5 + 86404*UE5) <=0;
(5827*VF5 + 3*VG5 + 4*VH5) - (9800*UA5 + 14*UB5 + 10*UC5 + 9*UD5 + 584300*UE5) <=0;
(4776*VF5 + 3*VG5 + 3*VH5) - (7500*UA5 + 4*UB5 + 7*UC5 + 4*UD5 + 238265*UE5) <=0;
(152*VF5 + 3*VG5 + 1*VH5) - (550*UA5 + 2*UB5 + 2*UC5 + 3*UD5 + 147473*UE5) <=0;
(661*VF5 + 3*VG5 + 3*VH5) - (4800*UA5 + 3*UB5 + 7*UC5 + 6*UD5 + 420908*UE5) <=0;
(1019*VF5 + 3*VG5 + 4*VH5) - (10250*UA5 + 5*UB5 + 20*UC5 + 7*UD5 + 239046*UE5) <=0;
(278*VF5 + 3*VG5 + 2*VH5) - (2300*UA5 + 2*UB5 + 7*UC5 + 4*UD5 + 171183*UE5) <=0;
(60*VF5 + 3*VG5 + 1*VH5) - (1000*UA5 + 1*UB5 + 30*UC5 + 4*UD5 + 86967*UE5) <=0;
(2155*VF5 + 3*VG5 + 4*VH5) - (20700*UA5 + 21*UB5 + 200*UC5 + 11*UD5 + 142521*UE5) <=0;
(908*VF5 + 3*VG5 + 2*VH5) - (1200*UA5 + 6*UB5 + 7*UC5 + 5*UD5 + 1372680*UE5) <=0;
(2593*VF5 + 3*VG5 + 4*VH5) - (11000*UA5 + 13*UB5 + 200*UC5 + 12*UD5 + 119500*UE5) <=0;
(272*VF5 + 3*VG5 + 3*VH5) - (4100*UA5 + 2*UB5 + 7*UC5 + 3*UD5 + 247573*UE5) <=0;
(64*VF5 + 3*VG5 + 2*VH5) - (2000*UA5 + 2*UB5 + 2*UC5 + 3*UD5 + 93157*UE5) <=0;
(1053*VF5 + 3*VG5 + 4*VH5) - (21000*UA5 + 5*UB5 + 338*UC5 + 10*UD5 + 1994765*UE5) <=0;
(137*VF5 + 3*VG5 + 1*VH5) - (500*UA5 + 2*UB5 + 2*UC5 + 2*UD5 + 29538*UE5) <=0;
(138*VF5 + 3*VG5 + 2*VH5) - (2152*UA5 + 4*UB5 + 48*UC5 + 7*UD5 + 226845*UE5) <=0;
(523*VF5 + 3*VG5 + 3*VH5) - (9700*UA5 + 5*UB5 + 7*UC5 + 5*UD5 + 117310*UE5) <=0;
(1222*VF5 + 3*VG5 + 4*VH5) - (15000*UA5 + 15*UB5 + 200*UC5 + 12*UD5 + 955890*UE5) <=0;
(1674*VF5 + 3*VG5 + 3*VH5) - (9000*UA5 + 6*UB5 + 7*UC5 + 7*UD5 + 3333230*UE5) <=0;
(554*VF5 + 3*VG5 + 3*VH5) - (4600*UA5 + 5*UB5 + 7*UC5 + 5*UD5 + 2349633*UE5) <=0;
(197*VF5 + 3*VG5 + 2*VH5) - (2000*UA5 + 2*UB5 + 7*UC5 + 2*UD5 + 139434*UE5) <=0;
(5794*VF5 + 3*VG5 + 4*VH5) - (37324*UA5 + 48*UB5 + 550*UC5 + 25*UD5 + 2090879*UE5) <=0;
(1505*VF5 + 3*VG5 + 3*VH5) - (11000*UA5 + 9*UB5 + 200*UC5 + 9*UD5 + 755723*UE5) <=0;
(1347*VF5 + 3*VG5 + 4*VH5) - (10000*UA5 + 4*UB5 + 7*UC5 + 5*UD5 + 374615*UE5) <=0;
(310*VF5 + 3*VG5 + 2*VH5) - (4000*UA5 + 2*UB5 + 2*UC5 + 2*UD5 + 224382*UE5) <=0;
(259*VF5 + 3*VG5 + 3*VH5) - (5500*UA5 + 2*UB5 + 50*UC5 + 5*UD5 + 194903*UE5) <=0;
(277*VF5 + 3*VG5 + 3*VH5) - (2000*UA5 + 8*UB5 + 2*UC5 + 6*UD5 + 173934*UE5) <=0;

UA5 >=0;
UB5 >=0;
UC5 >=0;
UD5 >=0;
UE5 >=0;
VF5 >=0;
VG5 >=0;
VH5 >=0;

```

## Solutions/Weights of Primal Problem

Global optimal solution found.

Variable	Value	Reduced Cost
VF5	0.2093802E-03	0.000000
VG5	0.000000	0.000000
VH5	0.000000	0.000000
UA5	0.000000	0.000000
UB5	0.000000	0.000000
UC5	0.000000	0.000000
UD5	0.250000	0.000000
UE5	0.000000	0.000000

## Dual Problem Formulation

```

!Dual Objective Function;

MIN = X5;

!Subject to;
13100*Y15 + 2000*Y25 + 550*Y35 + 9800*Y45 + 7500*Y55 + 550*Y65 + 4800*Y75 + 10250*Y85 + 2300*Y95 +
1000*Y105 + 20700*Y115 + 1200*Y125 + 11000*Y135 + 4100*Y145 + 2000*Y155 +
21000*Y165 + 500*Y175 + 2152*Y185 + 9700*Y195 + 15000*Y205 + 9000*Y215 + 4600*Y225 + 2000*Y235 +
37324*Y245 + 11000*Y255 + 10000*Y265 + 4000*Y275 + 5500*Y285 + 2000*Y295 - 7500*X5 <= 0;

7*Y15 + 2*Y25 + 2*Y35 + 14*Y45 + 4*Y55 + 2*Y65 + 3*Y75 + 5*Y85 + 2*Y95 + 1*Y105 + 21*Y115 + 6*Y125 +
13*Y135 + 2*Y145 + 2*Y155 + 5*Y165 + 2*Y175 + 4*Y185 + 5*Y195 + 15*Y205 +
+ 6*Y215 + 5*Y225 + 2*Y235 + 48*Y245 + 9*Y255 + 4*Y265 + 2*Y275 + 2*Y285 + 8*Y295 - 4*X5 <= 0;

320*Y15 + 7*Y25 + 2*Y35 + 10*Y45 + 7*Y55 + 2*Y65 + 7*Y75 + 20*Y85 + 7*Y95 + 30*Y105 + 200*Y115 +
7*Y125 + 200*Y135 + 7*Y145 + 2*Y155 + 338*Y165 + 2*Y175 + 48*Y185 + 7*Y195 +
200*Y205 + 7*Y215 + 7*Y225 + 7*Y235 + 550*Y245 + 200*Y255 + 7*Y265 + 2*Y275 + 50*Y285 + 2*Y295 - 7*X5
<= 0;

9*Y15 + 4*Y25 + 2*Y35 + 9*Y45 + 4*Y55 + 6*Y65 + 7*Y75 + 7*Y85 + 4*Y95 + 4*Y105 + 11*Y115 + 5*Y125 +
12*Y135 + 3*Y145 + 3*Y155 + 10*Y165 + 2*Y175 + 7*Y185 + 5*Y195 +
12*Y205 + 7*Y215 + 5*Y225 + 2*Y235 + 25*Y245 + 9*Y255 + 5*Y265 + 2*Y275 + 5*Y285 + 6*Y295 - 4*X5 <= 0;

820931*Y15 + 147596*Y25 + 86404*Y35 + 584300*Y45 + 238265*Y55 + 147473*Y65 + 420908*Y75 +
239046*Y85 + 171183*Y95 + 86967*Y105 + 142521*Y115 + 1372680*Y125 + 119500*Y135 +
247573*Y145 + 93157*Y155 + 1994765*Y165 + 29538*Y175 + 226845*Y185 + 117310*Y195 + 955890*Y205 +
3333230*Y215 + 2349633*Y225 + 139434*Y235 + 2090879*Y245 + 755723*Y255 +
374615*Y265 + 224382*Y275 + 194903*Y285 + 173934*Y295 - 238265*X5 <= 0;

229*Y15 + 354*Y25 + 115*Y35 + 5827*Y45 + 4776*Y55 + 152*Y65 + 661*Y75 + 1019*Y85 + 278*Y95 + 60*Y105 +
2155*Y115 + 908*Y125 + 2593*Y135 + 272*Y145 + 64*Y155 +
1053*Y165 + 137*Y175 + 138*Y185 + 523*Y195 + 1222*Y205 + 1674*Y215 + 554*Y225 + 197*Y235 + 5794*Y245 +
1505*Y255 + 1347*Y265 + 310*Y275 + 259*Y285 + 277*Y295 >= 4776;

3*Y15 + 3*Y25 + 3*Y35 + 3*Y45 + 3*Y55 + 3*Y65 + 3*Y75 + 3*Y85 + 3*Y95 + 3*Y105 + 3*Y115 + 3*Y125 +
3*Y135 + 3*Y145 + 3*Y155 + 3*Y165 + 3*Y175 + 3*Y185 + 3*Y195 + 3*Y205 +
3*Y215 + 3*Y225 + 3*Y235 + 3*Y245 + 3*Y255 + 3*Y265 + 3*Y275 + 3*Y285 + 3*Y295 >= 3 ;

4*Y15 + 3*Y25 + 1*Y35 + 4*Y45 + 3*Y55 + 1*Y65 + 3*Y75 + 4*Y85 + 2*Y95 + 1*Y105 + 4*Y115 + 2*Y125 +
4*Y135 + 3*Y145 + 2*Y155 + 4*Y165 + 1*Y175 + 2*Y185 + 3*Y195 + 4*Y205 +
3*Y215 + 3*Y225 + 2*Y235 + 4*Y245 + 3*Y255 + 4*Y265 + 2*Y275 + 3*Y285 + 3*Y295 >= 3 ;

@Free(X5);
Y15 >=0; Y25 >=0; Y35 >=0; Y45 >=0; Y55 >=0; Y65 >=0; Y75 >=0; Y85 >=0; Y95 >=0; Y105 >=0;
Y115 >=0; Y125 >=0; Y135 >=0; Y145 >=0; Y155 >=0; Y165 >=0; Y175 >=0; Y185 >=0; Y195 >=0; Y205 >=0;
Y215 >=0; Y225 >=0; Y235 >=0; Y245 >=0; Y255 >=0; Y265 >=0; Y275 >=0; Y285 >=0; Y295 >=0;

```

## Solutions of Dual Problem

The screenshot shows the LINGO software interface with the following details:

- Global optimal solution found.**
- Objective value:** 1.000000
- Infeasibilities:** 0.000000
- Total solver iterations:** 2

Variable	Value	Reduced Cost
X5	1.000000	-0.9172350E-16
Y15	0.000000	3.459818
Y25	0.000000	0.5459019
Y35	0.000000	0.3384461
Y45	0.000000	1.230744
Y55	1.000000	0.000000
Y65	0.000000	0.5866282
Y75	0.000000	1.627024
Y85	0.000000	0.7926524
Y95	0.000000	0.6606637
Y105	0.000000	0.3582182
Y115	0.000000	0.1881854
Y125	0.000000	5.564012

Y135	0.000000	0.2081668E-16
Y145	0.000000	0.9820567
Y155	0.000000	0.3774251
Y165	0.000000	8.210407
Y175	0.000000	0.9552456E-01
Y185	0.000000	0.9318809
Y195	0.000000	0.3835935
Y205	0.000000	3.792221
Y215	0.000000	13.61994
Y225	0.000000	9.732367
Y235	0.000000	0.5445691
Y245	0.000000	7.665179
Y255	0.000000	2.894102
Y265	0.000000	1.289383
Y275	0.000000	0.8758580
Y285	0.000000	0.7731040
Y295	0.000000	0.6713490

## SUMMARY

Efficiency score of Warehouse 5 (Bhiwandi) = 1

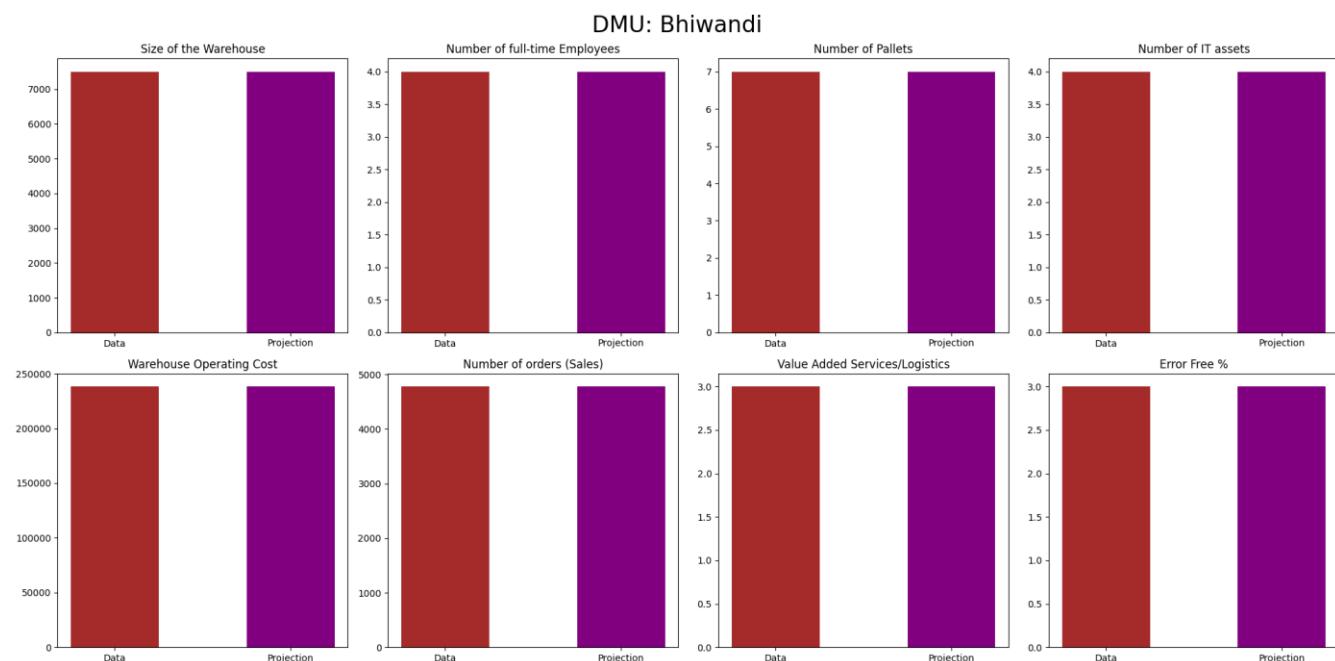
Warehouse 5 (Bhiwandi) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	7500	7500	0
No. of Full-time Employees	4	4	0
No. of Pallets	7	7	0
No. of IT assets	4	4	0
Warehouse Operating Cost	238265	238265	0
No. of Orders (Sales)	4776	4776	0
Level of Value-Added Services	3	3	0
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 5 (Bhiwandi)	1



## WAREHOUSE 6 (BHOPAL)

### Primal Problem Formulation

```

!Objective Function;
MAX = 152*VF6 + 3*VG6 + 1*VH6;

!Subject to;

550*UA6 + 2*UB6 + 2*UC6 + 3*UD6 + 147473*UE6 = 1;
(229*VF6 + 3*VG6 + 4*VH6) - (13100*UA6 + 7*UB6 + 320*UC6 + 9*UD6 + 820931*UE6) <=0;
(354*VF6 + 3*VG6 + 3*VH6) - (2000*UA6 + 2*UB6 + 7*UC6 + 4*UD6 + 147596*UE6) <=0;
(115*VF6 + 3*VG6 + 1*VH6) - (550*UA6 + 2*UB6 + 2*UC6 + 2*UD6 + 86404*UE6) <=0;
(5827*VF6 + 3*VG6 + 4*VH6) - (9800*UA6 + 14*UB6 + 10*UC6 + 9*UD6 + 584300*UE6) <=0;
(4776*VF6 + 3*VG6 + 3*VH6) - (7500*UA6 + 4*UB6 + 7*UC6 + 4*UD6 + 238265*UE6) <=0;
(152*VF6 + 3*VG6 + 1*VH6) - (550*UA6 + 2*UB6 + 2*UC6 + 3*UD6 + 147473*UE6) <=0;
(661*VF6 + 3*VG6 + 3*VH6) - (4800*UA6 + 3*UB6 + 7*UC6 + 6*UD6 + 420908*UE6) <=0;
(1019*VF6 + 3*VG6 + 4*VH6) - (10250*UA6 + 5*UB6 + 20*UC6 + 7*UD6 + 239046*UE6) <=0;
(278*VF6 + 3*VG6 + 2*VH6) - (2300*UA6 + 2*UB6 + 7*UC6 + 4*UD6 + 171183*UE6) <=0;
(60*VF6 + 3*VG6 + 1*VH6) - (1000*UA6 + 1*UB6 + 30*UC6 + 4*UD6 + 86967*UE6) <=0;
(2155*VF6 + 3*VG6 + 4*VH6) - (20700*UA6 + 21*UB6 + 200*UC6 + 11*UD6 + 142521*UE6) <=0;
(908*VF6 + 3*VG6 + 2*VH6) - (1200*UA6 + 6*UB6 + 7*UC6 + 5*UD6 + 1372680*UE6) <=0;
(2593*VF6 + 3*VG6 + 4*VH6) - (11000*UA6 + 13*UB6 + 200*UC6 + 12*UD6 + 119500*UE6) <=0;
(272*VF6 + 3*VG6 + 3*VH6) - (4100*UA6 + 2*UB6 + 7*UC6 + 3*UD6 + 247573*UE6) <=0;
(64*VF6 + 3*VG6 + 2*VH6) - (2000*UA6 + 2*UB6 + 2*UC6 + 3*UD6 + 93157*UE6) <=0;
(1053*VF6 + 3*VG6 + 4*VH6) - (21000*UA6 + 5*UB6 + 338*UC6 + 10*UD6 + 1994765*UE6) <=0;
(137*VF6 + 3*VG6 + 1*VH6) - (500*UA6 + 2*UB6 + 2*UC6 + 2*UD6 + 29538*UE6) <=0;
(138*VF6 + 3*VG6 + 2*VH6) - (2152*UA6 + 4*UB6 + 48*UC6 + 7*UD6 + 226845*UE6) <=0;
(523*VF6 + 3*VG6 + 3*VH6) - (9700*UA6 + 5*UB6 + 7*UC6 + 5*UD6 + 117310*UE6) <=0;
(1222*VF6 + 3*VG6 + 4*VH6) - (15000*UA6 + 15*UB6 + 200*UC6 + 12*UD6 + 955890*UE6) <=0;
(1674*VF6 + 3*VG6 + 3*VH6) - (9000*UA6 + 6*UB6 + 7*UC6 + 7*UD6 + 3333230*UE6) <=0;
(554*VF6 + 3*VG6 + 3*VH6) - (4600*UA6 + 5*UB6 + 7*UC6 + 5*UD6 + 2349633*UE6) <=0;
(197*VF6 + 3*VG6 + 2*VH6) - (2000*UA6 + 2*UB6 + 7*UC6 + 2*UD6 + 139434*UE6) <=0;
(5794*VF6 + 3*VG6 + 4*VH6) - (37324*UA6 + 48*UB6 + 550*UC6 + 25*UD6 + 2090879*UE6) <=0;
(1505*VF6 + 3*VG6 + 3*VH6) - (11000*UA6 + 9*UB6 + 200*UC6 + 9*UD6 + 755723*UE6) <=0;
(1347*VF6 + 3*VG6 + 4*VH6) - (10000*UA6 + 4*UB6 + 7*UC6 + 5*UD6 + 374615*UE6) <=0;
(310*VF6 + 3*VG6 + 2*VH6) - (4000*UA6 + 2*UB6 + 2*UC6 + 2*UD6 + 224382*UE6) <=0;
(259*VF6 + 3*VG6 + 3*VH6) - (5500*UA6 + 2*UB6 + 50*UC6 + 5*UD6 + 194903*UE6) <=0;
(277*VF6 + 3*VG6 + 3*VH6) - (2000*UA6 + 8*UB6 + 2*UC6 + 6*UD6 + 173934*UE6) <=0;

UA6 >=0;
UB6 >=0;
UC6 >=0;
UD6 >=0;
UE6 >=0;
VF6 >=0;
VG6 >=0;
VH6 >=0;

```

### Solutions/Weights of Primal Problem

Variable	Value	Reduced Cost
VF6	0.5628027E-03	0.000000
VG6	0.3048180	0.000000
VH6	0.000000	0.000000
UA6	0.1153199E-05	0.000000
UB6	0.4551481	0.000000
UC6	0.1313891E-03	0.000000
UD6	0.000000	0.000000
UE6	0.000000	0.000000

### Dual Problem Formulation

```

!Dual Objective Function;

MIN = X6;

!Subject to;
13100*Y16 + 2000*Y26 + 550*Y36 + 9800*Y46 + 7500*Y56 + 550*Y66 + 4800*Y76 + 10250*Y86 + 2300*Y96 +
1000*Y106 + 20700*Y116 + 1200*Y126 + 11000*Y136 + 4100*Y146 + 2000*Y156 +
21000*Y166 + 500*Y176 + 2152*Y186 + 9700*Y196 + 15000*Y206 + 9000*Y216 + 4600*Y226 + 2000*Y236 +
37324*Y246 + 11000*Y256 + 10000*Y266 + 4000*Y276 + 5500*Y286 + 2000*Y296 - 550*X6 <=0;

7*Y16 + 2*Y26 + 2*Y36 + 14*Y46 + 4*Y56 + 2*Y66 + 3*Y76 + 5*Y86 + 2*Y96 + 1*Y106 + 21*Y116 + 6*Y126 +
13*Y136 + 2*Y146 + 2*Y156 + 5*Y166 + 2*Y176 + 4*Y186 + 5*Y196 + 15*Y206
+ 6*Y216 + 5*Y226 + 2*Y236 + 48*Y246 + 9*Y256 + 4*Y266 + 2*Y276 + 2*Y286 + 8*Y296 - 2*X6 <=0;

320*Y16 + 7*Y26 + 2*Y36 + 10*Y46 + 7*Y56 + 2*Y66 + 7*Y76 + 20*Y86 + 7*Y96 + 30*Y106 + 200*Y116 +
7*Y126 + 200*Y136 + 7*Y146 + 2*Y156 + 338*Y166 + 2*Y176 + 48*Y186 + 7*Y196 +
200*Y206 + 7*Y216 + 7*Y226 + 7*Y236 + 550*Y246 + 200*Y256 + 7*Y266 + 2*Y276 + 50*Y286 + 2*Y296 - 2*X6
<= 0;

9*Y16 + 4*Y26 + 2*Y36 + 9*Y46 + 4*Y56 + 3*Y66 + 6*Y76 + 7*Y86 + 4*Y96 + 4*Y106 + 11*Y116 + 5*Y126 +
12*Y136 + 3*Y146 + 3*Y156 + 10*Y166 + 2*Y176 + 7*Y186 + 5*Y196 +
12*Y206 + 7*Y216 + 5*Y226 + 2*Y236 + 25*Y246 + 9*Y256 + 5*Y266 + 2*Y276 + 5*Y286 + 6*Y296 - 3*X6 <= 0;

820931*Y16 + 147596*Y26 + 86404*Y36 + 584300*Y46 + 238265*Y56 + 147473*Y66 + 420908*Y76 +
239046*Y86 + 171183*Y96 + 86967*Y106 + 142521*Y116 + 1372680*Y126 + 119500*Y136 +
247573*Y146 + 93157*Y156 + 1994765*Y166 + 29538*Y176 + 226845*Y186 + 117310*Y196 + 955890*Y206 +
3333230*Y216 + 2349633*Y226 + 139434*Y236 + 2090879*Y246 + 755723*Y256 +
374615*Y266 + 224382*Y276 + 194903*Y286 + 173934*Y296 - 147473*X6 <= 0;

229*Y16 + 354*Y26 + 115*Y36 + 5827*Y46 + 4776*Y56 + 152*Y66 + 661*Y76 + 1019*Y86 + 278*Y96 + 60*Y106 +
2155*Y116 + 908*Y126 + 2593*Y136 + 272*Y146 + 64*Y156 +
1053*Y166 + 137*Y176 + 138*Y186 + 523*Y196 + 1222*Y206 + 1674*Y216 + 554*Y226 + 197*Y236 + 5794*Y246 +
1505*Y256 + 1347*Y266 + 310*Y276 + 259*Y286 + 277*Y296 >= 152;

3*Y16 + 3*Y26 + 3*Y36 + 3*Y46 + 3*Y56 + 3*Y66 + 3*Y76 + 3*Y86 + 3*Y96 + 3*Y106 + 3*Y116 + 3*Y126 +
3*Y136 + 3*Y146 + 3*Y156 + 3*Y166 + 3*Y176 + 3*Y186 + 3*Y196 + 3*Y206 +
3*Y216 + 3*Y226 + 3*Y236 + 3*Y246 + 3*Y256 + 3*Y266 + 3*Y276 + 3*Y286 + 3*Y296 >= 3;

4*Y16 + 3*Y26 + 1*Y36 + 4*Y46 + 3*Y56 + 1*Y66 + 3*Y76 + 4*Y86 + 2*Y96 + 1*Y106 + 4*Y116 + 2*Y126 +
4*Y136 + 3*Y146 + 2*Y156 + 4*Y166 + 1*Y176 + 2*Y186 + 3*Y196 + 4*Y206 +
3*Y216 + 3*Y226 + 2*Y236 + 4*Y246 + 3*Y256 + 4*Y266 + 2*Y276 + 3*Y286 + 3*Y296 >= 1;

@Free(X6);
Y16 >=0; Y26 >=0; Y36 >=0; Y46 >=0; Y56 >=0; Y66 >=0; Y76 >=0; Y86 >=0; Y96 >=0; Y106 >=0; Y116 >=0;
Y126 >=0; Y136 >=0; Y146 >=0; Y156 >=0; Y166 >=0; Y176 >=0; Y186 >=0; Y196 >=0; Y206 >=0;
Y216 >=0; Y226 >=0; Y236 >=0; Y246 >=0; Y256 >=0; Y266 >=0; Y276 >=0; Y286 >=0; Y296 >=0;

```

## Solutions of Dual Problem

Variable	Value	Reduced Cost
X6	1.000000	0.4163336E-16
Y16	0.000000	7.896552
Y26	0.000000	0.8620690E-01
Y36	0.000000	0.2220446E-15
Y46	0.000000	5.931034
Y56	0.000000	1.051724
Y66	1.000000	0.1110223E-15
Y76	0.000000	0.5689655
Y86	0.000000	1.758621
Y96	0.000000	0.8620690E-01
Y106	0.000000	0.1665335E-15
Y116	0.000000	12.58621
Y126	0.000000	2.017241

Y136	0.000000	8.724138
Y146	0.000000	0.8620690E-01
Y156	0.000000	0.1526557E-15
Y166	0.000000	7.241379
Y176	0.000000	0.2081668E-15
Y186	0.000000	1.758621
Y196	0.000000	1.534483
Y206	0.000000	9.689655
Y216	0.000000	2.017241
Y226	0.000000	1.534483
Y236	0.000000	0.8620690E-01
Y246	0.000000	31.65517
Y256	0.000000	6.793103
Y266	0.000000	1.051724
Y276	0.000000	0.9714451E-16
Y286	0.000000	0.8275862
Y296	0.000000	2.896552

## SUMMARY

Efficiency score of Warehouse 6 (Bhopal) = 1

Warehouse 6 (Bhopal) is an efficient warehouse.

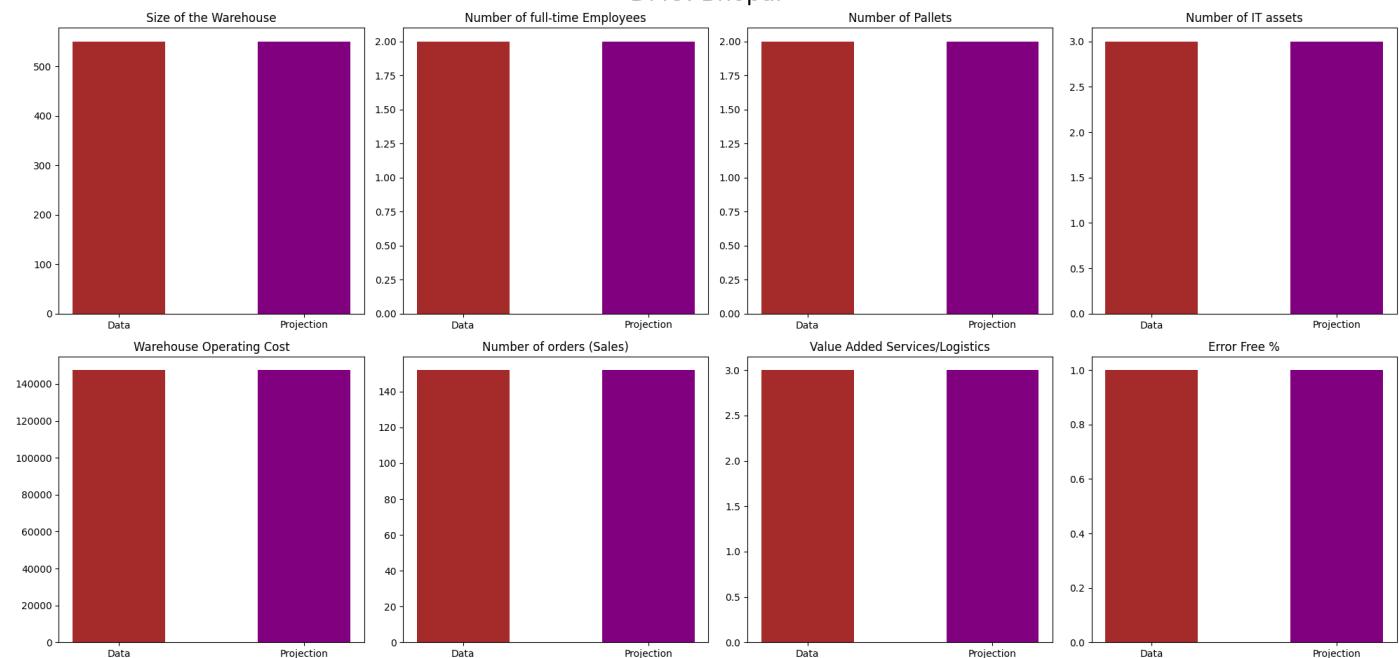
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	550	550	0
No. of Full-time Employees	2	2	0
No. of Pallets	2	2	0
No. of IT assets	3	3	0
Warehouse Operating Cost	147473	147473	0
No. of Orders (Sales)	152	152	0
Level of Value-Added Services	3	3	0
Error Free (%)	4	1	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 6 (Bhopal)	1

DMU: Bhopal



# WAREHOUSE 7 (BHUBANESHWAR)

## Primal Problem Formulation

```

!Objective Function;
MAX = 661*VF7 + 3*VG7 + 3*VH7;

!Subject to;

4800*UA7 + 3*UB7 + 7*UC7 + 6*UD7 + 420908*UE7 = 1;
(229*VF7 + 3*VG7 + 4*VH7) - (13100*UA7 + 7*UB7 + 320*UC7 + 9*UD7 + 820931*UE7) <=0;
(354*VF7 + 3*VG7 + 3*VH7) - (2000*UA7 + 2*UB7 + 7*UC7 + 4*UD7 + 147596*UE7) <=0;
(115*VF7 + 3*VG7 + 1*VH7) - (550*UA7 + 2*UB7 + 2*UC7 + 2*UD7 + 86404*UE7) <=0;
(5827*VF7 + 3*VG7 + 4*VH7) - (9800*UA7 + 14*UB7 + 10*UC7 + 9*UD7 + 584300*UE7) <=0;
(4776*VF7 + 3*VG7 + 3*VH7) - (7500*UA7 + 4*UB7 + 7*UC7 + 4*UD7 + 238265*UE7) <=0;
(152*VF7 + 3*VG7 + 1*VH7) - (550*UA7 + 2*UB7 + 2*UC7 + 3*UD7 + 147473*UE7) <=0;
(661*VF7 + 3*VG7 + 3*VH7) - (4800*UA7 + 3*UB7 + 7*UC7 + 6*UD7 + 420908*UE7) <=0;
(1019*VF7 + 3*VG7 + 4*VH7) - (10250*UA7 + 5*UB7 + 20*UC7 + 7*UD7 + 239046*UE7) <=0;
(278*VF7 + 3*VG7 + 2*VH7) - (2300*UA7 + 2*UB7 + 7*UC7 + 4*UD7 + 171183*UE7) <=0;
(60*VF7 + 3*VG7 + 1*VH7) - (1000*UA7 + 1*UB7 + 30*UC7 + 4*UD7 + 86967*UE7) <=0;
(2155*VF7 + 3*VG7 + 4*VH7) - (20700*UA7 + 21*UB7 + 200*UC7 + 11*UD7 + 142521*UE7) <=0;
(908*VF7 + 3*VG7 + 2*VH7) - (1200*UA7 + 6*UB7 + 7*UC7 + 5*UD7 + 1372680*UE7) <=0;
(2593*VF7 + 3*VG7 + 4*VH7) - (11000*UA7 + 13*UB7 + 200*UC7 + 12*UD7 + 119500*UE7) <=0;
(272*VF7 + 3*VG7 + 3*VH7) - (4100*UA7 + 2*UB7 + 7*UC7 + 3*UD7 + 247573*UE7) <=0;
(64*VF7 + 3*VG7 + 2*VH7) - (2000*UA7 + 2*UB7 + 2*UC7 + 3*UD7 + 93157*UE7) <=0;
(1053*VF7 + 3*VG7 + 4*VH7) - (21000*UA7 + 5*UB7 + 338*UC7 + 10*UD7 + 1994765*UE7) <=0;
(137*VF7 + 3*VG7 + 1*VH7) - (500*UA7 + 2*UB7 + 2*UC7 + 2*UD7 + 29538*UE7) <=0;
(138*VF7 + 3*VG7 + 2*VH7) - (2152*UA7 + 4*UB7 + 48*UC7 + 7*UD7 + 226845*UE7) <=0;
(523*VF7 + 3*VG7 + 3*VH7) - (9700*UA7 + 5*UB7 + 7*UC7 + 5*UD7 + 117310*UE7) <=0;
(1222*VF7 + 3*VG7 + 4*VH7) - (15000*UA7 + 15*UB7 + 200*UC7 + 12*UD7 + 955890*UE7) <=0;
(1674*VF7 + 3*VG7 + 3*VH7) - (9000*UA7 + 6*UB7 + 7*UC7 + 7*UD7 + 3333230*UE7) <=0;
(554*VF7 + 3*VG7 + 3*VH7) - (4600*UA7 + 5*UB7 + 7*UC7 + 5*UD7 + 2349633*UE7) <=0;
(197*VF7 + 3*VG7 + 2*VH7) - (2000*UA7 + 2*UB7 + 7*UC7 + 2*UD7 + 139434*UE7) <=0;
(5794*VF7 + 3*VG7 + 4*VH7) - (37324*UA7 + 48*UB7 + 550*UC7 + 25*UD7 + 2090879*UE7) <=0;
(1505*VF7 + 3*VG7 + 3*VH7) - (11000*UA7 + 9*UB7 + 200*UC7 + 9*UD7 + 755723*UE7) <=0;
(1347*VF7 + 3*VG7 + 4*VH7) - (10000*UA7 + 4*UB7 + 7*UC7 + 5*UD7 + 374615*UE7) <=0;
(310*VF7 + 3*VG7 + 2*VH7) - (4000*UA7 + 2*UB7 + 2*UC7 + 2*UD7 + 224382*UE7) <=0;
(259*VF7 + 3*VG7 + 3*VH7) - (5500*UA7 + 2*UB7 + 50*UC7 + 5*UD7 + 194903*UE7) <=0;
(277*VF7 + 3*VG7 + 3*VH7) - (2000*UA7 + 8*UB7 + 2*UC7 + 6*UD7 + 173934*UE7) <=0;

UA7 >=0;
UB7 >=0;
UC7 >=0;
UD7 >=0;
UE7 >=0;
VF7 >=0;
VG7 >=0;
VH7 >=0;

```

## Solutions/Weights of the Primal Problem

LINGO 11.0 - [Solution Report - warehouse 7 PP]

File Edit LINGO Window Help

Global optimal solution found.

Objective value:	0.8152891
Infeasibilities:	0.000000
Total solver iterations:	13

Variable	Value	Reduced Cost
VF7	0.9701203E-04	-0.2557954E-12
VG7	0.000000	0.4848661
VH7	0.2503880	0.000000
UA7	0.000000	283.1975
UB7	0.2144936	0.000000
UC7	0.5093132E-01	0.000000
UD7	0.000000	1.214979
UE7	0.000000	128920.9

## Dual Problem Formulation

```

!Dual Objective Function;

MIN = X7;

!Subject to;
13100*Y17 + 2000*Y27 + 550*Y37 + 9800*Y47 + 7500*Y57 + 550*Y67 + 4800*Y77 + 10250*Y87 + 2300*Y97 +
1000*Y107 + 20700*Y117 + 1200*Y127 + 11000*Y137 + 4100*Y147 + 2000*Y157 +
21000*Y167 + 500*Y177 + 2152*Y187 + 9700*Y197 + 15000*Y207 + 9000*Y217 + 4600*Y227 + 2000*Y237 +
37324*Y247 + 11000*Y257 + 10000*Y267 + 4000*Y277 + 5500*Y287 + 2000*Y297 - 4800*X7 <= 0;

7*Y17 + 2*Y27 + 2*Y37 + 14*Y47 + 4*Y57 + 2*Y67 + 3*Y77 + 5*Y87 + 2*Y97 + 1*Y107 + 21*Y117 + 6*Y127 +
13*Y137 + 2*Y147 + 2*Y157 + 5*Y167 + 2*Y177 + 4*Y187 + 5*Y197 + 15*Y207 +
+ 6*Y217 + 5*Y227 + 2*Y237 + 48*Y247 + 9*Y257 + 4*Y267 + 2*Y277 + 2*Y287 + 8*Y297 - 3*X7 <= 0;

320*Y17 + 7*Y27 + 2*Y37 + 10*Y47 + 7*Y57 + 2*Y67 + 7*Y77 + 20*Y87 + 7*Y97 + 30*Y107 + 200*Y117 +
7*Y127 + 200*Y137 + 7*Y147 + 2*Y157 + 338*Y167 + 2*Y177 + 48*Y187 + 7*Y197 +
200*Y207 + 7*Y217 + 7*Y227 + 7*Y237 + 550*Y247 + 200*Y257 + 7*Y267 + 2*Y277 + 50*Y287 + 2*Y297 - 7*X7
<=0;

9*Y17 + 4*Y27 + 2*Y37 + 9*Y47 + 4*Y57 + 3*Y67 + 6*Y77 + 7*Y87 + 4*Y97 + 4*Y107 + 11*Y117 + 5*Y127 +
12*Y137 + 3*Y147 + 3*Y157 + 10*Y167 + 2*Y177 + 7*Y187 + 5*Y197 +
12*Y207 + 7*Y217 + 5*Y227 + 2*Y237 + 25*Y247 + 9*Y257 + 5*Y267 + 2*Y277 + 5*Y287 + 6*Y297 - 6*X7 <=0;

820931*Y17 + 147596*Y27 + 86404*Y37 + 584300*Y47 + 238265*Y57 + 147473*Y67 + 420908*Y77 +
239046*Y87 + 171183*Y97 + 86967*Y107 + 142521*Y117 + 1372680*Y127 + 119500*Y137 +
247573*Y147 + 93157*Y157 + 1994765*Y167 + 29538*Y177 + 226845*Y187 + 117310*Y197 + 955890*Y207 +
3333230*Y217 + 2349633*Y227 + 139434*Y237 + 2090879*Y247 + 755723*Y257 +
374615*Y267 + 224382*Y277 + 194903*Y287 + 173934*Y297 - 420908*X7 <=0;

229*Y17 + 354*Y27 + 115*Y37 + 5827*Y47 + 4776*Y57 + 152*Y67 + 661*Y77 + 1019*Y87 + 278*Y97 + 60*Y107 +
2155*Y117 + 908*Y127 + 2593*Y137 + 272*Y147 + 64*Y157 +
1053*Y167 + 137*Y177 + 138*Y187 + 523*Y197 + 1222*Y207 + 1674*Y217 + 554*Y227 + 197*Y237 + 5794*Y247 +
1505*Y257 + 1347*Y267 + 310*Y277 + 259*Y287 + 277*Y297 >=661;

3*Y17 + 3*Y27 + 3*Y37 + 3*Y47 + 3*Y57 + 3*Y67 + 3*Y77 + 3*Y87 + 3*Y97 + 3*Y107 + 3*Y117 + 3*Y127 +
3*Y137 + 3*Y147 + 3*Y157 + 3*Y167 + 3*Y177 + 3*Y187 + 3*Y197 + 3*Y207 +
3*Y217 + 3*Y227 + 3*Y237 + 3*Y247 + 3*Y257 + 3*Y267 + 3*Y277 + 3*Y287 + 3*Y297 >= 3;

4*Y17 + 3*Y27 + 1*Y37 + 4*Y47 + 3*Y57 + 1*Y67 + 3*Y77 + 4*Y87 + 2*Y97 + 1*Y107 + 4*Y117 + 2*Y127 +
4*Y137 + 3*Y147 + 2*Y157 + 4*Y167 + 1*Y177 + 2*Y187 + 3*Y197 + 4*Y207 +
3*Y217 + 3*Y227 + 2*Y237 + 4*Y247 + 3*Y257 + 4*Y267 + 2*Y277 + 3*Y287 + 3*Y297 >= 3;

@Free(X7);
Y17 >=0; Y27 >=0; Y37 >=0; Y47 >=0; Y57 >=0; Y67 >=0; Y77 >=0; Y87 >=0; Y97 >=0; Y107 >=0; Y117 >=0;
Y127 >=0; Y137 >=0; Y147 >=0; Y157 >=0; Y167 >=0; Y177 >=0; Y187 >=0; Y197 >=0; Y207 >=0; Y217 >=0;
Y227 >=0; Y237 >=0; Y247 >=0; Y257 >=0; Y267 >=0; Y277 >=0; Y287 >=0; Y297 >=0;

```

## Solutions of Dual Problem

Variable	Value	Reduced Cost
X7	0.8152891	0.1110223E-15
Y17	0.000000	16.77571
Y27	0.6154443	-0.5551115E-16
Y37	0.000000	0.2693054
Y47	0.000000	1.945382
Y57	0.6131160E-01	-0.2109424E-14
Y67	0.000000	0.2657159
Y77	0.000000	0.1847109
Y87	0.000000	0.9906868
Y97	0.000000	0.2577610
Y107	0.000000	1.486224
Y117	0.000000	13.48002
Y127	0.000000	1.054618
Y137	0.000000	11.72158
Y147	0.000000	0.7954986E-02
Y157	0.000000	0.2386496E-01
Y167	0.000000	17.18355
Y177	0.000000	0.2671711
Y187	0.000000	2.788514
Y197	0.000000	0.6270858

Y207	0.000000	12.28357
Y217	0.000000	0.7299185
Y227	0.000000	0.6240784
Y237	0.000000	0.2656189
Y247	0.000000	36.74428
Y257	0.000000	11.21954
Y267	0.000000	0.8226620E-01
Y277	0.4848661	0.000000
Y287	0.000000	2.199263
Y297	0.000000	1.039775

## SUMMARY

Efficiency score of Warehouse 7 (Bhubaneshwar) = 0.8152891

Warehouse 7 (Bhubaneshwar) is not an efficient/Inefficient warehouse.

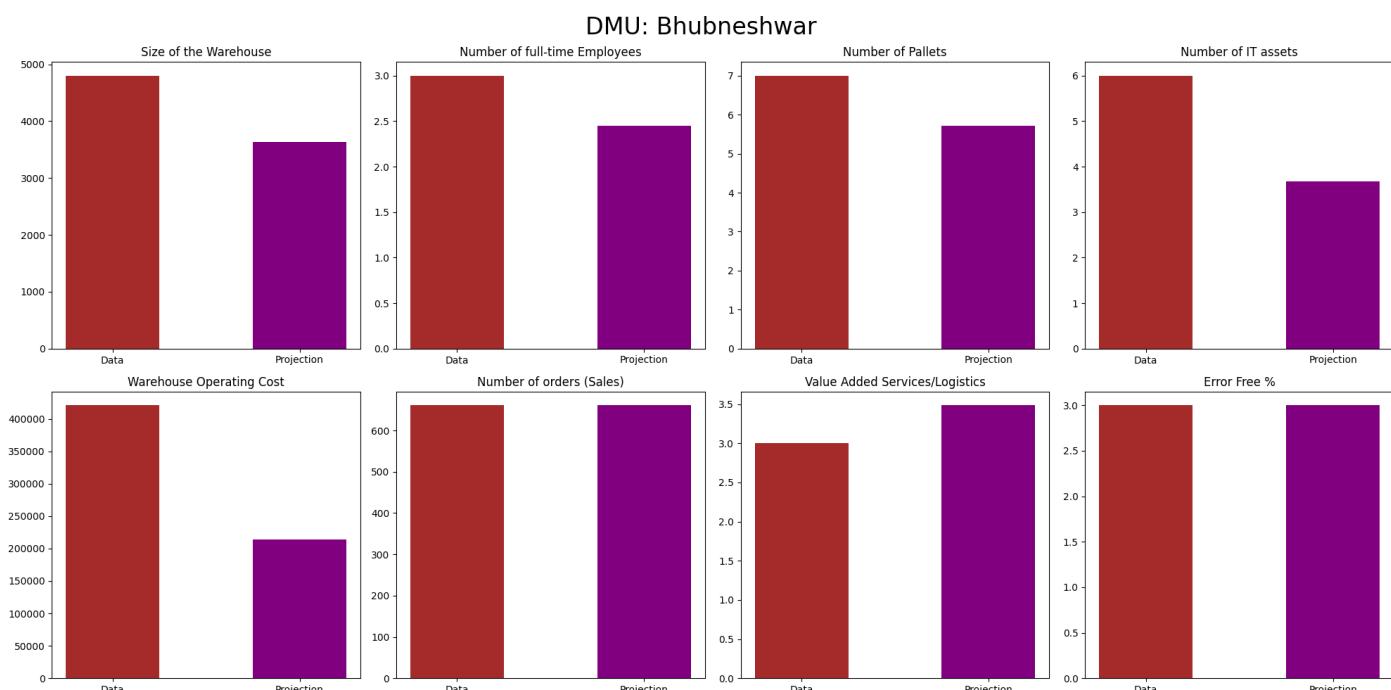
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	4800	3630.19	28.198
No. of Full-time Employees	3	2.44587	0
No. of Pallets	7	5.70702	0
No. of IT assets	6	3.67676	1.215
Warehouse Operating Cost	420908	214241	128921
No. of Orders (Sales)	661	661	0
Level of Value-Added Services	3	3.48487	0.485
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 2 (Ahmedabad)	0.615
Warehouse 5 (Bhiwandi)	0.061
Warehouse 27 (Raipur)	0.485

In order to make warehouse 7 (Bhubaneshwar) efficient, they need to decrease size of the warehouse by 24.371%, No of full-time employees by 18.471%, number of pallets by 18.471%, IT Assets by 38.721%, operating cost by 49.1%, whereas value-added logistics needs to be increased by 16.162%.



# WAREHOUSE 8 (CHENNAI)

## Primal Problem Formulation

```

!Objective Function;

MAX = 1019*VF8 + 3*VG8 + 4*VH8;

!Subject to;

10250*UA8 + 5*UB8 + 20*UC8 + 7*UD8 + 239046*UE8 = 1;
(229*VF8 + 3*VG8 + 4*VH8) - (13100*UA8 + 7*UB8 + 320*UC8 + 9*UD8 + 820931*UE8) <=0;
(354*VF8 + 3*VG8 + 3*VH8) - (2000*UA8 + 2*UB8 + 7*UC8 + 4*UD8 + 147596*UE8) <=0;
(115*VF8 + 3*VG8 + 1*VH8) - (550*UA8 + 2*UB8 + 2*UC8 + 2*UD8 + 86404*UE8) <=0;
(5827*VF8 + 3*VG8 + 4*VH8) - (9800*UA8 + 14*UB8 + 10*UC8 + 9*UD8 + 584300*UE8) <=0;
(4776*VF8 + 3*VG8 + 3*VH8) - (7500*UA8 + 4*UB8 + 7*UC8 + 4*UD8 + 238265*UE8) <=0;
(152*VF8 + 3*VG8 + 1*VH8) - (550*UA8 + 2*UB8 + 2*UC8 + 3*UD8 + 147473*UE8) <=0;
(661*VF8 + 3*VG8 + 3*VH8) - (4800*UA8 + 3*UB8 + 7*UC8 + 6*UD8 + 420908*UE8) <=0;
(1019*VF8 + 3*VG8 + 4*VH8) - (10250*UA8 + 5*UB8 + 20*UC8 + 7*UD8 + 239046*UE8) <=0;
(278*VF8 + 3*VG8 + 2*VH8) - (2300*UA8 + 2*UB8 + 7*UC8 + 4*UD8 + 171183*UE8) <=0;
(60*VF8 + 3*VG8 + 1*VH8) - (1000*UA8 + 1*UB8 + 30*UC8 + 4*UD8 + 86967*UE8) <=0;
(2155*VF8 + 3*VG8 + 4*VH8) - (20700*UA8 + 21*UB8 + 200*UC8 + 11*UD8 + 142521*UE8) <=0;
(908*VF8 + 3*VG8 + 2*VH8) - (1200*UA8 + 6*UB8 + 7*UC8 + 5*UD8 + 1372680*UE8) <=0;
(2593*VF8 + 3*VG8 + 4*VH8) - (11000*UA8 + 13*UB8 + 200*UC8 + 12*UD8 + 119500*UE8) <=0;
(272*VF8 + 3*VG8 + 3*VH8) - (4100*UA8 + 2*UB8 + 7*UC8 + 3*UD8 + 247573*UE8) <=0;
(64*VF8 + 3*VG8 + 2*VH8) - (2000*UA8 + 2*UB8 + 2*UC8 + 3*UD8 + 93157*UE8) <=0;
(1053*VF8 + 3*VG8 + 4*VH8) - (21000*UA8 + 5*UB8 + 338*UC8 + 10*UD8 + 1994765*UE8) <=0;
(137*VF8 + 3*VG8 + 1*VH8) - (500*UA8 + 2*UB8 + 2*UC8 + 2*UD8 + 29538*UE8) <=0;
(138*VF8 + 3*VG8 + 2*VH8) - (2152*UA8 + 4*UB8 + 48*UC8 + 7*UD8 + 226845*UE8) <=0;
(523*VF8 + 3*VG8 + 3*VH8) - (9700*UA8 + 5*UB8 + 7*UC8 + 5*UD8 + 117310*UE8) <=0;
(1222*VF8 + 3*VG8 + 4*VH8) - (15000*UA8 + 15*UB8 + 200*UC8 + 12*UD8 + 955890*UE8) <=0;
(1674*VF8 + 3*VG8 + 3*VH8) - (9000*UA8 + 6*UB8 + 7*UC8 + 7*UD8 + 3333230*UE8) <=0;
(554*VF8 + 3*VG8 + 3*VH8) - (4600*UA8 + 5*UB8 + 7*UC8 + 5*UD8 + 2349633*UE8) <=0;
(197*VF8 + 3*VG8 + 2*VH8) - (2000*UA8 + 2*UB8 + 7*UC8 + 2*UD8 + 139434*UE8) <=0;
(5794*VF8 + 3*VG8 + 4*VH8) - (37324*UA8 + 48*UB8 + 550*UC8 + 25*UD8 + 2090879*UE8) <=0;
(1505*VF8 + 3*VG8 + 3*VH8) - (11000*UA8 + 9*UB8 + 200*UC8 + 9*UD8 + 755723*UE8) <=0;
(1347*VF8 + 3*VG8 + 4*VH8) - (10000*UA8 + 4*UB8 + 7*UC8 + 5*UD8 + 374615*UE8) <=0;
(310*VF8 + 3*VG8 + 2*VH8) - (4000*UA8 + 2*UB8 + 2*UC8 + 2*UD8 + 224382*UE8) <=0;
(259*VF8 + 3*VG8 + 3*VH8) - (5500*UA8 + 2*UB8 + 50*UC8 + 5*UD8 + 194903*UE8) <=0;
(277*VF8 + 3*VG8 + 3*VH8) - (2000*UA8 + 8*UB8 + 2*UC8 + 6*UD8 + 173934*UE8) <=0;

UA8 >=0;
UB8 >=0;
UC8 >=0;
UD8 >=0;
UE8 >=0;
VF8 >=0;
VG8 >=0;
VH8 >=0;

```

## Solutions/Weights of Primal Problem



Variable	Value	Reduced Cost
VF8	0.4313883E-04	0.5684342E-13
VG8	0.000000	1.000000
VH8	0.1930990	0.000000
UA8	0.000000	2165.903
UB8	0.000000	0.5339827E-01
UC8	0.000000	6.993753
UD8	0.7100964E-01	0.000000
UE8	0.2103915E-05	-0.3637979E-10

## Dual Problem Formulation

```

!Dual Objective Function;

MIN = X8;

!Subject to;
13100*Y18 + 2000*Y28 + 550*Y38 + 9800*Y48 + 7500*Y58 + 550*Y68 + 4800*Y78 + 10250*Y88 + 2300*Y98 +
1000*Y108 + 20700*Y118 + 1200*Y128 + 11000*Y138 + 4100*Y148 + 2000*Y158 +
21000*Y168 + 500*Y178 + 2152*Y188 + 9700*Y198 + 15000*Y208 + 9000*Y218 + 4600*Y228 + 2000*Y238 +
37324*Y248 + 11000*Y258 + 10000*Y268 + 4000*Y278 + 5500*Y288 + 2000*Y298 -10250*X8 <=0;

7*Y18 + 2*Y28 + 2*Y38 + 14*Y48 + 4*Y58 + 2*Y68 + 3*Y78 + 5*Y88 + 2*Y98 + 1*Y108 + 21*Y118 + 6*Y128 +
13*Y138 + 2*Y148 + 2*Y158 + 5*Y168 + 2*Y178 + 4*Y188 + 5*Y198 + 15*Y208 +
6*Y218 + 5*Y228 + 2*Y238 + 48*Y248 + 9*Y258 + 4*Y268 + 2*Y278 + 2*Y288 + 8*Y298 -5*X8 <= 0;

320*Y18 + 7*Y28 + 2*Y38 + 10*Y48 + 7*Y58 + 2*Y68 + 7*Y78 + 20*Y88 + 7*Y98 + 30*Y108 + 200*Y118 +
7*Y128 + 200*Y138 + 7*Y148 + 2*Y158 + 338*Y168 + 2*Y178 + 48*Y188 + 7*Y198 +
200*Y208 + 7*Y218 + 7*Y228 + 7*Y238 + 550*Y248 + 200*Y258 + 7*Y268 + 2*Y278 + 50*Y288 + 2*Y298 -20*X8
<= 0;

9*Y18 + 4*Y28 + 2*Y38 + 9*Y48 + 4*Y58 + 3*Y68 + 6*Y78 + 7*Y88 + 4*Y98 + 4*Y108 + 11*Y118 + 5*Y128 +
12*Y138 + 3*Y148 + 3*Y158 + 10*Y168 + 2*Y178 + 7*Y188 + 5*Y198 +
12*Y208 + 7*Y218 + 5*Y228 + 2*Y238 + 25*Y248 + 9*Y258 + 5*Y268 + 2*Y278 + 5*Y288 + 6*Y298 - 7*X8 <= 0;

820931*Y18 + 147596*Y28 + 86404*Y38 + 584300*Y48 + 238265*Y58 + 147473*Y68 + 420908*Y78 +
239046*Y88 + 171183*Y98 + 86967*Y108 + 142521*Y118 + 1372680*Y128 + 119500*Y138 +
247573*Y148 + 93157*Y158 + 1994765*Y168 + 29538*Y178 + 226845*Y188 + 117310*Y198 + 955890*Y208 +
3333230*Y218 + 2349633*Y228 + 139434*Y238 + 2090879*Y248 + 755723*Y258 +
374615*Y268 + 224382*Y278 + 194903*Y288 + 173934*Y298 - 239046*X8 <=0;

229*Y18 + 354*Y28 + 115*Y38 + 5827*Y48 + 4776*Y58 + 152*Y68 + 661*Y78 + 1019*Y88 + 278*Y98 + 60*Y108 +
2155*Y118 + 908*Y128 + 2593*Y138 + 272*Y148 + 64*Y158 +
1053*Y168 + 137*Y178 + 138*Y188 + 523*Y198 + 1222*Y208 + 1674*Y218 + 554*Y228 + 197*Y238 + 5794*Y248 +
1505*Y258 + 1347*Y268 + 310*Y278 + 259*Y288 + 277*Y298 >= 1019;

3*Y18 + 3*Y28 + 3*Y38 + 3*Y48 + 3*Y58 + 3*Y68 + 3*Y78 + 3*Y88 + 3*Y98 + 3*Y108 + 3*Y118 + 3*Y128 +
3*Y138 + 3*Y148 + 3*Y158 + 3*Y168 + 3*Y178 + 3*Y188 + 3*Y198 + 3*Y208 +
3*Y218 + 3*Y228 + 3*Y238 + 3*Y248 + 3*Y258 + 3*Y268 + 3*Y278 + 3*Y288 + 3*Y298 >=3 ;

4*Y18 + 3*Y28 + 1*Y38 + 4*Y48 + 3*Y58 + 1*Y68 + 3*Y78 + 4*Y88 + 2*Y98 + 1*Y108 + 4*Y118 + 2*Y128 +
4*Y138 + 3*Y148 + 2*Y158 + 4*Y168 + 1*Y178 + 2*Y188 + 3*Y198 + 4*Y208 +
3*Y218 + 3*Y228 + 2*Y238 + 4*Y248 + 3*Y258 + 4*Y268 + 2*Y278 + 3*Y288 + 3*Y298 >=4;

@Free(X8);
Y18 >=0; Y28 >=0; Y38 >=0; Y48 >=0; Y58 >=0; Y68 >=0; Y78 >=0; Y88 >=0; Y98 >=0; Y108 >=0; Y118 >=0;
Y128 >=0; Y138 >=0; Y148 >=0; Y158 >=0; Y168 >=0; Y178 >=0; Y188 >=0; Y198 >=0; Y208 >=0; Y218 >=0;
Y228 >=0; Y238 >=0; Y248 >=0; Y258 >=0; Y268 >=0; Y278 >=0; Y288 >=0; Y298 >=0;

```

### Solutions of Dual Problem:



Global optimal solution found.

Objective value:	0.8163543	
Infeasibilities:	0.000000	
Total solver iterations:	5	
Variable	Value	Reduced Cost
X8	0.8163543	-0.5551115E-16
Y18	0.000000	1.583981
Y28	0.8430534	-0.5551115E-16
Y38	0.000000	0.1257460
Y48	0.000000	0.8446386
Y58	0.1091330	-0.2775558E-16
Y68	0.000000	0.3236435
Y78	0.000000	0.7038009
Y88	0.000000	0.1836457
Y98	0.000000	0.2460026
Y108	0.000000	0.2713225
Y118	0.000000	0.2155981
Y128	0.000000	2.817683
Y138	0.000000	0.2192787
Y148	0.000000	0.1428709
Y158	0.000000	0.2006454E-01
Y168	0.000000	4.089092
Y178	0.000000	0.5155745E-02
Y188	0.000000	0.5821790
Y198	0.3811469	0.5551115E-16

Y208	0.000000	2.038116
Y218	0.000000	6.858390
Y228	0.000000	4.695281
Y238	0.000000	0.4068032E-01
Y248	0.000000	5.151931
Y258	0.000000	1.584843
Y268	0.000000	0.3127026
Y278	0.000000	0.2145290
Y288	0.000000	0.1746377
Y298	0.000000	0.2007539

## SUMMARY

Efficiency score of Warehouse 8 (Chennai) = 0.8163543

Warehouse 8 (Chennai) is an inefficient warehouse.

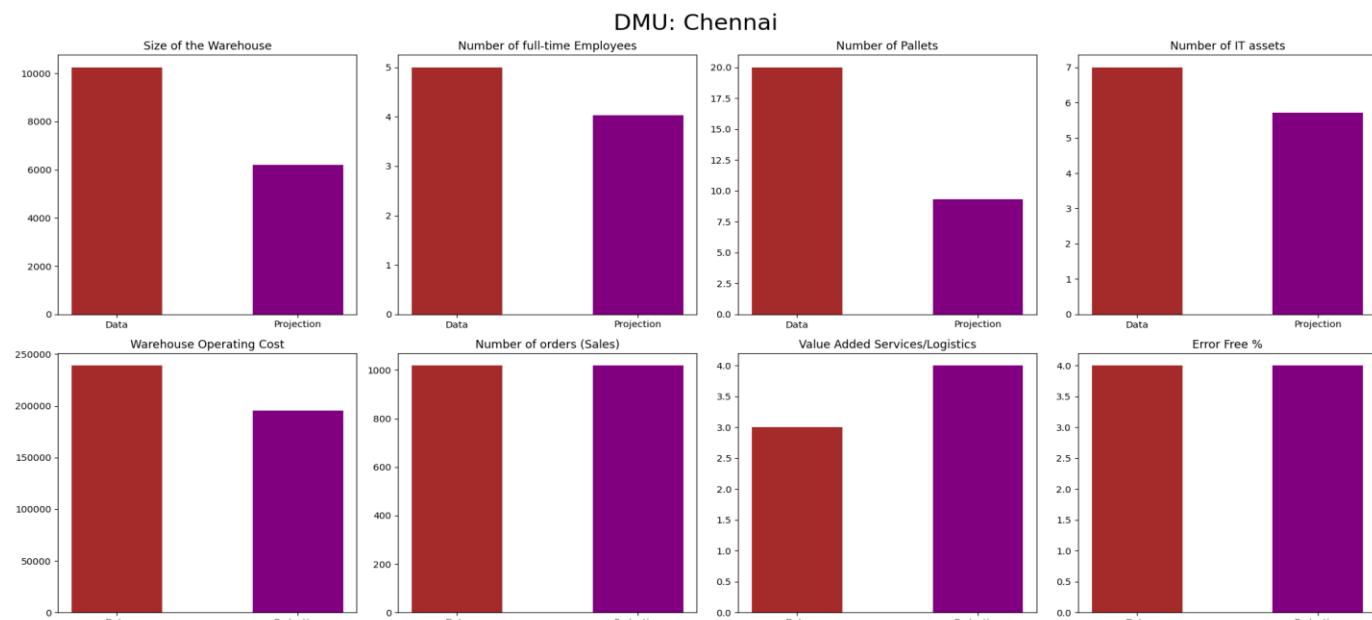
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	10250	6201.73	2165.9
No. of Full-time Employees	5	4.02837	0.053
No. of Pallets	20	9.33333	6.994
No. of IT assets	7	5.71448	0
Warehouse Operating Cost	239046	195146	0
No. of Orders (Sales)	1019	1019	0
Level of Value-Added Services	3	4	1
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 2 (Ahmedabad)	0.8430534
Warehouse 5 (Bhiwandi)	0.109133
Warehouse 19 (Karnal)	0.3811469

In order to make warehouse 8 (Chennai) efficient, they need to decrease size of the warehouse by 39.49%, No of full-time employees by 19.433%, number of pallets by 53.33%, IT Assets by 18.365% ,operating cost by 18.365%, whereas value-added logistics needs to be increased by 33.333%.



# WAREHOUSE 9 (DEHRADUN)

## Primal Problem Formulation

```

!Objective Function;

MAX = 278*VF9 + 3*VG9 + 2*VH9;

!Subject to;

2300*UA9 + 2*UB9 + 7*UC9 + 4*UD9 + 171183*UE9 = 1;
(229*VF9 + 3*VG9 + 4*VH9) - (13100*UA9 + 7*UB9 + 320*UC9 + 9*UD9 + 820931*UE9) <=0;
(354*VF9 + 3*VG9 + 3*VH9) - (2000*UA9 + 2*UB9 + 7*UC9 + 4*UD9 + 147596*UE9) <=0;
(115*VF9 + 3*VG9 + 1*VH9) - (550*UA9 + 2*UB9 + 2*UC9 + 2*UD9 + 86404*UE9) <=0;
(5827*VF9 + 3*VG9 + 4*VH9) - (9800*UA9 + 14*UB9 + 10*UC9 + 9*UD9 + 584300*UE9) <=0;
(4776*VF9 + 3*VG9 + 3*VH9) - (7500*UA9 + 4*UB9 + 7*UC9 + 4*UD9 + 238265*UE9) <=0;
(152*VF9 + 3*VG9 + 1*VH9) - (550*UA9 + 2*UB9 + 2*UC9 + 3*UD9 + 147473*UE9) <=0;
(661*VF9 + 3*VG9 + 3*VH9) - (4800*UA9 + 3*UB9 + 7*UC9 + 6*UD9 + 420908*UE9) <=0;
(1019*VF9 + 3*VG9 + 4*VH9) - (10250*UA9 + 5*UB9 + 20*UC9 + 7*UD9 + 239046*UE9) <=0;
(278*VF9 + 3*VG9 + 2*VH9) - (2300*UA9 + 2*UB9 + 7*UC9 + 4*UD9 + 171183*UE9) <=0;
(60*VF9 + 3*VG9 + 1*VH9) - (1000*UA9 + 1*UB9 + 30*UC9 + 4*UD9 + 86967*UE9) <=0;
(2155*VF9 + 3*VG9 + 4*VH9) - (20700*UA9 + 21*UB9 + 200*UC9 + 11*UD9 + 142521*UE9) <=0;
(908*VF9 + 3*VG9 + 2*VH9) - (1200*UA9 + 6*UB9 + 7*UC9 + 5*UD9 + 1372680*UE9) <=0;
(2593*VF9 + 3*VG9 + 4*VH9) - (11000*UA9 + 13*UB9 + 200*UC9 + 12*UD9 + 119500*UE9) <=0;
(272*VF9 + 3*VG9 + 3*VH9) - (4100*UA9 + 2*UB9 + 7*UC9 + 3*UD9 + 247573*UE9) <=0;
(64*VF9 + 3*VG9 + 2*VH9) - (2000*UA9 + 2*UB9 + 2*UC9 + 3*UD9 + 93157*UE9) <=0;
(1053*VF9 + 3*VG9 + 4*VH9) - (21000*UA9 + 5*UB9 + 338*UC9 + 10*UD9 + 1994765*UE9) <=0;
(137*VF9 + 3*VG9 + 1*VH9) - (500*UA9 + 2*UB9 + 2*UC9 + 2*UD9 + 29538*UE9) <=0;
(138*VF9 + 3*VG9 + 2*VH9) - (2152*UA9 + 4*UB9 + 48*UC9 + 7*UD9 + 226845*UE9) <=0;
(523*VF9 + 3*VG9 + 3*VH9) - (9700*UA9 + 5*UB9 + 7*UC9 + 5*UD9 + 117310*UE9) <=0;
(1222*VF9 + 3*VG9 + 4*VH9) - (15000*UA9 + 15*UB9 + 200*UC9 + 12*UD9 + 955890*UE9) <=0;
(1674*VF9 + 3*VG9 + 3*VH9) - (9000*UA9 + 6*UB9 + 7*UC9 + 7*UD9 + 3333230*UE9) <=0;
(554*VF9 + 3*VG9 + 3*VH9) - (4600*UA9 + 5*UB9 + 7*UC9 + 5*UD9 + 2349633*UE9) <=0;
(197*VF9 + 3*VG9 + 2*VH9) - (2000*UA9 + 2*UB9 + 7*UC9 + 2*UD9 + 139434*UE9) <=0;
(5794*VF9 + 3*VG9 + 4*VH9) - (37324*UA9 + 48*UB9 + 550*UC9 + 25*UD9 + 2090879*UE9) <=0;
(1505*VF9 + 3*VG9 + 3*VH9) - (11000*UA9 + 9*UB9 + 200*UC9 + 9*UD9 + 755723*UE9) <=0;
(1347*VF9 + 3*VG9 + 4*VH9) - (10000*UA9 + 4*UB9 + 7*UC9 + 5*UD9 + 374615*UE9) <=0;
(310*VF9 + 3*VG9 + 2*VH9) - (4000*UA9 + 2*UB9 + 2*UC9 + 2*UD9 + 224382*UE9) <=0;
(259*VF9 + 3*VG9 + 3*VH9) - (5500*UA9 + 2*UB9 + 50*UC9 + 5*UD9 + 194903*UE9) <=0;
(277*VF9 + 3*VG9 + 3*VH9) - (2000*UA9 + 8*UB9 + 2*UC9 + 6*UD9 + 173934*UE9) <=0;

UA9 >=0;
UB9 >=0;
UC9 >=0;
UD9 >=0;
UE9 >=0;
VF9 >=0;
VG9 >=0;
VH9 >=0;

```

## Solutions/Weight of Primal Problem Formulation

LINGO 11.0 - [Solution Report - warehouse 9 PP]

File Edit LINGO Window Help

Global optimal solution found.

Objective value:	0.9514737
Infeasibilities:	0.000000
Total solver iterations:	10

Variable	Value	Reduced Cost
VF9	0.2154281E-03	0.4964917E-12
VG9	0.2794981	0.2220446E-15
VH9	0.2654520E-01	0.6661338E-15
UA9	0.1711115E-04	-0.4405365E-12
UB9	0.4283426	-0.1387779E-15
UC9	0.1435865E-01	0.3885781E-15
UD9	0.000000	0.6879571
UE9	0.2014554E-07	0.1455192E-10

## Dual Problem Formulation

```

!Dual Objective Function;

MIN = X9;

!Subject to;
13100*Y19 + 2000*Y29 + 550*Y39 + 9800*Y49 + 7500*Y59 + 550*Y69 + 4800*Y79 + 10250*Y89 + 2300*Y99 +
1000*Y109 + 20700*Y119 + 1200*Y129 + 11000*Y139 + 4100*Y149 + 2000*Y159 +
21000*Y169 + 500*Y179 + 2152*Y189 + 9700*Y199 + 15000*Y209 + 9000*Y219 + 4600*Y229 + 2000*Y239 +
37324*Y249 + 11000*Y259 + 10000*Y269 + 4000*Y279 + 5500*Y289 + 2000*Y299 - 2300*X9 <=0;

7*Y19 + 2*Y29 + 2*Y39 + 14*Y49 + 4*Y59 + 2*Y69 + 3*Y79 + 5*Y89 + 2*Y99 + 1*Y109 + 21*Y119 + 6*Y129 +
13*Y139 + 2*Y149 + 2*Y159 + 5*Y169 + 2*Y179 + 4*Y189 + 5*Y199 + 15*Y209
+ 6*Y219 + 5*Y229 + 2*Y239 + 48*Y249 + 9*Y259 + 4*Y269 + 2*Y279 + 2*Y289 + 8*Y299 - 2*X9 <=0;

320*Y19 + 7*Y29 + 2*Y39 + 10*Y49 + 7*Y59 + 2*Y69 + 7*Y79 + 20*Y89 + 7*Y99 + 30*Y109 + 200*Y119 +
7*Y129 + 200*Y139 + 7*Y149 + 2*Y159 + 338*Y169 + 2*Y179 + 48*Y189 + 7*Y199 +
200*Y209 + 7*Y219 + 7*Y229 + 7*Y239 + 550*Y249 + 200*Y259 + 7*Y269 + 2*Y279 + 50*Y289 + 2*Y299 - 7*X9
<= 0;

9*Y19 + 4*Y29 + 2*Y39 + 9*Y49 + 4*Y59 + 3*Y69 + 6*Y79 + 7*Y89 + 4*Y99 + 4*Y109 + 11*Y119 + 5*Y129 +
12*Y139 + 3*Y149 + 3*Y159 + 10*Y169 + 2*Y179 + 7*Y189 + 5*Y199 +
12*Y209 + 7*Y219 + 5*Y229 + 2*Y239 + 25*Y249 + 9*Y259 + 5*Y269 + 2*Y279 + 5*Y289 + 6*Y299 - 4*X9 <= 0;

820931*Y19 + 147596*Y29 + 86404*Y39 + 584300*Y49 + 238265*Y59 + 147473*Y69 + 420908*Y79 +
239046*Y89 + 171183*Y99 + 86967*Y109 + 142521*Y119 + 1372680*Y129 + 119500*Y139 +
247573*Y149 + 93157*Y159 + 1994765*Y169 + 29538*Y179 + 226845*Y189 + 117310*Y199 + 955890*Y209 +
3333230*Y219 + 2349633*Y229 + 139434*Y239 + 2090879*Y249 + 755723*Y259 +
374615*Y269 + 224382*Y279 + 194903*Y289 + 173934*Y299 - 171183*X9 <= 0;

229*Y19 + 354*Y29 + 115*Y39 + 5827*Y49 + 4776*Y59 + 152*Y69 + 661*Y79 + 1019*Y89 + 278*Y99 + 60*Y109 +
2155*Y119 + 908*Y129 + 2593*Y139 + 272*Y149 + 64*Y159 +
1053*Y169 + 137*Y179 + 138*Y189 + 523*Y199 + 1222*Y209 + 1674*Y219 + 554*Y229 + 197*Y239 + 5794*Y249 +
1505*Y259 + 1347*Y269 + 310*Y279 + 259*Y289 + 277*Y299 >=278;

3*Y19 + 3*Y29 + 3*Y39 + 3*Y49 + 3*Y59 + 3*Y69 + 3*Y79 + 3*Y89 + 3*Y99 + 3*Y109 + 3*Y119 + 3*Y129 +
3*Y139 + 3*Y149 + 3*Y159 + 3*Y169 + 3*Y179 + 3*Y189 + 3*Y199 + 3*Y209 +
3*Y219 + 3*Y229 + 3*Y239 + 3*Y249 + 3*Y259 + 3*Y269 + 3*Y279 + 3*Y289 + 3*Y299 >=3;

4*Y19 + 3*Y29 + 1*Y39 + 4*Y49 + 3*Y59 + 1*Y69 + 3*Y79 + 4*Y89 + 2*Y99 + 1*Y109 + 4*Y119 + 2*Y129 +
4*Y139 + 3*Y149 + 2*Y159 + 4*Y169 + 1*Y179 + 2*Y189 + 3*Y199 + 4*Y209 +
3*Y219 + 3*Y229 + 2*Y239 + 4*Y249 + 3*Y259 + 4*Y269 + 2*Y279 + 3*Y289 + 3*Y299 >= 2;

@Free(X9);
Y19 >=0; Y29 >=0; Y39 >=0; Y49 >=0; Y59 >=0; Y69 >=0; Y79 >=0; Y89 >=0; Y99 >=0; Y109 >=0; Y119 >=0;
Y129 >=0; Y139 >=0; Y149 >=0; Y159 >=0; Y169 >=0; Y179 >=0; Y189 >=0; Y199 >=0; Y209 >=0;
Y219 >=0; Y229 >=0; Y239 >=0; Y249 >=0; Y259 >=0; Y269 >=0; Y279 >=0; Y289 >=0; Y299 >=0;

```

## Solutions of Dual Problem

Global optimal solution found.		
Variable	Value	Reduced Cost
X9	0.9514737	0.7632783E-16
Y19	0.000000	6.839852
Y29	0.3409041	-0.1231654E-15
Y39	0.000000	0.6740573E-02
Y49	0.000000	4.119869
Y59	0.3906967E-02	-0.1776357E-14
Y69	0.2185827	0.1110223E-15
Y79	0.000000	0.4156234
Y89	0.000000	1.444895
Y99	0.000000	0.4852626E-01
Y109	0.1048665	0.1110223E-15
Y119	0.000000	10.81507
Y129	0.000000	1.631560
Y139	0.000000	7.127533
Y149	0.000000	0.5561262E-01
Y159	0.000000	0.1612942E-01
Y169	0.000000	6.222935
Y179	0.2136193E-01	-0.4857226E-16
Y189	0.000000	1.522665
Y199	0.000000	1.379766
Y209	0.000000	8.364865

Y219	0.000000	1.612960
Y229	0.000000	1.330792
Y239	0.000000	0.6020299E-01
Y249	0.000000	26.94562
Y259	0.000000	5.687911
Y269	0.000000	0.7576825
Y279	0.3103778	0.000000
Y289	0.000000	0.6987296
Y299	0.000000	2.515381

## SUMMARY

Efficiency score of Warehouse 9 (Dehradun) = 0.9514737

Warehouse 9 (Dehradun) is an inefficient warehouse.

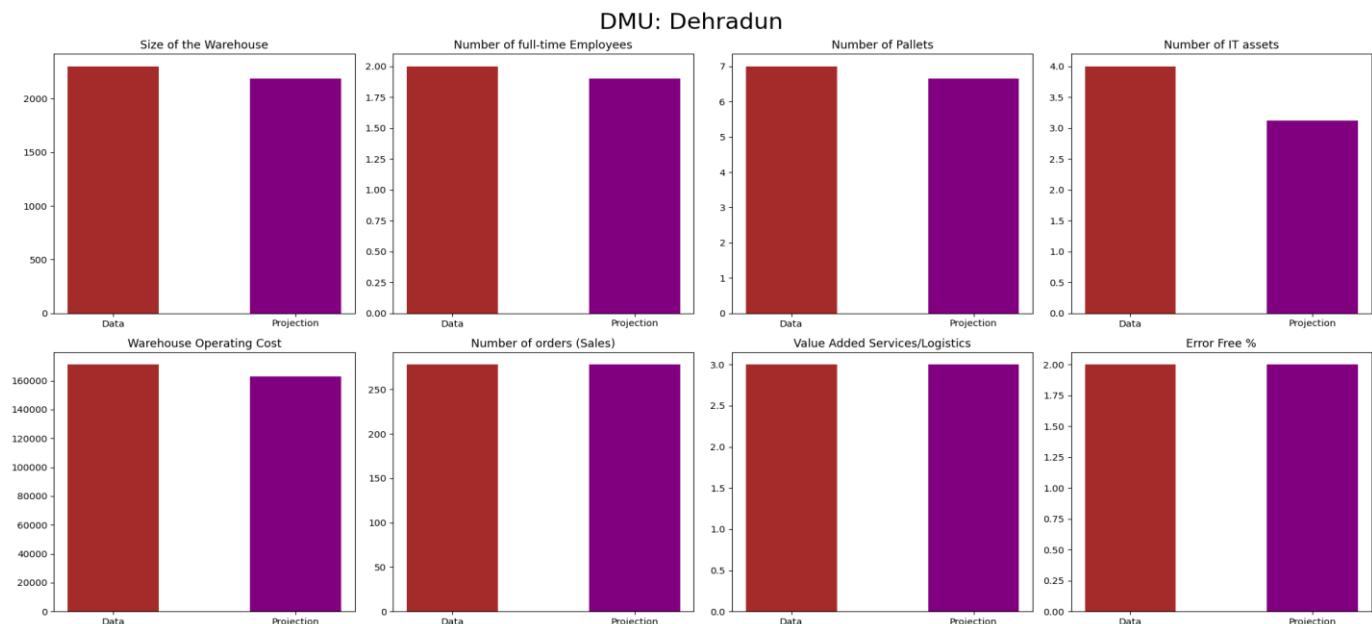
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	2300	2188.39	0
No. of Full-time Employees	2	1.90295	0
No. of Pallets	7	6.66032	0
No. of IT assets	4	3.11794	0.688
Warehouse Operating Cost	171183	162876	0
No. of Orders (Sales)	278	278	0
Level of Value-Added Services	3	3	0
Error Free (%)	2	2	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 2 (Ahmedabad)	0.3409041
Warehouse 5 (Bhiwandi)	0.03906967
Warehouse 6 (Bhopal)	0.2185827
Warehouse 10 (Gagret)	0.1048665
Warehouse 17 (Jammu)	0.0213619
Warehouse 27 (Raipur)	0.3103778

In order to make warehouse 9 (Dehradun) efficient, they need to decrease size of the warehouse by 4.853%, No of full-time employees by 4.853%, number of pallets by 4.853%, IT Assets by 22.052% , operating cost by 4.853%.



# WAREHOUSE 10 (GAGRET)

## Primal Problem Formulation

```

!Objective Function;

MAX = 60*VF10 + 3*VG10 + 1*VH10;

!Subject to;

1000*UA10 + 1*UB10 + 30*UC10 + 4*UD10 + 86967*UE10 = 1;
(229*VF10 + 3*VG10 + 4*VH10) - (13100*UA10 + 7*UB10 + 320*UC10 + 9*UD10 + 820931*UE10) <=0;
(354*VF10 + 3*VG10 + 3*VH10) - (2000*UA10 + 2*UB10 + 7*UC10 + 4*UD10 + 147596*UE10) <=0;
(115*VF10 + 3*VG10 + 1*VH10) - (550*UA10 + 2*UB10 + 2*UC10 + 2*UD10 + 86404*UE10) <=0;
(5827*VF10 + 3*VG10 + 4*VH10) - (9800*UA10 + 14*UB10 + 10*UC10 + 9*UD10 + 584300*UE10) <=0;
(4776*VF10 + 3*VG10 + 3*VH10) - (7500*UA10 + 4*UB10 + 7*UC10 + 4*UD10 + 238265*UE10) <=0;
(152*VF10 + 3*VG10 + 1*VH10) - (550*UA10 + 2*UB10 + 2*UC10 + 3*UD10 + 147473*UE10) <=0;
(661*VF10 + 3*VG10 + 3*VH10) - (4800*UA10 + 3*UB10 + 7*UC10 + 6*UD10 + 420908*UE10) <=0;
(1019*VF10 + 3*VG10 + 4*VH10) - (10250*UA10 + 5*UB10 + 20*UC10 + 7*UD10 + 239046*UE10) <=0;
(278*VF10 + 3*VG10 + 2*VH10) - (2300*UA10 + 2*UB10 + 7*UC10 + 4*UD10 + 171183*UE10) <=0;
(60*VF10 + 3*VG10 + 1*VH10) - (1000*UA10 + 1*UB10 + 30*UC10 + 4*UD10 + 86967*UE10) <=0;
(2155*VF10 + 3*VG10 + 4*VH10) - (20700*UA10 + 21*UB10 + 200*UC10 + 11*UD10 + 142521*UE10) <=0;
(908*VF10 + 3*VG10 + 2*VH10) - (1200*UA10 + 6*UB10 + 7*UC10 + 5*UD10 + 1372680*UE10) <=0;
(2593*VF10 + 3*VG10 + 4*VH10) - (11000*UA10 + 13*UB10 + 200*UC10 + 12*UD10 + 119500*UE10) <=0;
(272*VF10 + 3*VG10 + 3*VH10) - (4100*UA10 + 2*UB10 + 7*UC10 + 3*UD10 + 247573*UE10) <=0;
(64*VF10 + 3*VG10 + 2*VH10) - (2000*UA10 + 2*UB10 + 2*UC10 + 3*UD10 + 93157*UE10) <=0;
(1053*VF10 + 3*VG10 + 4*VH10) - (21000*UA10 + 5*UB10 + 338*UC10 + 10*UD10 + 1994765*UE10) <=0;
(137*VF10 + 3*VG10 + 1*VH10) - (500*UA10 + 2*UB10 + 2*UC10 + 2*UD10 + 29538*UE10) <=0;
(138*VF10 + 3*VG10 + 2*VH10) - (2152*UA10 + 4*UB10 + 48*UC10 + 7*UD10 + 226845*UE10) <=0;
(523*VF10 + 3*VG10 + 3*VH10) - (9700*UA10 + 5*UB10 + 7*UC10 + 5*UD10 + 117310*UE10) <=0;
(1222*VF10 + 3*VG10 + 4*VH10) - (15000*UA10 + 15*UB10 + 200*UC10 + 12*UD10 + 955890*UE10) <=0;
(1674*VF10 + 3*VG10 + 3*VH10) - (9000*UA10 + 6*UB10 + 7*UC10 + 7*UD10 + 3333230*UE10) <=0;
(554*VF10 + 3*VG10 + 3*VH10) - (4600*UA10 + 5*UB10 + 7*UC10 + 5*UD10 + 2349633*UE10) <=0;
(197*VF10 + 3*VG10 + 2*VH10) - (2000*UA10 + 2*UB10 + 7*UC10 + 2*UD10 + 139434*UE10) <=0;
(5794*VF10 + 3*VG10 + 4*VH10) - (37324*UA10 + 48*UB10 + 550*UC10 + 25*UD10 + 2090879*UE10) <=0;
(1505*VF10 + 3*VG10 + 3*VH10) - (11000*UA10 + 9*UB10 + 200*UC10 + 9*UD10 + 755723*UE10) <=0;
(1347*VF10 + 3*VG10 + 4*VH10) - (10000*UA10 + 4*UB10 + 7*UC10 + 5*UD10 + 374615*UE10) <=0;
(310*VF10 + 3*VG10 + 2*VH10) - (4000*UA10 + 2*UB10 + 2*UC10 + 2*UD10 + 224382*UE10) <=0;
(259*VF10 + 3*VG10 + 3*VH10) - (5500*UA10 + 2*UB10 + 50*UC10 + 5*UD10 + 194903*UE10) <=0;
(277*VF10 + 3*VG10 + 3*VH10) - (2000*UA10 + 8*UB10 + 2*UC10 + 6*UD10 + 173934*UE10) <=0;

UA10 >=0;
UB10 >=0;
UC10 >=0;
UD10 >=0;
UE10 >=0;
VF10 >=0;
VG10 >=0;
VH10 >=0;

```

## Solutions/Weights of Primal Problem

Variable	Value	Reduced Cost
VF10	0.235809E-05	0.000000
VG10	0.3286171	0.000000
VH10	0.000000	0.000000
UA10	0.171111E-05	0.000000
UB10	0.3454382	0.000000
UC10	0.000000	0.000000
UD10	0.160727	0.000000
UE10	0.000000	0.000000

## Dual Problem Formulation

```

!Dual Objective Function;

```

```

MIN = X10;

!Subject to;
13100*Y110 + 2000*Y210 + 550*Y310 + 9800*Y410 + 7500*Y510 + 550*Y610 + 4800*Y710 + 10250*Y810 +
2300*Y910 + 1000*Y1010 + 20700*Y1110 + 1200*Y1210 + 11000*Y1310 + 4100*Y1410 + 2000*Y1510 +
21000*Y1610 + 500*Y1710 + 2152*Y1810 + 9700*Y1910 + 15000*Y2010 + 9000*Y2110 + 4600*Y2210 +
2000*Y2310 + 37324*Y2410 + 11000*Y2510 + 10000*Y2610 + 4000*Y2710 + 5500*Y2810 + 2000*Y2910
- 1000*X10 <= 0;

7*Y110 + 2*Y210 + 2*Y310 + 14*Y410 + 4*Y510 + 2*Y610 + 3*Y710 + 5*Y810 + 2*Y910 + 1*Y1010 + 21*Y1110 +
6*Y1210 + 13*Y1310 + 2*Y1410 + 2*Y1510 + 5*Y1610 + 2*Y1710 + 4*Y1810 + 5*Y1910
+ 15*Y2010 + 6*Y2110 + 5*Y2210 + 2*Y2310 + 48*Y2410 + 9*Y2510 + 4*Y2610 + 2*Y2710 + 2*Y2810 + 8*Y2910
- 1*X10 <= 0;

320*Y110 + 7*Y210 + 2*Y310 + 10*Y410 + 7*Y510 + 2*Y610 + 7*Y710 + 20*Y810 + 7*Y910 + 30*Y1010 +
200*Y1110 + 7*Y1210 + 200*Y1310 + 7*Y1410 + 2*Y1510 + 338*Y1610 + 2*Y1710 + 48*Y1810 +
7*Y1910 + 200*Y2010 + 7*Y2110 + 7*Y2210 + 7*Y2310 + 550*Y2410 + 200*Y2510 + 7*Y2610 + 2*Y2710 +
50*Y2810 + 2*Y2910 - 30*X10 <= 0;

9*Y110 + 4*Y210 + 2*Y310 + 9*Y410 + 4*Y510 + 3*Y610 + 6*Y710 + 7*Y810 + 4*Y910 + 4*Y1010 + 11*Y1110 +
5*Y1210 + 12*Y1310 + 3*Y1410 + 3*Y1510 + 10*Y1610 + 2*Y1710 + 7*Y1810 + 5*Y1910 +
12*Y2010 + 7*Y2110 + 5*Y2210 + 2*Y2310 + 25*Y2410 + 9*Y2510 + 5*Y2610 + 2*Y2710 + 5*Y2810 + 6*Y2910 -
4*X10 <= 0;

820931*Y110 + 147596*Y210 + 86404*Y310 + 584300*Y410 + 238265*Y510 + 147473*Y610 + 420908*Y710 +
239046*Y810 + 171183*Y910 + 86967*Y1010 + 142521*Y1110 + 1372680*Y1210
+ 119500*Y1310 + 247573*Y1410 + 93157*Y1510 + 1994765*Y1610 + 29538*Y1710 + 226845*Y1810 +
117310*Y1910 + 955890*Y2010 + 3333230*Y2110 + 2349633*Y2210 + 139434*Y2310
+ 2090879*Y2410 + 755723*Y2510 + 374615*Y2610 + 224382*Y2710 + 194903*Y2810 + 173934*Y2910 -
86967*X10 <= 0;

229*Y110 + 354*Y210 + 115*Y310 + 5827*Y410 + 4776*Y510 + 152*Y610 + 661*Y710 + 1019*Y810 + 278*Y910 +
60*Y1010 + 2155*Y1110 + 908*Y1210 + 2593*Y1310 + 272*Y1410 + 64*Y1510 +
1053*Y1610 + 137*Y1710 + 138*Y1810 + 523*Y1910 + 1222*Y2010 + 1674*Y2110 + 554*Y2210 + 197*Y2310 +
5794*Y2410 + 1505*Y2510 + 1347*Y2610 + 310*Y2710 + 259*Y2810 + 277*Y2910 >= 60;

3*Y110 + 3*Y210 + 3*Y310 + 3*Y410 + 3*Y510 + 3*Y610 + 3*Y710 + 3*Y810 + 3*Y910 + 3*Y1010 + 3*Y1110 +
3*Y1210 + 3*Y1310 + 3*Y1410 + 3*Y1510 + 3*Y1610 + 3*Y1710 + 3*Y1810
+ 3*Y1910 + 3*Y2010 + 3*Y2110 + 3*Y2210 + 3*Y2310 + 3*Y2410 + 3*Y2510 + 3*Y2610 + 3*Y2710 + 3*Y2810 +
3*Y2910 >= 3;

4*Y110 + 3*Y210 + 1*Y310 + 4*Y410 + 3*Y510 + 1*Y610 + 3*Y710 + 4*Y810 + 2*Y910 + 1*Y1010 + 4*Y1110 +
2*Y1210 + 4*Y1310 + 3*Y1410 + 2*Y1510 + 4*Y1610 + 1*Y1710 + 2*Y1810
+ 3*Y1910 + 4*Y2010 + 3*Y2110 + 3*Y2210 + 2*Y2310 + 4*Y2410 + 3*Y2510 + 4*Y2610 + 2*Y2710 + 3*Y2810 +
3*Y2910 >= 1;

@Free(X10);
Y110 >= 0; Y210 >= 0; Y310 >= 0; Y410 >= 0; Y510 >= 0; Y610 >= 0; Y710 >= 0; Y810 >= 0; Y910 >= 0; Y1010 >= 0;
Y1110 >= 0; Y1210 >= 0; Y1310 >= 0; Y1410 >= 0; Y1510 >= 0; Y1610 >= 0; Y1710 >= 0; Y1810 >= 0;
Y1910 >= 0; Y2010 >= 0; Y2110 >= 0; Y2210 >= 0; Y2310 >= 0; Y2410 >= 0; Y2510 >= 0; Y2610 >= 0; Y2710 >= 0;
Y2810 >= 0; Y2910 >= 0;

```

## Solutions of Dual Problem

File Edit LINGO Window Help		
Global optimal solution found.		
Objective value:	1.000000	
Infeasibilities:	0.000000	
Total solver iterations:	2	
Variable	Value	Reduced Cost
X10	1.000000	-0.5551115E-16
Y110	0.000000	7.469307
Y210	0.000000	0.8175988
Y310	0.000000	0.3938198
Y410	0.000000	8.614574
Y510	0.000000	2.240955
Y610	0.000000	0.8167470
Y710	0.000000	3.108112
Y810	0.000000	2.644083
Y910	0.000000	0.9809482
Y1010	1.000000	0.2775558E-15
Y1110	0.000000	8.339109
Y1210	0.000000	10.89267

Y1310	0.000000	4.997929
Y1410	0.000000	1.509980
Y1510	0.000000	0.4405870
Y1610	0.000000	14.80314
Y1710	0.000000	0.000000
Y1810	0.000000	2.161867
Y1910	0.000000	1.801012
Y2010	0.000000	11.58570
Y2110	0.000000	24.47026
Y2210	0.000000	17.26074
Y2310	0.000000	0.7610737
Y2410	0.000000	32.57067
Y2510	0.000000	7.813153
Y2610	0.000000	3.185234
Y2710	0.000000	1.349373
Y2810	0.000000	1.145219
Y2910	0.000000	3.386313

## SUMMARY

Efficiency score of Warehouse 10 (Gagret) = 1

Warehouse 10 (Gagret) is an efficient warehouse.

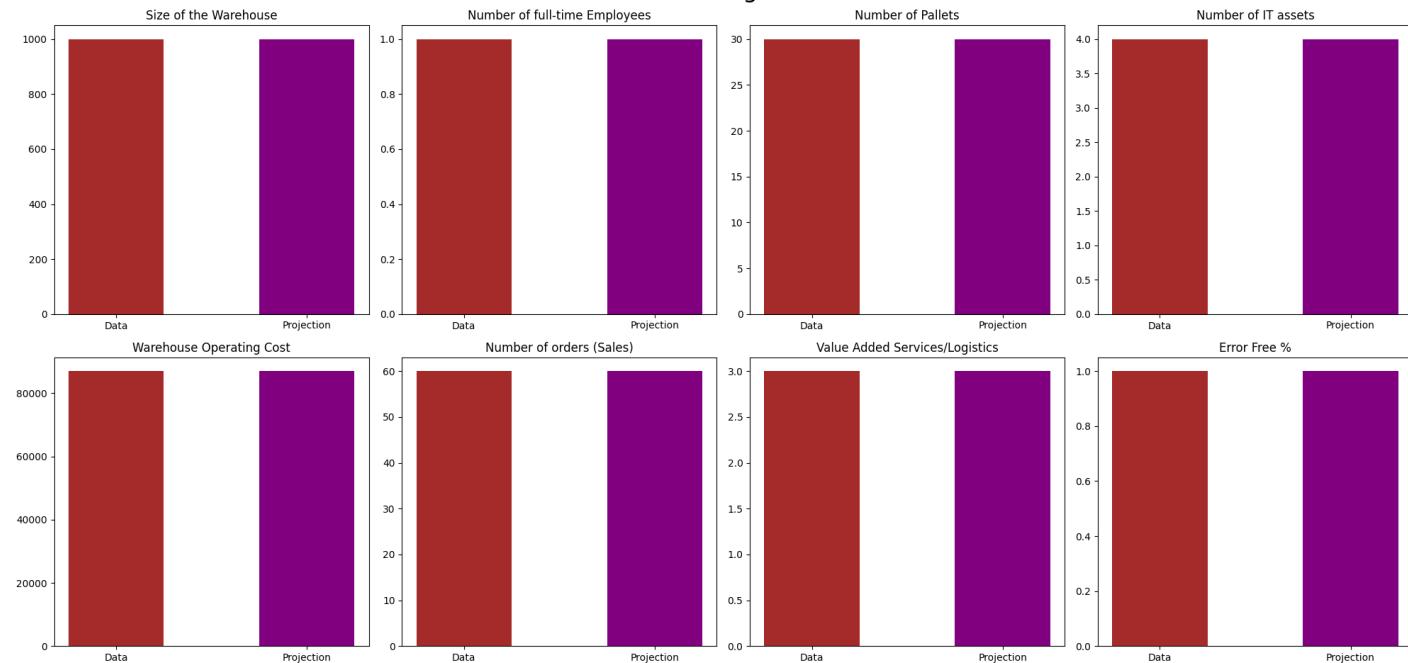
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	1000	1000	0
No. of Full-time Employees	1	1	0
No. of Pallets	30	30	0
No. of IT assets	4	4	0
Warehouse Operating Cost	86967	86967	0
No. of Orders (Sales)	60	60	0
Level of Value-Added Services	3	3	0
Error Free (%)	1	1	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 1 (Gagret)	1

DMU: Gagret



# WAREHOUSE 11 (GHAZIABAD)

## Primal Problem Formulation

```

!Objective Function;

MAX = 2155*VF11 + 3*VG11 + 4*VH11;

!Subject to;

20700*UA11 + 21*UB11 + 200*UC11 + 11*UD11 + 142521*UE11 = 1;
(229*VF11 + 3*VG11 + 4*VH11) - (13100*UA11 + 7*UB11 + 320*UC11 + 9*UD11 + 820931*UE11) <=0;
(354*VF11 + 3*VG11 + 3*VH11) - (2000*UA11 + 2*UB11 + 7*UC11 + 4*UD11 + 147596*UE11) <=0;
(115*VF11 + 3*VG11 + 1*VH11) - (550*UA11 + 2*UB11 + 2*UC11 + 2*UD11 + 86404*UE11) <=0;
(5827*VF11 + 3*VG11 + 4*VH11) - (9800*UA11 + 14*UB11 + 10*UC11 + 9*UD11 + 584300*UE11) <=0;
(4776*VF11 + 3*VG11 + 3*VH11) - (7500*UA11 + 4*UB11 + 7*UC11 + 4*UD11 + 238265*UE11) <=0;
(152*VF11 + 3*VG11 + 1*VH11) - (550*UA11 + 2*UB11 + 2*UC11 + 3*UD11 + 147473*UE11) <=0;
(661*VF11 + 3*VG11 + 3*VH11) - (4800*UA11 + 3*UB11 + 7*UC11 + 6*UD11 + 420908*UE11) <=0;
(1019*VF11 + 3*VG11 + 4*VH11) - (10250*UA11 + 5*UB11 + 20*UC11 + 7*UD11 + 239046*UE11) <=0;
(278*VF11 + 3*VG11 + 2*VH11) - (2300*UA11 + 2*UB11 + 7*UC11 + 4*UD11 + 171183*UE11) <=0;
(60*VF11 + 3*VG11 + 1*VH11) - (1000*UA11 + 1*UB11 + 30*UC11 + 4*UD11 + 86967*UE11) <=0;
(2155*VF11 + 3*VG11 + 4*VH11) - (20700*UA11 + 21*UB11 + 200*UC11 + 11*UD11 + 142521*UE11) <=0;
(908*VF11 + 3*VG11 + 2*VH11) - (1200*UA11 + 6*UB11 + 7*UC11 + 5*UD11 + 1372680*UE11) <=0;
(2593*VF11 + 3*VG11 + 4*VH11) - (11000*UA11 + 13*UB11 + 200*UC11 + 12*UD11 + 119500*UE11) <=0;
(272*VF11 + 3*VG11 + 3*VH11) - (4100*UA11 + 2*UB11 + 7*UC11 + 3*UD11 + 247573*UE11) <=0;
(64*VF11 + 3*VG11 + 2*VH11) - (2000*UA11 + 2*UB11 + 2*UC11 + 3*UD11 + 93157*UE11) <=0;
(1053*VF11 + 3*VG11 + 4*VH11) - (21000*UA11 + 5*UB11 + 338*UC11 + 10*UD11 + 1994765*UE11) <=0;
(137*VF11 + 3*VG11 + 1*VH11) - (500*UA11 + 2*UB11 + 2*UC11 + 2*UD11 + 29538*UE11) <=0;
(138*VF11 + 3*VG11 + 2*VH11) - (2152*UA11 + 4*UB11 + 48*UC11 + 7*UD11 + 226845*UE11) <=0;
(523*VF11 + 3*VG11 + 3*VH11) - (9700*UA11 + 5*UB11 + 7*UC11 + 5*UD11 + 117310*UE11) <=0;
(1222*VF11 + 3*VG11 + 4*VH11) - (15000*UA11 + 15*UB11 + 200*UC11 + 12*UD11 + 955890*UE11) <=0;
(1674*VF11 + 3*VG11 + 3*VH11) - (9000*UA11 + 6*UB11 + 7*UC11 + 7*UD11 + 3333230*UE11) <=0;
(554*VF11 + 3*VG11 + 3*VH11) - (4600*UA11 + 5*UB11 + 7*UC11 + 5*UD11 + 2349633*UE11) <=0;
(197*VF11 + 3*VG11 + 2*VH11) - (2000*UA11 + 2*UB11 + 7*UC11 + 2*UD11 + 139434*UE11) <=0;
(5794*VF11 + 3*VG11 + 4*VH11) - (37324*UA11 + 48*UB11 + 550*UC11 + 25*UD11 + 2090879*UE11) <=0;
(1505*VF11 + 3*VG11 + 3*VH11) - (11000*UA11 + 9*UB11 + 200*UC11 + 9*UD11 + 755723*UE11) <=0;
(1347*VF11 + 3*VG11 + 4*VH11) - (10000*UA11 + 4*UB11 + 7*UC11 + 5*UD11 + 374615*UE11) <=0;
(310*VF11 + 3*VG11 + 2*VH11) - (4000*UA11 + 2*UB11 + 2*UC11 + 2*UD11 + 224382*UE11) <=0;
(259*VF11 + 3*VG11 + 3*VH11) - (5500*UA11 + 2*UB11 + 50*UC11 + 5*UD11 + 194903*UE11) <=0;
(277*VF11 + 3*VG11 + 3*VH11) - (2000*UA11 + 8*UB11 + 2*UC11 + 6*UD11 + 173934*UE11) <=0;

UA11 >=0;
UB11 >=0;
UC11 >=0;
UD11 >=0;
UE11 >=0;
VF11 >=0;
VG11 >=0;
VH11 >=0;

```

## Solutions/Weights of Primal Problem

LINGO 11.0 - [Solution Report - warehouse 11 PP]

**File Edit LINGO Window Help**

**Global optimal solution found.**

Objective value:	0.9279273
Infeasibilities:	0.000000
Total solver iterations:	11

**Variable Value Reduced Cost**

VF11	0.9435113E-04	-0.1136868E-12
VG11	0.000000	3.101090
VH11	0.1811501	0.000000
UA11	0.000000	11309.18
UB11	0.000000	8.683058
UC11	0.000000	63.02339
UD11	0.4709747E-01	-0.8881784E-15
UE11	0.3381452E-05	-0.7275958E-11

## Dual Problem Formulation

```

!Dual Objective Function;
MIN = X11;

!Subject to;
13100*Y111 + 2000*Y211 + 550*Y311 + 9800*Y411 + 7500*Y511 + 550*Y611 + 4800*Y711 + 10250*Y811 + 2300*Y911 +
10000*Y1011 + 20700*Y1111 + 1200*Y1211 + 11000*Y1311 + 4100*Y1411 + 2000*Y1511 +
21000*Y1611 + 500*Y1711 + 2152*Y1811 + 9700*Y1911 + 15000*Y2011 + 9000*Y2111 + 4600*Y2211 + 2000*Y2311 +
37324*Y2411 + 11000*Y2511 + 10000*Y2611 + 4000*Y2711 + 5500*Y2811 + 2000*Y2911
- 20700*X11 <=0;

7*Y111 + 2*Y211 + 2*Y311 + 14*Y411 + 4*Y511 + 2*Y611 + 3*Y711 + 5*Y811 + 2*Y911 + 1*Y1011 + 21*Y1111 +
6*Y1211 + 13*Y1311 + 2*Y1411 + 2*Y1511 + 5*Y1611 + 2*Y1711 + 4*Y1811 + 5*Y1911
+ 15*Y2011 + 6*Y2111 + 5*Y2211 + 2*Y2311 + 48*Y2411 + 9*Y2511 + 4*Y2611 + 2*Y2711 + 2*Y2811 + 8*Y2911 - 21*X11
<= 0;

320*Y111 + 7*Y211 + 2*Y311 + 10*Y411 + 7*Y511 + 2*Y611 + 7*Y711 + 20*Y811 + 7*Y911 + 30*Y1011 + 200*Y1111 +
7*Y1211 + 200*Y1311 + 7*Y1411 + 2*Y1511 + 338*Y1611 + 2*Y1711 + 48*Y1811 +
7*Y1911 + 200*Y2011 + 7*Y2111 + 7*Y2211 + 7*Y2311 + 550*Y2411 + 200*Y2511 + 7*Y2611 + 2*Y2711 + 50*Y2811 +
2*Y2911 - 200*X11 <= 0;

9*Y111 + 4*Y211 + 2*Y311 + 9*Y411 + 4*Y511 + 3*Y611 + 6*Y711 + 7*Y811 + 4*Y911 + 4*Y1011 + 11*Y1111 + 5*Y1211
+ 12*Y1311 + 3*Y1411 + 3*Y1511 + 10*Y1611 + 2*Y1711 + 7*Y1811 + 5*Y1911 +
12*Y2011 + 7*Y2111 + 5*Y2211 + 2*Y2311 + 25*Y2411 + 9*Y2511 + 5*Y2611 + 2*Y2711 + 5*Y2811 + 6*Y2911 - 11*X11
<= 0;

820931*Y111 + 147596*Y211 + 86404*Y311 + 584300*Y411 + 238265*Y511 + 147473*Y611 + 420908*Y711 +
239046*Y811 + 171183*Y911 + 86967*Y1011 + 142521*Y1111 + 1372680*Y1211
+ 119500*Y1311 + 247573*Y1411 + 93157*Y1511 + 1994765*Y1611 + 29538*Y1711 + 226845*Y1811 + 117310*Y1911
+ 955890*Y2011 + 3333230*Y2111 + 2349633*Y2211 + 139434*Y2311
+ 2090879*Y2411 + 755723*Y2511 + 374615*Y2611 + 224382*Y2711 + 194903*Y2811 + 173934*Y2911 - 142521*X11
<= 0;

229*Y111 + 354*Y211 + 115*Y311 + 5827*Y411 + 4776*Y511 + 152*Y611 + 661*Y711 + 1019*Y811 + 278*Y911 +
60*Y1011 + 2155*Y1111 + 908*Y1211 + 2593*Y1311 + 272*Y1411 + 64*Y1511 +
1053*Y1611 + 137*Y1711 + 138*Y1811 + 523*Y1911 + 1222*Y2011 + 1674*Y2111 + 554*Y2211 + 197*Y2311 + 5794*Y2411
+ 1505*Y2511 + 1347*Y2611 + 310*Y2711 + 259*Y2811 + 277*Y2911 >=2155;

3*Y111 + 3*Y211 + 3*Y311 + 3*Y411 + 3*Y511 + 3*Y611 + 3*Y711 + 3*Y811 + 3*Y911 + 3*Y1011 + 3*Y1111 + 3*Y1211
+ 3*Y1311 + 3*Y1411 + 3*Y1511 + 3*Y1611 + 3*Y1711 + 3*Y1811
+ 3*Y1911 + 3*Y2011 + 3*Y2111 + 3*Y2211 + 3*Y2311 + 3*Y2411 + 3*Y2511 + 3*Y2611 + 3*Y2711 + 3*Y2811 + 3*Y2911
>= 3;

4*Y111 + 3*Y211 + 1*Y311 + 4*Y411 + 3*Y511 + 1*Y611 + 3*Y711 + 4*Y811 + 2*Y911 + 1*Y1011 + 4*Y1111 + 2*Y1211
+ 4*Y1311 + 3*Y1411 + 2*Y1511 + 4*Y1611 + 1*Y1711 + 2*Y1811
+ 3*Y1911 + 4*Y2011 + 3*Y2111 + 3*Y2211 + 2*Y2311 + 4*Y2411 + 3*Y2511 + 4*Y2611 + 2*Y2711 + 3*Y2811 + 3*Y2911
>= 4;

@Free(X11);
Y111 >=0; Y211 >=0; Y311 >=0; Y411 >=0; Y511 >=0; Y611 >=0; Y711 >=0; Y811 >=0; Y911 >=0; Y1011 >=0; Y1111
>=0; Y1211 >=0; Y1311 >=0; Y1411 >=0; Y1511 >=0; Y1611 >=0; Y1711 >=0; Y1811 >=0;
Y1911 >=0; Y2011 >=0; Y2111 >=0; Y2211 >=0; Y2311 >=0; Y2411 >=0; Y2511 >=0; Y2611 >=0;
Y2711 >=0; Y2811 >=0; Y2911 >=0;

```

## Solutions of Dual Problem

Global optimal solution found.		
Objective value:	0.9279273	
Infeasibilities:	0.000000	
Total solver iterations:	3	
Variable	Value	Reduced Cost
X11	0.9279273	0.000000
Y111	0.000000	2.453609
Y211	0.000000	0.1106279
Y311	0.000000	0.1943654
Y411	0.000000	1.125275
Y511	0.8882951E-01	-0.1665335E-15
Y611	0.000000	0.4444737
Y711	0.000000	1.100048
Y811	0.000000	0.3172604
Y911	0.000000	0.3787070
Y1011	0.000000	0.2956534
Y1111	0.000000	0.7207273E-01
Y1211	0.000000	4.429167
Y1311	0.5962148	-0.7771561E-15
Y1411	0.000000	0.4093346
Y1511	0.000000	0.8795952E-01
Y1611	0.000000	6.392224
Y1711	1.348652	-0.2775558E-16
Y1811	0.000000	0.7214269

Y1911	0.000000	0.3936934E-01
Y2011	0.000000	2.957568
Y2111	0.000000	10.89944
Y2211	0.000000	7.584937
Y2311	0.000000	0.1847968
Y2411	0.000000	6.976372
Y2511	0.000000	2.293869
Y2611	0.000000	0.6505383
Y2711	0.000000	0.4613827
Y2811	0.000000	0.3266550
Y2911	0.000000	0.3011485

## SUMMARY

Efficiency score of Warehouse 11 (Ghaziabad) = 0.9279273

Warehouse 11 (Ghaziabad) is not an efficient or Inefficient warehouse.

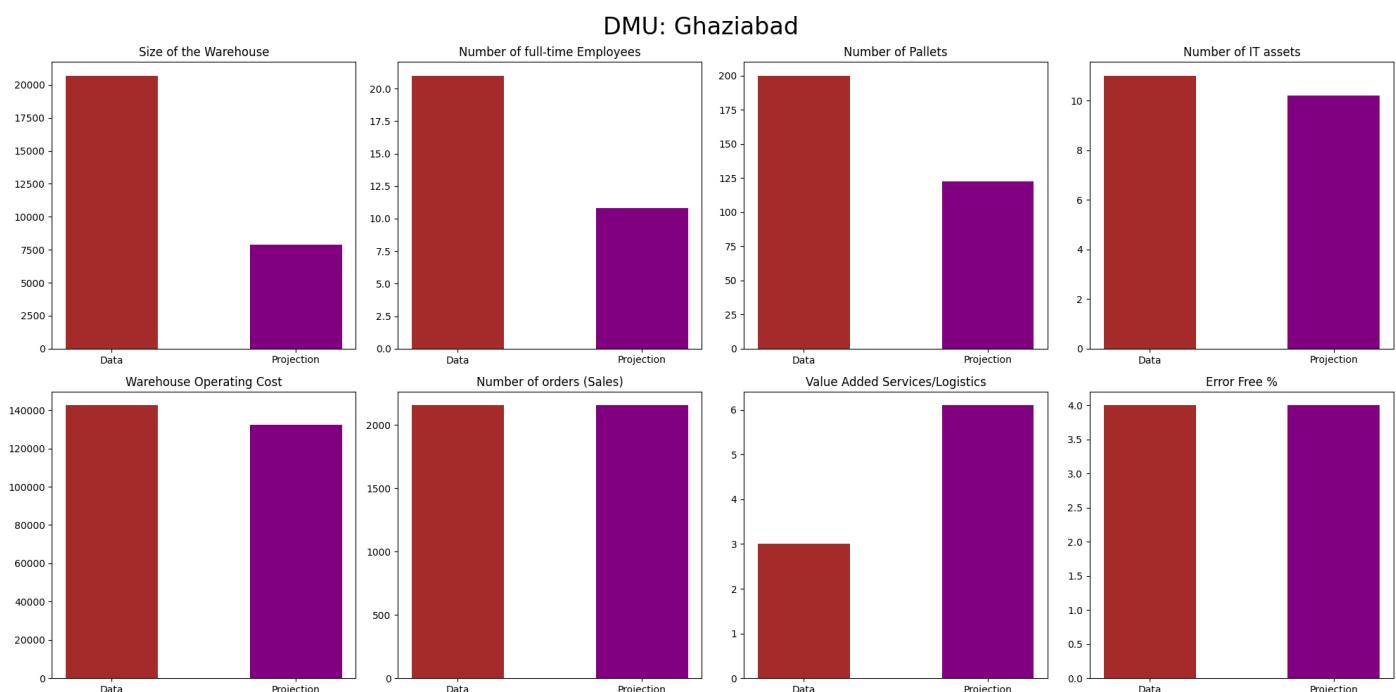
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	20700	7898.91	11309.2
No. of Full-time Employees	21	10.8034	8.683
No. of Pallets	200	122.562	63.023
No. of IT assets	11	10.2072	0
Warehouse Operating Cost	142521	132249	0
No. of Orders (Sales)	2155	2155	0
Level of Value-Added Services	3	6.10109	3.101
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 5 (Bhiwandi)	0.08882951
Warehouse 13 (Hyderabad)	0.5962148
Warehouse 17 (Jammu)	1.348652

In order to make warehouse 11 (Ghaziabad) efficient, they need to decrease size of the warehouse by 61.841%, No of full-time employees by 48.555%, number of pallets by 38.719%, IT Assets by 7.207%, operating cost by 7.207%, whereas value-added logistics needs to be increased by 103.37%.



## WAREHOUSE 12 (GORAKHPUR)

### Primal Problem Formulation

```

!Objective Function;

MAX = 908*VF12 + 3*VG12 + 2*VH12;

!Subject to;

1200*UA12 + 6*UB12 + 7*UC12 + 5*UD12 + 1372680*UE12 = 1;
(229*VF12 + 3*VG12 + 4*VH12) - (13100*UA12 + 7*UB12 + 320*UC12 + 9*UD12 + 820931*UE12) <=0;
(354*VF12 + 3*VG12 + 3*VH12) - (2000*UA12 + 2*UB12 + 7*UC12 + 4*UD12 + 147596*UE12) <=0;
(115*VF12 + 3*VG12 + 1*VH12) - (550*UA12 + 2*UB12 + 2*UC12 + 2*UD12 + 86404*UE12) <=0;
(5827*VF12 + 3*VG12 + 4*VH12) - (9800*UA12 + 14*UB12 + 10*UC12 + 9*UD12 + 584300*UE12) <=0;
(4776*VF12 + 3*VG12 + 3*VH12) - (7500*UA12 + 4*UB12 + 7*UC12 + 4*UD12 + 238265*UE12) <=0;
(152*VF12 + 3*VG12 + 1*VH12) - (550*UA12 + 2*UB12 + 2*UC12 + 3*UD12 + 147473*UE12) <=0;
(661*VF12 + 3*VG12 + 3*VH12) - (4800*UA12 + 3*UB12 + 7*UC12 + 6*UD12 + 420908*UE12) <=0;
(1019*VF12 + 3*VG12 + 4*VH12) - (10250*UA12 + 5*UB12 + 20*UC12 + 7*UD12 + 239046*UE12) <=0;
(278*VF12 + 3*VG12 + 2*VH12) - (2300*UA12 + 2*UB12 + 7*UC12 + 4*UD12 + 171183*UE12) <=0;
(60*VF12 + 3*VG12 + 1*VH12) - (1000*UA12 + 1*UB12 + 30*UC12 + 4*UD12 + 86967*UE12) <=0;
(2155*VF12 + 3*VG12 + 4*VH12) - (20700*UA12 + 21*UB12 + 200*UC12 + 11*UD12 + 142521*UE12) <=0;
(908*VF12 + 3*VG12 + 2*VH12) - (1200*UA12 + 6*UB12 + 7*UC12 + 5*UD12 + 1372680*UE12) <=0;
(2593*VF12 + 3*VG12 + 4*VH12) - (11000*UA12 + 13*UB12 + 200*UC12 + 12*UD12 + 119500*UE12) <=0;
(272*VF12 + 3*VG12 + 3*VH12) - (4100*UA12 + 2*UB12 + 7*UC12 + 3*UD12 + 247573*UE12) <=0;
(64*VF12 + 3*VG12 + 2*VH12) - (2000*UA12 + 2*UB12 + 2*UC12 + 3*UD12 + 93157*UE12) <=0;
(1053*VF12 + 3*VG12 + 4*VH12) - (21000*UA12 + 5*UB12 + 338*UC12 + 10*UD12 + 1994765*UE12) <=0;
(137*VF12 + 3*VG12 + 1*VH12) - (500*UA12 + 2*UB12 + 2*UC12 + 2*UD12 + 29538*UE12) <=0;
(138*VF12 + 3*VG12 + 2*VH12) - (2152*UA12 + 4*UB12 + 48*UC12 + 7*UD12 + 226845*UE12) <=0;
(523*VF12 + 3*VG12 + 3*VH12) - (9700*UA12 + 5*UB12 + 7*UC12 + 5*UD12 + 117310*UE12) <=0;
(1222*VF12 + 3*VG12 + 4*VH12) - (15000*UA12 + 15*UB12 + 200*UC12 + 12*UD12 + 955890*UE12) <=0;
(1674*VF12 + 3*VG12 + 3*VH12) - (9000*UA12 + 6*UB12 + 7*UC12 + 7*UD12 + 3333230*UE12) <=0;
(554*VF12 + 3*VG12 + 3*VH12) - (4600*UA12 + 5*UB12 + 7*UC12 + 5*UD12 + 2349633*UE12) <=0;
(197*VF12 + 3*VG12 + 2*VH12) - (2000*UA12 + 2*UB12 + 7*UC12 + 2*UD12 + 139434*UE12) <=0;
(5794*VF12 + 3*VG12 + 4*VH12) - (37324*UA12 + 48*UB12 + 550*UC12 + 25*UD12 + 2090879*UE12) <=0;
(1505*VF12 + 3*VG12 + 3*VH12) - (11000*UA12 + 9*UB12 + 200*UC12 + 9*UD12 + 755723*UE12) <=0;
(1347*VF12 + 3*VG12 + 4*VH12) - (10000*UA12 + 4*UB12 + 7*UC12 + 5*UD12 + 374615*UE12) <=0;
(310*VF12 + 3*VG12 + 2*VH12) - (4000*UA12 + 2*UB12 + 2*UC12 + 2*UD12 + 224382*UE12) <=0;
(259*VF12 + 3*VG12 + 3*VH12) - (5500*UA12 + 2*UB12 + 50*UC12 + 5*UD12 + 194903*UE12) <=0;
(277*VF12 + 3*VG12 + 3*VH12) - (2000*UA12 + 8*UB12 + 2*UC12 + 6*UD12 + 173934*UE12) <=0;

UA12 >=0;
UB12 >=0;
UC12 >=0;
UD12 >=0;
UE12 >=0;
VF12 >=0;
VG12 >=0;
VH12 >=0;

```

### Solutions/Weights of Primal Problem

Variable	Value	Reduced Cost
VF12	0.7276738E-03	0.000000
VG12	0.000000	0.000000
VH12	0.1696361	0.000000
UA12	0.8333334E-03	0.000000
UB12	0.000000	0.000000
UC12	0.000000	0.000000
UD12	0.000000	0.000000
UE12	0.000000	0.000000

### Dual Problem Formulation

```

!Dual Objective Function;
MIN = X12;

!Subject to;
13100*Y112 + 2000*Y212 + 550*Y312 + 9800*Y412 + 7500*Y512 + 550*Y612 + 4800*Y712 + 10250*Y812 + 2300*Y912 +
1000*Y1012 + 20700*Y1112 + 1200*Y1212 + 11000*Y1312 + 4100*Y1412 + 2000*Y1512 +
21000*Y1612 + 500*Y1712 + 2152*Y1812 + 9700*Y1912 + 15000*Y2012 + 9000*Y2112 + 4600*Y2212 + 2000*Y2312 +
37324*Y2412 + 11000*Y2512 + 10000*Y2612 + 4000*Y2712 + 5500*Y2812 + 2000*Y2912
- 1200*X12 <=0;

7*Y112 + 2*Y212 + 2*Y312 + 14*Y412 + 4*Y512 + 2*Y612 + 3*Y712 + 5*Y812 + 2*Y912 + 1*Y1012 + 21*Y1112 +
6*Y1212 + 13*Y1312 + 2*Y1412 + 2*Y1512 + 5*Y1612 + 2*Y1712 + 4*Y1812 + 5*Y1912
+ 15*Y2012 + 6*Y2112 + 5*Y2212 + 2*Y2312 + 48*Y2412 + 9*Y2512 + 4*Y2612 + 2*Y2712 + 2*Y2812 + 8*Y2912 - 6*X12
<=0;

320*Y112 + 7*Y212 + 2*Y312 + 10*Y412 + 7*Y512 + 2*Y612 + 7*Y712 + 20*Y812 + 7*Y912 + 30*Y1012 + 200*Y1112 +
7*Y1212 + 200*Y1312 + 7*Y1412 + 2*Y1512 + 338*Y1612 + 2*Y1712 + 48*Y1812 +
7*Y1912 + 200*Y2012 + 7*Y2112 + 7*Y2212 + 7*Y2312 + 550*Y2412 + 200*Y2512 + 7*Y2612 + 2*Y2712 + 50*Y2812 +
2*Y2912 - 7*X12 <=0;

9*Y112 + 4*Y212 + 2*Y312 + 9*Y412 + 4*Y512 + 3*Y612 + 6*Y712 + 7*Y812 + 4*Y912 + 4*Y1012 + 11*Y1112 + 5*Y1212
+ 12*Y1312 + 3*Y1412 + 3*Y1512 + 10*Y1612 + 2*Y1712 + 7*Y1812 + 5*Y1912 +
12*Y2012 + 7*Y2112 + 5*Y2212 + 2*Y2312 + 25*Y2412 + 9*Y2512 + 5*Y2612 + 2*Y2712 + 5*Y2812 + 6*Y2912 - 5*X12
<= 0;

820931*Y112 + 147596*Y212 + 86404*Y312 + 584300*Y412 + 238265*Y512 + 147473*Y612 + 420908*Y712 +
239046*Y812 + 171183*Y912 + 86967*Y1012 + 142521*Y1112 + 1372680*Y1212
+ 119500*Y1312 + 247573*Y1412 + 93157*Y1512 + 1994765*Y1612 + 29538*Y1712 + 226845*Y1812 + 117310*Y1912
+ 955890*Y2012 + 3333230*Y2112 + 2349633*Y2212 + 139434*Y2312
+ 2090879*Y2412 + 755723*Y2512 + 374615*Y2612 + 224382*Y2712 + 194903*Y2812 + 173934*Y2912 -
1372680*X12 <=0;

229*Y112 + 354*Y212 + 115*Y312 + 5827*Y412 + 4776*Y512 + 152*Y612 + 661*Y712 + 1019*Y812 + 278*Y912 +
60*Y1012 + 2155*Y1112 + 908*Y1212 + 2593*Y1312 + 272*Y1412 + 64*Y1512 +
1053*Y1612 + 137*Y1712 + 138*Y1812 + 523*Y1912 + 1222*Y2012 + 1674*Y2112 + 554*Y2212 + 197*Y2312 + 5794*Y2412
+ 1505*Y2512 + 1347*Y2612 + 310*Y2712 + 259*Y2812 + 277*Y2912 >=908;

3*Y112 + 3*Y212 + 3*Y312 + 3*Y412 + 3*Y512 + 3*Y612 + 3*Y712 + 3*Y812 + 3*Y912 + 3*Y1012 + 3*Y1112 + 3*Y1212
+ 3*Y1312 + 3*Y1412 + 3*Y1512 + 3*Y1612 + 3*Y1712 + 3*Y1812
+ 3*Y1912 + 3*Y2012 + 3*Y2112 + 3*Y2212 + 3*Y2312 + 3*Y2412 + 3*Y2512 + 3*Y2612 + 3*Y2712 + 3*Y2812 + 3*Y2912
>=3;

4*Y112 + 3*Y212 + 1*Y312 + 4*Y412 + 3*Y512 + 1*Y612 + 3*Y712 + 4*Y812 + 2*Y912 + 1*Y1012 + 4*Y1112 + 2*Y1212
+ 4*Y1312 + 3*Y1412 + 2*Y1512 + 4*Y1612 + 1*Y1712 + 2*Y1812
+ 3*Y1912 + 4*Y2012 + 3*Y2112 + 3*Y2212 + 2*Y2312 + 4*Y2412 + 3*Y2512 + 4*Y2612 + 2*Y2712 + 3*Y2812 + 3*Y2912
>=2;

@Free(X12);
Y112 >=0; Y212 >=0; Y312 >=0; Y412 >=0; Y512 >=0; Y612 >=0; Y712 >=0; Y812 >=0; Y912 >=0; Y1012 >=0; Y1112
>=0; Y1212 >=0; Y1312 >=0; Y1412 >=0; Y1512 >=0; Y1612 >=0; Y1712 >=0; Y1812 >=0;
Y1912 >=0; Y2012 >=0; Y2112 >=0; Y2212 >=0; Y2312 >=0; Y2412 >=0; Y2512 >=0; Y2612 >=0; Y2712 >=0; Y2812 >=0;
Y2912 >=0;

```

## Solutions of Dual Problem

Global optimal solution found.		
Objective value:	1.000000	
Infeasibilities:	0.000000	
Total solver iterations:	6	
Variable	Value	Reduced Cost
X12	1.000000	0.5551115E-16
Y112	0.000000	4.735663
Y212	0.000000	-0.1266348E-15
Y312	0.000000	0.3837680E-01
Y412	0.000000	0.7621862
Y512	0.000000	-0.1776357E-14
Y612	0.000000	0.2488340E-01
Y712	0.000000	1.071507
Y812	0.000000	2.958881
Y912	0.000000	0.4215938
Y1012	0.000000	0.1920668
Y1112	0.000000	7.586997
Y1212	1.000000	0.1942890E-15

Y1312	0.000000	2.888588
Y1412	0.000000	0.9155647
Y1512	0.000000	0.4057890
Y1612	0.000000	7.532596
Y1712	0.000000	-0.5551115E-16
Y1812	0.000000	0.5632901
Y1912	0.000000	3.243214
Y2012	0.000000	5.477021
Y2112	0.000000	2.736291
Y2212	0.000000	1.372286
Y2312	0.000000	0.3389545
Y2412	0.000000	14.27747
Y2512	0.000000	3.555920
Y2612	0.000000	2.633372
Y2712	0.000000	1.106770
Y2812	0.000000	1.490843
Y2912	0.000000	0.4072046

## SUMMARY

Efficiency score of Warehouse 12 (Gorakhpur) = 1

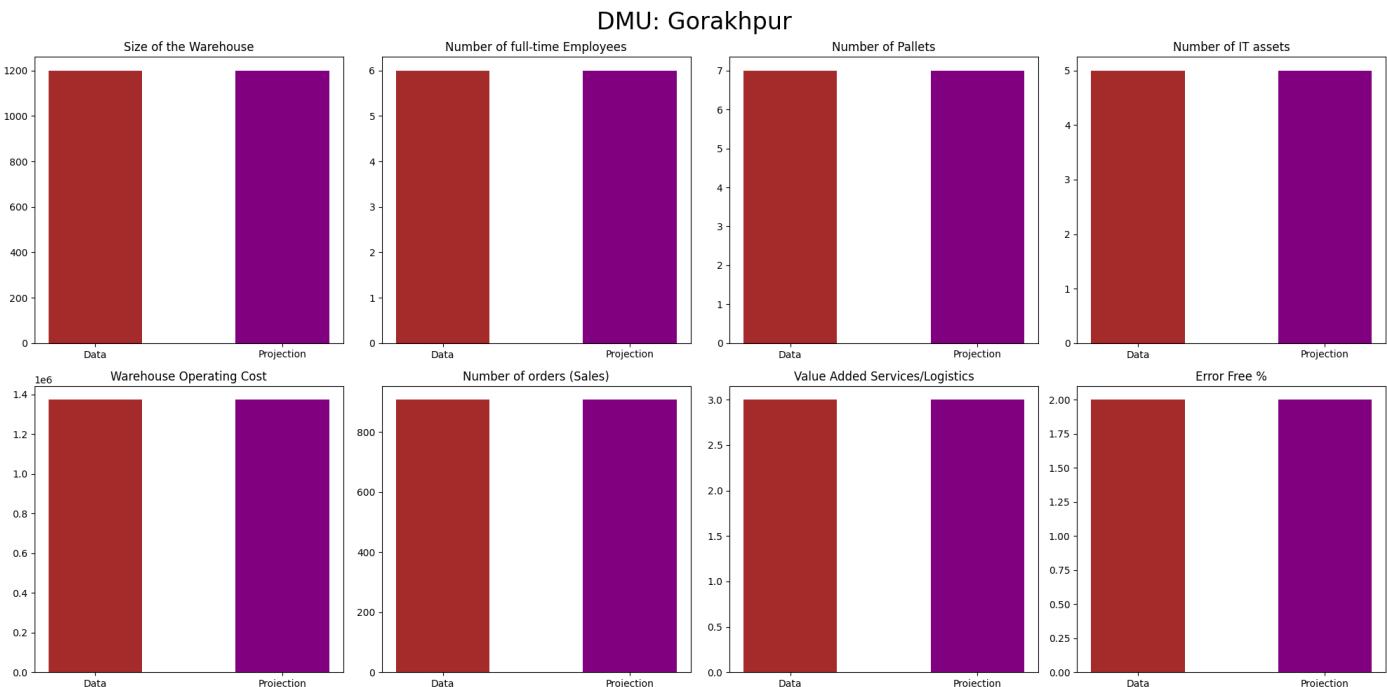
Warehouse 12 (Gorakhpur) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	1200	1200	0
No. of Full-time Employees	6	6	0
No. of Pallets	7	7	0
No. of IT assets	5	5	0
Warehouse Operating Cost	1372680	1372680	0
No. of Orders (Sales)	908	908	0
Level of Value-Added Services	3	3	0
Error Free (%)	2	2	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 12 (Gorakhpur)	1



# WAREHOUSE 13 (HYDERABAD)

## Primal Problem Formulation

```

!Objective Function;

MAX = 2593*VF13 + 3*VG13 + 4*VH13;

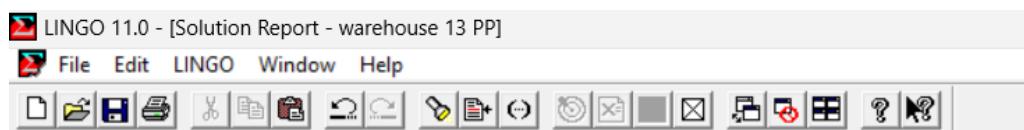
!Subject to;

11000*UA13 + 13*UB13 + 200*UC13 + 12*UD13 + 119500*UE13 = 1;
(229*VF13 + 3*VG13 + 4*VH13) - (13100*UA13 + 7*UB13 + 320*UC13 + 9*UD13 + 820931*UE13) <=0;
(354*VF13 + 3*VG13 + 3*VH13) - (2000*UA13 + 2*UB13 + 7*UC13 + 4*UD13 + 147596*UE13) <=0;
(115*VF13 + 3*VG13 + 1*VH13) - (550*UA13 + 2*UB13 + 2*UC13 + 2*UD13 + 86404*UE13) <=0;
(5827*VF13 + 3*VG13 + 4*VH13) - (9800*UA13 + 14*UB13 + 10*UC13 + 9*UD13 + 584300*UE13) <=0;
(4776*VF13 + 3*VG13 + 3*VH13) - (7500*UA13 + 4*UB13 + 7*UC13 + 4*UD13 + 238265*UE13) <=0;
(152*VF13 + 3*VG13 + 1*VH13) - (550*UA13 + 2*UB13 + 2*UC13 + 3*UD13 + 147473*UE13) <=0;
(661*VF13 + 3*VG13 + 3*VH13) - (4800*UA13 + 3*UB13 + 7*UC13 + 6*UD13 + 420908*UE13) <=0;
(1019*VF13 + 3*VG13 + 4*VH13) - (10250*UA13 + 5*UB13 + 20*UC13 + 7*UD13 + 239046*UE13) <=0;
(278*VF13 + 3*VG13 + 2*VH13) - (2300*UA13 + 2*UB13 + 7*UC13 + 4*UD13 + 171183*UE13) <=0;
(60*VF13 + 3*VG13 + 1*VH13) - (1000*UA13 + 1*UB13 + 30*UC13 + 4*UD13 + 86967*UE13) <=0;
(2155*VF13 + 3*VG13 + 4*VH13) - (20700*UA13 + 21*UB13 + 200*UC13 + 11*UD13 + 142521*UE13) <=0;
(908*VF13 + 3*VG13 + 2*VH13) - (1200*UA13 + 6*UB13 + 7*UC13 + 5*UD13 + 1372680*UE13) <=0;
(2593*VF13 + 3*VG13 + 4*VH13) - (11000*UA13 + 13*UB13 + 200*UC13 + 12*UD13 + 119500*UE13) <=0;
(272*VF13 + 3*VG13 + 3*VH13) - (4100*UA13 + 2*UB13 + 7*UC13 + 3*UD13 + 247573*UE13) <=0;
(64*VF13 + 3*VG13 + 2*VH13) - (2000*UA13 + 2*UB13 + 2*UC13 + 3*UD13 + 93157*UE13) <=0;
(1053*VF13 + 3*VG13 + 4*VH13) - (21000*UA13 + 5*UB13 + 338*UC13 + 10*UD13 + 1994765*UE13) <=0;
(137*VF13 + 3*VG13 + 1*VH13) - (500*UA13 + 2*UB13 + 2*UC13 + 2*UD13 + 29538*UE13) <=0;
(138*VF13 + 3*VG13 + 2*VH13) - (2152*UA13 + 4*UB13 + 48*UC13 + 7*UD13 + 226845*UE13) <=0;
(523*VF13 + 3*VG13 + 3*VH13) - (9700*UA13 + 5*UB13 + 7*UC13 + 5*UD13 + 117310*UE13) <=0;
(1222*VF13 + 3*VG13 + 4*VH13) - (15000*UA13 + 15*UB13 + 200*UC13 + 12*UD13 + 955890*UE13) <=0;
(1674*VF13 + 3*VG13 + 3*VH13) - (9000*UA13 + 6*UB13 + 7*UC13 + 7*UD13 + 3333230*UE13) <=0;
(554*VF13 + 3*VG13 + 3*VH13) - (4600*UA13 + 5*UB13 + 7*UC13 + 5*UD13 + 2349633*UE13) <=0;
(197*VF13 + 3*VG13 + 2*VH13) - (2000*UA13 + 2*UB13 + 7*UC13 + 2*UD13 + 139434*UE13) <=0;
(5794*VF13 + 3*VG13 + 4*VH13) - (37324*UA13 + 48*UB13 + 550*UC13 + 25*UD13 + 2090879*UE13) <=0;
(1505*VF13 + 3*VG13 + 3*VH13) - (11000*UA13 + 9*UB13 + 200*UC13 + 9*UD13 + 755723*UE13) <=0;
(1347*VF13 + 3*VG13 + 4*VH13) - (10000*UA13 + 4*UB13 + 7*UC13 + 5*UD13 + 374615*UE13) <=0;
(310*VF13 + 3*VG13 + 2*VH13) - (4000*UA13 + 2*UB13 + 2*UC13 + 2*UD13 + 224382*UE13) <=0;
(259*VF13 + 3*VG13 + 3*VH13) - (5500*UA13 + 2*UB13 + 50*UC13 + 5*UD13 + 194903*UE13) <=0;
(277*VF13 + 3*VG13 + 3*VH13) - (2000*UA13 + 8*UB13 + 2*UC13 + 6*UD13 + 173934*UE13) <=0;

UA13 >=0;
UB13 >=0;
UC13 >=0;
UD13 >=0;
UE13 >=0;
VF13 >=0;
VG13 >=0;
VH13 >=0;

```

## Solutions/Weights of Primal Problem



Variable	Value	Reduced Cost
VF13	0.1072968E-03	0.000000
VG13	0.000000	0.000000
VH13	0.1804449	0.000000
UA13	0.000000	0.000000
UB13	0.000000	0.000000
UC13	0.000000	0.000000
UD13	0.4859151E-03	0.000000
UE13	0.3488719E-05	0.000000

## Dual Problem Formulation

```

!Dual Objective Function;
MIN = X13;

!Subject to;
13100*Y113 + 2000*Y213 + 550*Y313 + 9800*Y413 + 7500*Y513 + 550*Y613 + 4800*Y713 + 10250*Y813 + 2300*Y913 +
1000*Y1013 + 20700*Y1113 + 1200*Y1213 + 11000*Y1313 + 4100*Y1413 + 2000*Y1513 +
21000*Y1613 + 500*Y1713 + 2152*Y1813 + 9700*Y1913 + 15000*Y2013 + 9000*Y2113 + 4600*Y2213 + 2000*Y2313 +
37324*Y2413 + 11000*Y2513 + 10000*Y2613 + 4000*Y2713 + 5500*Y2813 + 2000*Y2913
-11000*X13 <=0;

7*Y113 + 2*Y213 + 2*Y313 + 14*Y413 + 4*Y513 + 2*Y613 + 3*Y713 + 5*Y813 + 2*Y913 + 1*Y1013 + 21*Y1113 +
6*Y1213 + 13*Y1313 + 2*Y1413 + 2*Y1513 + 5*Y1613 + 2*Y1713 + 4*Y1813 + 5*Y1913
+ 15*Y2013 + 6*Y2113 + 5*Y2213 + 2*Y2313 + 48*Y2413 + 9*Y2513 + 4*Y2613 + 2*Y2713 + 2*Y2813 + 8*Y2913 -13*X13
<=0;

320*Y113 + 7*Y213 + 2*Y313 + 10*Y413 + 7*Y513 + 2*Y613 + 7*Y713 + 20*Y813 + 7*Y913 + 30*Y1013 + 200*Y1113 +
7*Y1213 + 200*Y1313 + 7*Y1413 + 2*Y1513 + 338*Y1613 + 2*Y1713 + 48*Y1813 +
7*Y1913 + 200*Y2013 + 7*Y2113 + 7*Y2213 + 7*Y2313 + 550*Y2413 + 200*Y2513 + 7*Y2613 + 2*Y2713 + 50*Y2813 +
2*Y2913 -200*X13 <=0;

9*Y113 + 4*Y213 + 2*Y313 + 9*Y413 + 4*Y513 + 3*Y613 + 6*Y713 + 7*Y813 + 4*Y913 + 4*Y1013 + 11*Y1113 + 5*Y1213
+ 12*Y1313 + 3*Y1413 + 3*Y1513 + 10*Y1613 + 2*Y1713 + 7*Y1813 + 5*Y1913 +
12*Y2013 + 7*Y2113 + 5*Y2213 + 2*Y2313 + 25*Y2413 + 9*Y2513 + 5*Y2613 + 2*Y2713 + 5*Y2813 + 6*Y2913 - 12*X13
<=0;

820931*Y113 + 147596*Y213 + 86404*Y313 + 584300*Y413 + 238265*Y513 + 147473*Y613 + 420908*Y713 +
239046*Y813 + 171183*Y913 + 86967*Y1013 + 142521*Y1113 + 1372680*Y1213
+ 119500*Y1313 + 247573*Y1413 + 93157*Y1513 + 1994765*Y1613 + 29538*Y1713 + 226845*Y1813 + 117310*Y1913
+ 955890*Y2013 + 3333230*Y2113 + 2349633*Y2213 + 139434*Y2313
+ 2090879*Y2413 + 755723*Y2513 + 374615*Y2613 + 224382*Y2713 + 194903*Y2813 + 173934*Y2913 - 119500*X13
<=0;

229*Y113 + 354*Y213 + 115*Y313 + 5827*Y413 + 4776*Y513 + 152*Y613 + 661*Y713 + 1019*Y813 + 278*Y913 +
60*Y1013 + 2155*Y1113 + 908*Y1213 + 2593*Y1313 + 272*Y1413 + 64*Y1513 +
1053*Y1613 + 137*Y1713 + 138*Y1813 + 523*Y1913 + 1222*Y2013 + 1674*Y2113 + 554*Y2213 + 197*Y2313 + 5794*Y2413
+ 1505*Y2513 + 1347*Y2613 + 310*Y2713 + 259*Y2813 + 277*Y2913 >=2593;

3*Y113 + 3*Y213 + 3*Y313 + 3*Y413 + 3*Y513 + 3*Y613 + 3*Y713 + 3*Y813 + 3*Y913 + 3*Y1013 + 3*Y1113 + 3*Y1213
+ 3*Y1313 + 3*Y1413 + 3*Y1513 + 3*Y1613 + 3*Y1713 + 3*Y1813
+ 3*Y1913 + 3*Y2013 + 3*Y2113 + 3*Y2213 + 3*Y2313 + 3*Y2413 + 3*Y2513 + 3*Y2613 + 3*Y2713 + 3*Y2813 + 3*Y2913
>=3;

4*Y113 + 3*Y213 + 1*Y313 + 4*Y413 + 3*Y513 + 1*Y613 + 3*Y713 + 4*Y813 + 2*Y913 + 1*Y1013 + 4*Y1113 + 2*Y1213
+ 4*Y1313 + 3*Y1413 + 2*Y1513 + 4*Y1613 + 1*Y1713 + 2*Y1813
+ 3*Y1913 + 4*Y2013 + 3*Y2113 + 3*Y2213 + 2*Y2313 + 4*Y2413 + 3*Y2513 + 4*Y2613 + 2*Y2713 + 3*Y2813 + 3*Y2913
>=4;

@Free(X13);
Y113 >=0; Y213 >=0; Y313 >=0; Y413 >=0; Y513 >=0; Y613 >=0; Y713 >=0; Y813 >=0; Y913 >=0; Y1013 >=0; Y1113
>=0; Y1213 >=0; Y1313 >=0; Y1413 >=0; Y1513 >=0; Y1613 >=0; Y1713 >=0; Y1813 >=0; Y1913 >=0; Y2013 >=0; Y2113
>=0; Y2213 >=0; Y2313 >=0; Y2413 >=0; Y2513 >=0; Y2613 >=0; Y2713 >=0; Y2813 >=0; Y2913 >=0;

```

## Solutions of Dual Problem

The screenshot shows the LINGO software interface with the following details:

- Global optimal solution found.**
- Objective value:** 1.000000
- Infeasibilities:** 0.000000
- Total solver iterations:** 1

Variable	Value	Reduced Cost
X13	1.000000	0.000000
Y113	0.000000	6.781401
Y213	0.000000	1.098592
Y313	0.000000	0.6786959
Y413	0.000000	2.642336
Y513	0.000000	0.1519674
Y613	0.000000	1.175464
Y713	0.000000	3.267326
Y813	0.000000	1.607404
Y913	0.000000	1.325282
Y1013	0.000000	0.7046181
Y1113	0.000000	0.3615607
Y1213	0.000000	11.13669

Y1313	1.000000	0.000000
Y1413	0.000000	1.966843
Y1513	0.000000	0.7548746
Y1613	0.000000	16.28650
Y1713	0.000000	0.1943454
Y1813	0.000000	1.845064
Y1913	0.000000	0.7799768
Y2013	0.000000	7.527811
Y2113	0.000000	27.24755
Y2213	0.000000	19.44855
Y2313	0.000000	1.090838
Y2413	0.000000	15.26242
Y2513	0.000000	5.743633
Y2613	0.000000	2.615378
Y2713	0.000000	1.758121
Y2813	0.000000	1.531103
Y2913	0.000000	1.348689

## SUMMARY

Efficiency score of Warehouse 13 (Hyderabad) = 1

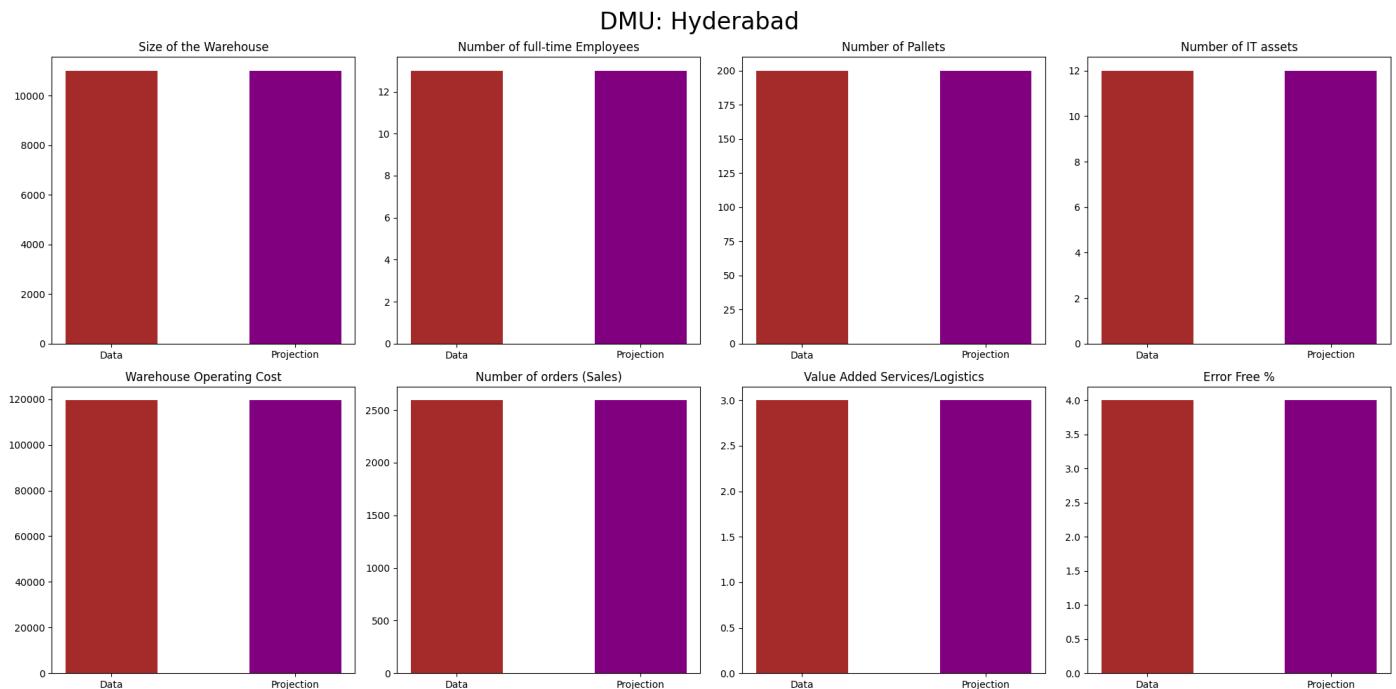
Warehouse 13 (Hyderabad) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	11000	11000	0
No. of Full-time Employees	13	13	0
No. of Pallets	200	200	0
No. of IT assets	12	12	0
Warehouse Operating Cost	119500	119500	0
No. of Orders (Sales)	2593	2593	0
Level of Value-Added Services	3	3	0
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 13 (Hyderabad)	1



## WAREHOUSE 14 (INDORE)

### Primal Problem Formulation

```

!Objective Function;

MAX = 272*VF14 + 3*VG14 + 3*VH14;

!Subject to;

4100*UA14 + 2*UB14 + 7*UC14 + 3*UD14 + 247573*UE14 = 1;
(229*VF14 + 3*VG14 + 4*VH14) - (13100*UA14 + 7*UB14 + 320*UC14 + 9*UD14 + 820931*UE14) <=0;
(354*VF14 + 3*VG14 + 3*VH14) - (2000*UA14 + 2*UB14 + 7*UC14 + 4*UD14 + 147596*UE14) <=0;
(115*VF14 + 3*VG14 + 1*VH14) - (550*UA14 + 2*UB14 + 2*UC14 + 2*UD14 + 86404*UE14) <=0;
(5827*VF14 + 3*VG14 + 4*VH14) - (9800*UA14 + 14*UB14 + 10*UC14 + 9*UD14 + 584300*UE14) <=0;
(4776*VF14 + 3*VG14 + 3*VH14) - (7500*UA14 + 4*UB14 + 7*UC14 + 4*UD14 + 238265*UE14) <=0;
(152*VF14 + 3*VG14 + 1*VH14) - (550*UA14 + 2*UB14 + 2*UC14 + 3*UD14 + 147473*UE14) <=0;
(661*VF14 + 3*VG14 + 3*VH14) - (4800*UA14 + 3*UB14 + 7*UC14 + 6*UD14 + 420908*UE14) <=0;
(1019*VF14 + 3*VG14 + 4*VH14) - (10250*UA14 + 5*UB14 + 20*UC14 + 7*UD14 + 239046*UE14) <=0;
(278*VF14 + 3*VG14 + 2*VH14) - (2300*UA14 + 2*UB14 + 7*UC14 + 4*UD14 + 171183*UE14) <=0;
(60*VF14 + 3*VG14 + 1*VH14) - (1000*UA14 + 1*UB14 + 30*UC14 + 4*UD14 + 86967*UE14) <=0;
(2155*VF14 + 3*VG14 + 4*VH14) - (20700*UA14 + 21*UB14 + 200*UC14 + 11*UD14 + 142521*UE14) <=0;
(908*VF14 + 3*VG14 + 2*VH14) - (1200*UA14 + 6*UB14 + 7*UC14 + 5*UD14 + 1372680*UE14) <=0;
(2593*VF14 + 3*VG14 + 4*VH14) - (11000*UA14 + 13*UB14 + 200*UC14 + 12*UD14 + 119500*UE14) <=0;
(272*VF14 + 3*VG14 + 3*VH14) - (4100*UA14 + 2*UB14 + 7*UC14 + 3*UD14 + 247573*UE14) <=0;
(64*VF14 + 3*VG14 + 2*VH14) - (2000*UA14 + 2*UB14 + 2*UC14 + 3*UD14 + 93157*UE14) <=0;
(1053*VF14 + 3*VG14 + 4*VH14) - (21000*UA14 + 5*UB14 + 338*UC14 + 10*UD14 + 1994765*UE14) <=0;
(137*VF14 + 3*VG14 + 1*VH14) - (500*UA14 + 2*UB14 + 2*UC14 + 2*UD14 + 29538*UE14) <=0;
(138*VF14 + 3*VG14 + 2*VH14) - (2152*UA14 + 4*UB14 + 48*UC14 + 7*UD14 + 226845*UE14) <=0;
(523*VF14 + 3*VG14 + 3*VH14) - (9700*UA14 + 5*UB14 + 7*UC14 + 5*UD14 + 117310*UE14) <=0;
(1222*VF14 + 3*VG14 + 4*VH14) - (15000*UA14 + 15*UB14 + 200*UC14 + 12*UD14 + 955890*UE14) <=0;
(1674*VF14 + 3*VG14 + 3*VH14) - (9000*UA14 + 6*UB14 + 7*UC14 + 7*UD14 + 3333230*UE14) <=0;
(554*VF14 + 3*VG14 + 3*VH14) - (4600*UA14 + 5*UB14 + 7*UC14 + 5*UD14 + 2349633*UE14) <=0;
(197*VF14 + 3*VG14 + 2*VH14) - (2000*UA14 + 2*UB14 + 7*UC14 + 2*UD14 + 139434*UE14) <=0;
(5794*VF14 + 3*VG14 + 4*VH14) - (37324*UA14 + 48*UB14 + 550*UC14 + 25*UD14 + 2090879*UE14) <=0;
(1505*VF14 + 3*VG14 + 3*VH14) - (11000*UA14 + 9*UB14 + 200*UC14 + 9*UD14 + 755723*UE14) <=0;
(1347*VF14 + 3*VG14 + 4*VH14) - (10000*UA14 + 4*UB14 + 7*UC14 + 5*UD14 + 374615*UE14) <=0;
(310*VF14 + 3*VG14 + 2*VH14) - (4000*UA14 + 2*UB14 + 2*UC14 + 2*UD14 + 224382*UE14) <=0;
(259*VF14 + 3*VG14 + 3*VH14) - (5500*UA14 + 2*UB14 + 50*UC14 + 5*UD14 + 194903*UE14) <=0;
(277*VF14 + 3*VG14 + 3*VH14) - (2000*UA14 + 8*UB14 + 2*UC14 + 6*UD14 + 173934*UE14) <=0;

UA14 >=0;
UB14 >=0;
UC14 >=0;
UD14 >=0;
UE14 >=0;
VF14 >=0;
VG14 >=0;
VH14 >=0;

```

### Solutions/Weights of Primal Problem

```

Global optimal solution found.
Objective value: 1.000000
Infeasibilities: 0.000000
Total solver iterations: 11

```

Variable	Value	Reduced Cost
VF14	0.000000	0.000000
VG14	0.000000	0.000000
VH14	0.333333	0.000000
UA14	0.7513597E-04	0.000000
UB14	0.000000	0.000000
UC14	0.2794236E-01	0.000000
UD14	0.1654487	0.000000
UE14	0.000000	0.000000

### Dual Problem Formulation

```

!Dual Objective Function;
MIN = X14;

!Subject to;
13100*Y114 + 2000*Y214 + 550*Y314 + 9800*Y414 + 7500*Y514 + 550*Y614 + 4800*Y714 + 10250*Y814 + 2300*Y914 +
1000*Y1014 + 20700*Y1114 + 1200*Y1214 + 11000*Y1314 + 4100*Y1414 + 2000*Y1514 +
21000*Y1614 + 500*Y1714 + 2152*Y1814 + 9700*Y1914 + 15000*Y2014 + 9000*Y2114 + 4600*Y2214 + 2000*Y2314 +
37324*Y2414 + 11000*Y2514 + 10000*Y2614 + 4000*Y2714 + 5500*Y2814 + 2000*Y2914
-4100*X14 <=0;

7*Y114 + 2*Y214 + 2*Y314 + 14*Y414 + 4*Y514 + 2*Y614 + 3*Y714 + 5*Y814 + 2*Y914 + 1*Y1014 + 21*Y1114 +
6*Y1214 + 13*Y1314 + 2*Y1414 + 2*Y1514 + 5*Y1614 + 2*Y1714 + 4*Y1814 + 5*Y1914
+ 15*Y2014 + 6*Y2114 + 5*Y2214 + 2*Y2314 + 48*Y2414 + 9*Y2514 + 4*Y2614 + 2*Y2714 + 2*Y2814 + 8*Y2914 -
2*X14 <=0;

320*Y114 + 7*Y214 + 2*Y314 + 10*Y414 + 7*Y514 + 2*Y614 + 7*Y714 + 20*Y814 + 7*Y914 + 30*Y1014 + 200*Y1114 +
7*Y1214 + 200*Y1314 + 7*Y1414 + 2*Y1514 + 338*Y1614 + 2*Y1714 + 48*Y1814 +
7*Y1914 + 200*Y2014 + 7*Y2114 + 7*Y2214 + 7*Y2314 + 550*Y2414 + 200*Y2514 + 7*Y2614 + 2*Y2714 + 50*Y2814 +
2*Y2914 -7*X14 <=0;

9*Y114 + 4*Y214 + 2*Y314 + 9*Y414 + 4*Y514 + 3*Y614 + 6*Y714 + 7*Y814 + 4*Y914 + 4*Y1014 + 11*Y1114 + 5*Y1214
+ 12*Y1314 + 3*Y1414 + 3*Y1514 + 10*Y1614 + 2*Y1714 + 7*Y1814 + 5*Y1914 +
12*Y2014 + 7*Y2114 + 5*Y2214 + 2*Y2314 + 25*Y2414 + 9*Y2514 + 5*Y2614 + 2*Y2714 + 5*Y2814 + 6*Y2914 -3*X14
<=0;

820931*Y114 + 147596*Y214 + 86404*Y314 + 584300*Y414 + 238265*Y514 + 147473*Y614 + 420908*Y714 +
239046*Y814 + 171183*Y914 + 86967*Y1014 + 142521*Y1114 + 1372680*Y1214
+ 119500*Y1314 + 247573*Y1414 + 93157*Y1514 + 1994765*Y1614 + 29538*Y1714 + 226845*Y1814 + 117310*Y1914
+ 955890*Y2014 + 3333230*Y2114 + 2349633*Y2214 + 139434*Y2314
+ 2090879*Y2414 + 755723*Y2514 + 374615*Y2614 + 224382*Y2714 + 194903*Y2814 + 173934*Y2914 -247573*X14
<=0;

229*Y114 + 354*Y214 + 115*Y314 + 5827*Y414 + 4776*Y514 + 152*Y614 + 661*Y714 + 1019*Y814 + 278*Y914 +
60*Y1014 + 2155*Y1114 + 908*Y1214 + 2593*Y1314 + 272*Y1414 + 64*Y1514 +
1053*Y1614 + 137*Y1714 + 138*Y1814 + 523*Y1914 + 1222*Y2014 + 1674*Y2114 + 554*Y2214 + 197*Y2314 + 5794*Y2414
+ 1505*Y2514 + 1347*Y2614 + 310*Y2714 + 259*Y2814 + 277*Y2914 >=272;

3*Y114 + 3*Y214 + 3*Y314 + 3*Y414 + 3*Y514 + 3*Y614 + 3*Y714 + 3*Y814 + 3*Y914 + 3*Y1014 + 3*Y1114 + 3*Y1214
+ 3*Y1314 + 3*Y1414 + 3*Y1514 + 3*Y1614 + 3*Y1714 + 3*Y1814
+ 3*Y1914 + 3*Y2014 + 3*Y2114 + 3*Y2214 + 3*Y2314 + 3*Y2414 + 3*Y2514 + 3*Y2614 + 3*Y2714 + 3*Y2814 + 3*Y2914
>=3;

4*Y114 + 3*Y214 + 1*Y314 + 4*Y414 + 3*Y514 + 1*Y614 + 3*Y714 + 4*Y814 + 2*Y914 + 1*Y1014 + 4*Y1114 + 2*Y1214
+ 4*Y1314 + 3*Y1414 + 2*Y1514 + 4*Y1614 + 1*Y1714 + 2*Y1814
+ 3*Y1914 + 4*Y2014 + 3*Y2114 + 3*Y2214 + 2*Y2314 + 4*Y2414 + 3*Y2514 + 4*Y2614 + 2*Y2714 + 3*Y2814 + 3*Y2914
>=3;

@Free(X14);
Y114 >=0; Y214 >=0; Y314 >=0; Y414 >=0; Y514 >=0; Y614 >=0; Y714 >=0; Y814 >=0; Y914 >=0; Y1014 >=0; Y1114
>=0; Y1214 >=0; Y1314 >=0; Y1414 >=0; Y1514 >=0; Y1614 >=0; Y1714 >=0; Y1814 >=0; Y1914 >=0; Y2014 >=0; Y2114
>=0; Y2214 >=0; Y2314 >=0; Y2414 >=0; Y2514 >=0; Y2614 >=0; Y2714 >=0; Y2814 >=0; Y2914 >=0;

```

## Solutions of Dual Problem



Global optimal solution found.

Objective value:	1.000000
Infeasibilities:	0.9094947E-12
Total solver iterations:	7

Variable	Value	Reduced Cost
X14	1.000000	0.5551115E-16
Y114	0.000000	1.853476
Y214	0.000000	-0.2220446E-15
Y314	0.000000	0.2483967
Y414	0.000000	1.905247
Y514	0.000000	0.2683007
Y614	0.000000	0.5063394
Y714	0.000000	0.8195558
Y814	0.000000	0.4781484
Y914	0.000000	0.3711119
Y1014	0.000000	0.5080196
Y1114	0.000000	1.948698
Y1214	0.000000	2.701803

Y1314	0.000000	1.579641
Y1414	1.000000	0.1387779E-16
Y1514	0.000000	0.8600973E-01
Y1614	0.000000	3.770623
Y1714	0.000000	0.1573161
Y1814	0.000000	1.063734
Y1914	0.000000	0.2962402
Y2014	0.000000	3.042342
Y2114	0.000000	5.828885
Y2214	0.000000	3.871687
Y2314	0.000000	-0.4163336E-16
Y2414	0.000000	8.972714
Y2514	0.000000	2.205446
Y2614	0.000000	0.3134854
Y2714	0.000000	0.1360587
Y2814	0.000000	0.2359005
Y2914	0.000000	0.7316817

## SUMMARY

Efficiency score of Warehouse 14 (Indore) = 1

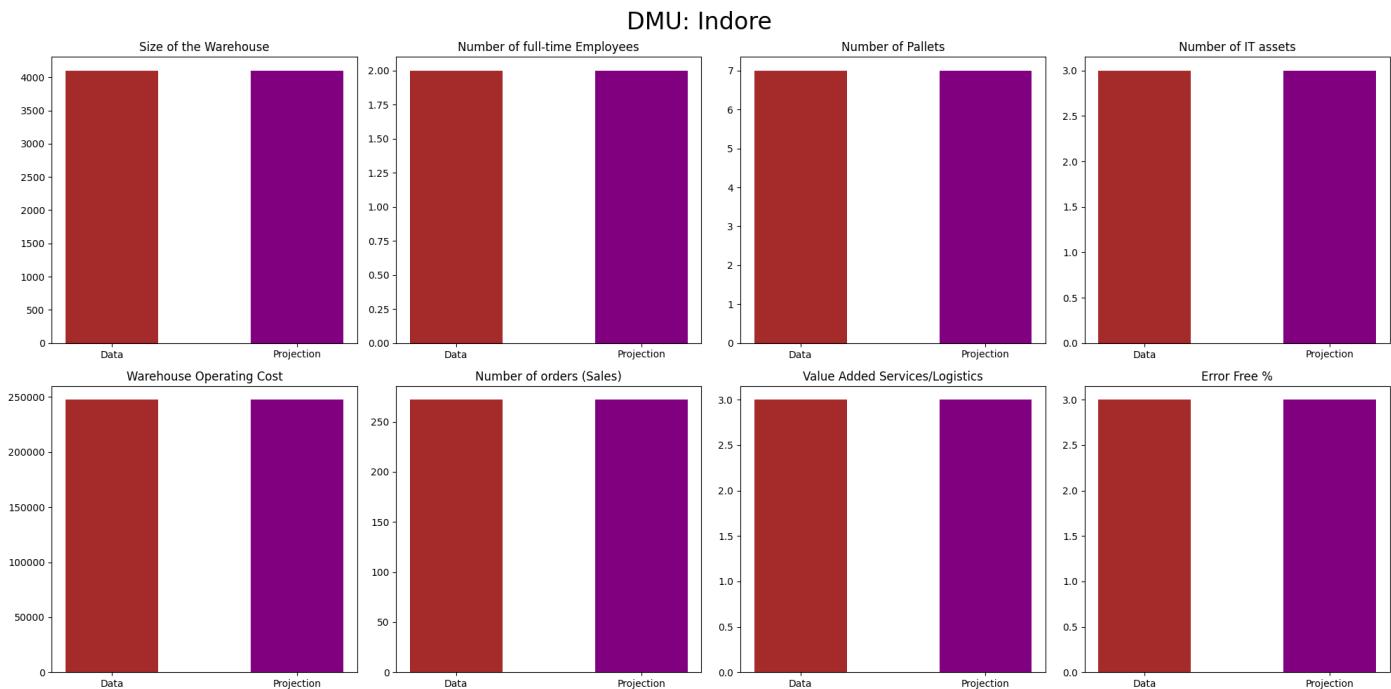
Warehouse 14 (Indore) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	4100	4100	0
No. of Full-time Employees	2	2	0
No. of Pallets	7	7	0
No. of IT assets	3	3	0
Warehouse Operating Cost	247573	247573	0
No. of Orders (Sales)	272	272	0
Level of Value-Added Services	3	3	0
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 14 (Indore)	1



# WAREHOUSE 15 (JABALPUR)

## Primal Problem Formulation

```

!Objective Function;

MAX = 64*VF15 + 3*VG15 + 2*VH15;

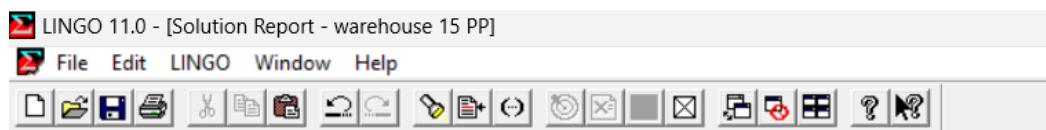
!Subject to;

2000*UA15 + 2*UB15 + 2*UC15 + 3*UD15 + 93157*UE15 = 1;
(229*VF15 + 3*VG15 + 4*VH15) - (13100*UA15 + 7*UB15 + 320*UC15 + 9*UD15 + 820931*UE15) <=0;
(354*VF15 + 3*VG15 + 3*VH15) - (2000*UA15 + 2*UB15 + 7*UC15 + 4*UD15 + 147596*UE15) <=0;
(115*VF15 + 3*VG15 + 1*VH15) - (550*UA15 + 2*UB15 + 2*UC15 + 2*UD15 + 86404*UE15) <=0;
(5827*VF15 + 3*VG15 + 4*VH15) - (9800*UA15 + 14*UB15 + 10*UC15 + 9*UD15 + 584300*UE15) <=0;
(4776*VF15 + 3*VG15 + 3*VH15) - (7500*UA15 + 4*UB15 + 7*UC15 + 4*UD15 + 238265*UE15) <=0;
(152*VF15 + 3*VG15 + 1*VH15) - (550*UA15 + 2*UB15 + 2*UC15 + 3*UD15 + 147473*UE15) <=0;
(661*VF15 + 3*VG15 + 3*VH15) - (4800*UA15 + 3*UB15 + 7*UC15 + 6*UD15 + 420908*UE15) <=0;
(1019*VF15 + 3*VG15 + 4*VH15) - (10250*UA15 + 5*UB15 + 20*UC15 + 7*UD15 + 239046*UE15) <=0;
(278*VF15 + 3*VG15 + 2*VH15) - (2300*UA15 + 2*UB15 + 7*UC15 + 4*UD15 + 171183*UE15) <=0;
(60*VF15 + 3*VG15 + 1*VH15) - (1000*UA15 + 1*UB15 + 30*UC15 + 4*UD15 + 86967*UE15) <=0;
(2155*VF15 + 3*VG15 + 4*VH15) - (20700*UA15 + 21*UB15 + 200*UC15 + 11*UD15 + 142521*UE15) <=0;
(908*VF15 + 3*VG15 + 2*VH15) - (1200*UA15 + 6*UB15 + 7*UC15 + 5*UD15 + 1372680*UE15) <=0;
(2593*VF15 + 3*VG15 + 4*VH15) - (11000*UA15 + 13*UB15 + 200*UC15 + 12*UD15 + 119500*UE15) <=0;
(272*VF15 + 3*VG15 + 3*VH15) - (4100*UA15 + 2*UB15 + 7*UC15 + 3*UD15 + 247573*UE15) <=0;
(64*VF15 + 3*VG15 + 2*VH15) - (2000*UA15 + 2*UB15 + 2*UC15 + 3*UD15 + 93157*UE15) <=0;
(1053*VF15 + 3*VG15 + 4*VH15) - (21000*UA15 + 5*UB15 + 338*UC15 + 10*UD15 + 1994765*UE15) <=0;
(137*VF15 + 3*VG15 + 1*VH15) - (500*UA15 + 2*UB15 + 2*UC15 + 2*UD15 + 29538*UE15) <=0;
(138*VF15 + 3*VG15 + 2*VH15) - (2152*UA15 + 4*UB15 + 48*UC15 + 7*UD15 + 226845*UE15) <=0;
(523*VF15 + 3*VG15 + 3*VH15) - (9700*UA15 + 5*UB15 + 7*UC15 + 5*UD15 + 117310*UE15) <=0;
(1222*VF15 + 3*VG15 + 4*VH15) - (15000*UA15 + 15*UB15 + 200*UC15 + 12*UD15 + 955890*UE15) <=0;
(1674*VF15 + 3*VG15 + 3*VH15) - (9000*UA15 + 6*UB15 + 7*UC15 + 7*UD15 + 3333230*UE15) <=0;
(554*VF15 + 3*VG15 + 3*VH15) - (4600*UA15 + 5*UB15 + 7*UC15 + 5*UD15 + 2349633*UE15) <=0;
(197*VF15 + 3*VG15 + 2*VH15) - (2000*UA15 + 2*UB15 + 7*UC15 + 2*UD15 + 139434*UE15) <=0;
(5794*VF15 + 3*VG15 + 4*VH15) - (37324*UA15 + 48*UB15 + 550*UC15 + 25*UD15 + 2090879*UE15) <=0;
(1505*VF15 + 3*VG15 + 3*VH15) - (11000*UA15 + 9*UB15 + 200*UC15 + 9*UD15 + 755723*UE15) <=0;
(1347*VF15 + 3*VG15 + 4*VH15) - (10000*UA15 + 4*UB15 + 7*UC15 + 5*UD15 + 374615*UE15) <=0;
(310*VF15 + 3*VG15 + 2*VH15) - (4000*UA15 + 2*UB15 + 2*UC15 + 2*UD15 + 224382*UE15) <=0;
(259*VF15 + 3*VG15 + 3*VH15) - (5500*UA15 + 2*UB15 + 50*UC15 + 5*UD15 + 194903*UE15) <=0;
(277*VF15 + 3*VG15 + 3*VH15) - (2000*UA15 + 8*UB15 + 2*UC15 + 6*UD15 + 173934*UE15) <=0;

UA15 >=0;
UB15 >=0;
UC15 >=0;
UD15 >=0;
UE15 >=0;
VF15 >=0;
VG15 >=0;
VH15 >=0;

```

## Solutions/Weights of Primal Problem



```

Global optimal solution found.
Objective value: 1.000000
Infeasibilities: 0.000000
Total solver iterations: 10

```

Variable	Value	Reduced Cost
VF15	0.371628E-05	0.000000
VG15	0.000000	0.000000
VH15	0.488107	0.000000
UA15	0.4571034E-05	0.000000
UB15	0.9454413E-03	0.000000
UC15	0.3597455	0.000000
UD15	0.000000	0.000000
UE15	0.000000	0.000000

## Dual Problem Formulation

```

!Dual Objective Function;
MIN = X15;

!Subject to;
13100*Y115 + 2000*Y215 + 550*Y315 + 9800*Y415 + 7500*Y515 + 550*Y615 + 4800*Y715 + 10250*Y815 + 2300*Y915 +
10000*Y1015 + 20700*Y1115 + 1200*Y1215 + 11000*Y1315 + 4100*Y1415 + 2000*Y1515 +
21000*Y1615 + 500*Y1715 + 2152*Y1815 + 9700*Y1915 + 15000*Y2015 + 9000*Y2115 + 4600*Y2215 + 2000*Y2315 +
37324*Y2415 + 11000*Y2515 + 10000*Y2615 + 4000*Y2715 + 5500*Y2815 + 2000*Y2915
-X15 <=0;

7*Y115 + 2*Y215 + 2*Y315 + 14*Y415 + 4*Y515 + 2*Y615 + 3*Y715 + 5*Y815 + 2*Y915 + 1*Y1015 + 21*Y1115 +
6*Y1215 + 13*Y1315 + 2*Y1415 + 2*Y1515 + 5*Y1615 + 2*Y1715 + 4*Y1815 + 5*Y1915
+ 15*Y2015 + 6*Y2115 + 5*Y2215 + 2*Y2315 + 48*Y2415 + 9*Y2515 + 4*Y2615 + 2*Y2715 + 2*Y2815 + 8*Y2915 -2*X15
<=0;

320*Y115 + 7*Y215 + 2*Y315 + 10*Y415 + 7*Y515 + 2*Y615 + 7*Y715 + 20*Y815 + 7*Y915 + 30*Y1015 + 200*Y1115 +
7*Y1215 + 200*Y1315 + 7*Y1415 + 2*Y1515 + 338*Y1615 + 2*Y1715 + 48*Y1815 +
7*Y1915 + 200*Y2015 + 7*Y2115 + 7*Y2215 + 7*Y2315 + 550*Y2415 + 200*Y2515 + 7*Y2615 + 2*Y2715 + 50*Y2815 +
2*Y2915 -2*X15 <=0;

9*Y115 + 4*Y215 + 2*Y315 + 9*Y415 + 4*Y515 + 3*Y615 + 6*Y715 + 7*Y815 + 4*Y915 + 4*Y1015 + 11*Y1115 + 5*Y1215
+ 12*Y1315 + 3*Y1415 + 3*Y1515 + 10*Y1615 + 2*Y1715 + 7*Y1815 + 5*Y1915 +
12*Y2015 + 7*Y2115 + 5*Y2215 + 2*Y2315 + 25*Y2415 + 9*Y2515 + 5*Y2615 + 2*Y2715 + 5*Y2815 + 6*Y2915 -3*X15
<=0;

820931*Y115 + 147596*Y215 + 86404*Y315 + 584300*Y415 + 238265*Y515 + 147473*Y615 + 420908*Y715 + 239046*Y815
+ 171183*Y915 + 86967*Y1015 + 142521*Y1115 + 1372680*Y1215 + 119500*Y1315 + 247573*Y1415 + 93157*Y1515 +
1994765*Y1615 + 29538*Y1715 + 226845*Y1815 + 117310*Y1915 + 955890*Y2015 + 3333230*Y2115 + 2349633*Y2215 +
139434*Y2315 + 2090879*Y2415 + 755723*Y2515 + 374615*Y2615 + 224382*Y2715 + 194903*Y2815 + 173934*Y2915 -
93157*X15 <=0;

229*Y115 + 354*Y215 + 115*Y315 + 5827*Y415 + 4776*Y515 + 152*Y615 + 661*Y715 + 1019*Y815 + 278*Y915 +
60*Y1015 + 2155*Y1115 + 908*Y1215 + 2593*Y1315 + 272*Y1415 + 64*Y1515 +
1053*Y1615 + 137*Y1715 + 138*Y1815 + 523*Y1915 + 1222*Y2015 + 1674*Y2115 + 554*Y2215 + 197*Y2315 + 5794*Y2415
+ 1505*Y2515 + 1347*Y2615 + 310*Y2715 + 259*Y2815 + 277*Y2915 >= 64;

3*Y115 + 3*Y215 + 3*Y315 + 3*Y415 + 3*Y515 + 3*Y615 + 3*Y715 + 3*Y815 + 3*Y915 + 3*Y1015 + 3*Y1115 + 3*Y1215
+ 3*Y1315 + 3*Y1415 + 3*Y1515 + 3*Y1615 + 3*Y1715 + 3*Y1815
+ 3*Y1915 + 3*Y2015 + 3*Y2115 + 3*Y2215 + 3*Y2315 + 3*Y2415 + 3*Y2515 + 3*Y2615 + 3*Y2715 + 3*Y2815 + 3*Y2915
>=3;

4*Y115 + 3*Y215 + 1*Y315 + 4*Y415 + 3*Y515 + 1*Y615 + 3*Y715 + 4*Y815 + 2*Y915 + 1*Y1015 + 4*Y1115 + 2*Y1215
+ 4*Y1315 + 3*Y1415 + 2*Y1515 + 4*Y1615 + 1*Y1715 + 2*Y1815
+ 3*Y1915 + 4*Y2015 + 3*Y2115 + 3*Y2215 + 2*Y2315 + 4*Y2415 + 3*Y2515 + 4*Y2615 + 2*Y2715 + 3*Y2815 + 3*Y2915
>=2;

@Free(X15);
Y115 >=0; Y215 >=0; Y315 >=0; Y415 >=0; Y515 >=0; Y615 >=0; Y715 >=0; Y815 >=0; Y915 >=0; Y1015 >=0; Y1115
>=0; Y1215 >=0; Y1315 >=0; Y1415 >=0; Y1515 >=0; Y1615 >=0; Y1715 >=0; Y1815 >=0; Y1915 >=0; Y2015 >=0; Y2115
>=0; Y2215 >=0; Y2315 >=0; Y2415 >=0; Y2515 >=0; Y2615 >=0; Y2715 >=0; Y2815 >=0; Y2915 >=0;

```

## Solutions of Dual Problem



Global optimal solution found.

Objective value:	1.000000
Infeasibilities:	0.000000
Total solver iterations:	3

Variable	Value	Reduced Cost
X15	1.000000	0.000000
Y115	0.000000	9.905897
Y215	0.000000	0.000000
Y315	0.000000	0.4469262
Y415	0.000000	4.409430
Y515	0.000000	0.9515868
Y615	0.000000	0.9268851
Y715	0.000000	2.267534
Y815	0.000000	0.7648069
Y915	0.000000	0.6853770
Y1015	0.000000	0.7358847
Y1115	0.000000	4.515471
Y1215	0.000000	10.60627

Y1315	0.000000	3.378570
Y1415	0.000000	0.7857480
Y1515	1.000000	0.000000
Y1615	0.000000	19.15214
Y1715	0.000000	-0.5551115E-16
Y1815	0.000000	1.953449
Y1915	0.000000	0.1204632
Y2015	0.000000	10.19099
Y2115	0.000000	25.51480
Y2215	0.000000	17.66493
Y2315	0.000000	0.4358525
Y2415	0.000000	28.10496
Y2515	0.000000	8.400843
Y2615	0.000000	1.523201
Y2715	0.000000	1.031335
Y2815	0.000000	0.9922743
Y2915	0.000000	0.8518289

## SUMMARY

Efficiency score of Warehouse 15 (Jabalpur) = 1

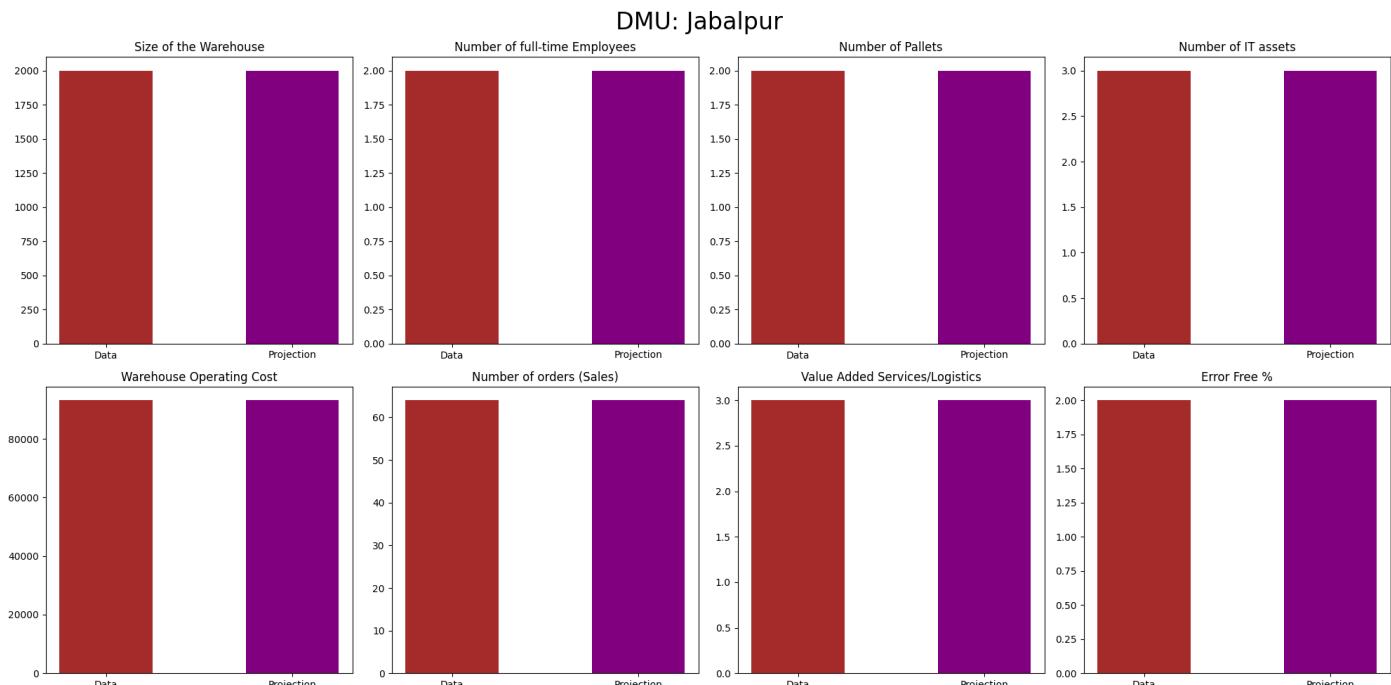
Warehouse 15 (Jabalpur) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	2000	2000	0
No. of Full-time Employees	2	2	0
No. of Pallets	2	2	0
No. of IT assets	3	3	0
Warehouse Operating Cost	93157	93157	0
No. of Orders (Sales)	64	64	0
Level of Value-Added Services	3	3	0
Error Free (%)	2	2	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 15 (Jabalpur)	1



# WAREHOUSE 16 (JAIPUR)

## Primal Problem Formulation

```

!Objective Function;

MAX = 1053*VF16 + 3*VG16 + 4*VH16;

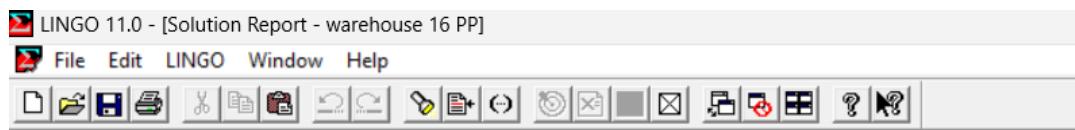
!Subject to;

21000*UA16 + 5*UB16 + 338*UC16 + 10*UD16 + 1994765*UE16 = 1;
(229*VF16 + 3*VG16 + 4*VH16) - (13100*UA16 + 7*UB16 + 320*UC16 + 9*UD16 + 820931*UE16) <=0;
(354*VF16 + 3*VG16 + 3*VH16) - (2000*UA16 + 2*UB16 + 7*UC16 + 4*UD16 + 147596*UE16) <=0;
(115*VF16 + 3*VG16 + 1*VH16) - (550*UA16 + 2*UB16 + 2*UC16 + 2*UD16 + 86404*UE16) <=0;
(5827*VF16 + 3*VG16 + 4*VH16) - (9800*UA16 + 14*UB16 + 10*UC16 + 9*UD16 + 584300*UE16) <=0;
(4776*VF16 + 3*VG16 + 3*VH16) - (7500*UA16 + 4*UB16 + 7*UC16 + 4*UD16 + 238265*UE16) <=0;
(152*VF16 + 3*VG16 + 1*VH16) - (550*UA16 + 2*UB16 + 2*UC16 + 3*UD16 + 147473*UE16) <=0;
(661*VF16 + 3*VG16 + 3*VH16) - (4800*UA16 + 3*UB16 + 7*UC16 + 6*UD16 + 420908*UE16) <=0;
(1019*VF16 + 3*VG16 + 4*VH16) - (10250*UA16 + 5*UB16 + 20*UC16 + 7*UD16 + 239046*UE16) <=0;
(278*VF16 + 3*VG16 + 2*VH16) - (2300*UA16 + 2*UB16 + 7*UC16 + 4*UD16 + 171183*UE16) <=0;
(60*VF16 + 3*VG16 + 1*VH16) - (1000*UA16 + 1*UB16 + 30*UC16 + 4*UD16 + 86967*UE16) <=0;
(2155*VF16 + 3*VG16 + 4*VH16) - (20700*UA16 + 21*UB16 + 200*UC16 + 11*UD16 + 142521*UE16) <=0;
(908*VF16 + 3*VG16 + 2*VH16) - (1200*UA16 + 6*UB16 + 7*UC16 + 5*UD16 + 1372680*UE16) <=0;
(2593*VF16 + 3*VG16 + 4*VH16) - (11000*UA16 + 13*UB16 + 200*UC16 + 12*UD16 + 119500*UE16) <=0;
(272*VF16 + 3*VG16 + 3*VH16) - (4100*UA16 + 2*UB16 + 7*UC16 + 3*UD16 + 247573*UE16) <=0;
(64*VF16 + 3*VG16 + 2*VH16) - (2000*UA16 + 2*UB16 + 2*UC16 + 3*UD16 + 93157*UE16) <=0;
(1053*VF16 + 3*VG16 + 4*VH16) - (21000*UA16 + 5*UB16 + 338*UC16 + 10*UD16 + 1994765*UE16) <=0;
(137*VF16 + 3*VG16 + 1*VH16) - (500*UA16 + 2*UB16 + 2*UC16 + 2*UD16 + 29538*UE16) <=0;
(138*VF16 + 3*VG16 + 2*VH16) - (2152*UA16 + 4*UB16 + 48*UC16 + 7*UD16 + 226845*UE16) <=0;
(523*VF16 + 3*VG16 + 3*VH16) - (9700*UA16 + 5*UB16 + 7*UC16 + 5*UD16 + 117310*UE16) <=0;
(1222*VF16 + 3*VG16 + 4*VH16) - (15000*UA16 + 15*UB16 + 200*UC16 + 12*UD16 + 955890*UE16) <=0;
(1674*VF16 + 3*VG16 + 3*VH16) - (9000*UA16 + 6*UB16 + 7*UC16 + 7*UD16 + 3333230*UE16) <=0;
(554*VF16 + 3*VG16 + 3*VH16) - (4600*UA16 + 5*UB16 + 7*UC16 + 5*UD16 + 2349633*UE16) <=0;
(197*VF16 + 3*VG16 + 2*VH16) - (2000*UA16 + 2*UB16 + 7*UC16 + 2*UD16 + 139434*UE16) <=0;
(5794*VF16 + 3*VG16 + 4*VH16) - (37324*UA16 + 48*UB16 + 550*UC16 + 25*UD16 + 2090879*UE16) <=0;
(1505*VF16 + 3*VG16 + 3*VH16) - (11000*UA16 + 9*UB16 + 200*UC16 + 9*UD16 + 755723*UE16) <=0;
(1347*VF16 + 3*VG16 + 4*VH16) - (10000*UA16 + 4*UB16 + 7*UC16 + 5*UD16 + 374615*UE16) <=0;
(310*VF16 + 3*VG16 + 2*VH16) - (4000*UA16 + 2*UB16 + 2*UC16 + 2*UD16 + 224382*UE16) <=0;
(259*VF16 + 3*VG16 + 3*VH16) - (5500*UA16 + 2*UB16 + 50*UC16 + 5*UD16 + 194903*UE16) <=0;
(277*VF16 + 3*VG16 + 3*VH16) - (2000*UA16 + 8*UB16 + 2*UC16 + 6*UD16 + 173934*UE16) <=0;

UA16 >=0;
UB16 >=0;
UC16 >=0;
UD16 >=0;
UE16 >=0;
VF16 >=0;
VG16 >=0;
VH16 >=0;

```

## Solutions/Weights of Primal Problem



Variable	Value	Reduced Cost
VF16	0.9045681E-04	0.000000
VG16	0.000000	1.000000
VH16	0.1226594	-0.4440892E-15
UA16	0.000000	8914.360
UB16	0.2000000	0.000000
UC16	0.000000	188.6971
UD16	0.000000	0.5255540
UE16	0.000000	960002.8

## Dual Problem Formulation

```

!Dual Objective Function;

MIN = X16;

!Subject to;
13100*Y116 + 2000*Y216 + 550*Y316 + 9800*Y416 + 7500*Y516 + 550*Y616 + 4800*Y716 + 10250*Y816 + 2300*Y916 +
1000*Y1016 + 20700*Y1116 + 1200*Y1216 + 11000*Y1316 + 4100*Y1416 + 2000*Y1516 +
21000*Y1616 + 500*Y1716 + 2152*Y1816 + 9700*Y1916 + 15000*Y2016 + 9000*Y2116 + 4600*Y2216 + 2000*Y2316 +
37324*Y2416 + 11000*Y2516 + 10000*Y2616 + 4000*Y2716 + 5500*Y2816 + 2000*Y2916
-21000*X16 <=0;

7*Y116 + 2*Y216 + 2*Y316 + 14*Y416 + 4*Y516 + 2*Y616 + 3*Y716 + 5*Y816 + 2*Y916 + 1*Y1016 + 21*Y1116 +
6*Y1216 + 13*Y1316 + 2*Y1416 + 2*Y1516 + 5*Y1616 + 2*Y1716 + 4*Y1816 + 5*Y1916
+ 15*Y2016 + 6*Y2116 + 5*Y2216 + 2*Y2316 + 48*Y2416 + 9*Y2516 + 4*Y2616 + 2*Y2716 + 2*Y2816 + 8*Y2916 -5*X16
<=0;

320*Y116 + 7*Y216 + 2*Y316 + 10*Y416 + 7*Y516 + 2*Y616 + 7*Y716 + 20*Y816 + 7*Y916 + 30*Y1016 + 200*Y1116 +
7*Y1216 + 200*Y1316 + 7*Y1416 + 2*Y1516 + 338*Y1616 + 2*Y1716 + 48*Y1816 +
7*Y1916 + 200*Y2016 + 7*Y2116 + 7*Y2216 + 7*Y2316 + 550*Y2416 + 200*Y2516 + 7*Y2616 + 2*Y2716 + 50*Y2816 +
2*Y2916 -338*X16 <=0;

9*Y116 + 4*Y216 + 2*Y316 + 9*Y416 + 4*Y516 + 3*Y616 + 6*Y716 + 7*Y816 + 4*Y916 + 4*Y1016 + 11*Y1116 + 5*Y1216
+ 12*Y1316 + 3*Y1416 + 3*Y1516 + 10*Y1616 + 2*Y1716 + 7*Y1816 + 5*Y1916 +
12*Y2016 + 7*Y2116 + 5*Y2216 + 2*Y2316 + 25*Y2416 + 9*Y2516 + 5*Y2616 + 2*Y2716 + 5*Y2816 + 6*Y2916 -10*X16
<=0;

820931*Y116 + 147596*Y216 + 86404*Y316 + 584300*Y416 + 238265*Y516 + 147473*Y616 + 420908*Y716 +
239046*Y816 + 171183*Y916 + 86967*Y1016 + 142521*Y1116 + 1372680*Y1216
+ 119500*Y1316 + 247573*Y1416 + 93157*Y1516 + 1994765*Y1616 + 29538*Y1716 + 226845*Y1816 + 117310*Y1916
+ 955890*Y2016 + 3333230*Y2116 + 2349633*Y2216 + 139434*Y2316
+ 2090879*Y2416 + 755723*Y2516 + 374615*Y2616 + 224382*Y2716 + 194903*Y2816 + 173934*Y2916 -1994765*X16
<=0;

229*Y116 + 354*Y216 + 115*Y316 + 5827*Y416 + 4776*Y516 + 152*Y616 + 661*Y716 + 1019*Y816 + 278*Y916 +
60*Y1016 + 2155*Y1116 + 908*Y1216 + 2593*Y1316 + 272*Y1416 + 64*Y1516 +
1053*Y1616 + 137*Y1716 + 138*Y1816 + 523*Y1916 + 1222*Y2016 + 1674*Y2116 + 554*Y2216 + 197*Y2316 + 5794*Y2416
+ 1505*Y2516 + 1347*Y2616 + 310*Y2716 + 259*Y2816 + 277*Y2916 >=1053;

3*Y116 + 3*Y216 + 3*Y316 + 3*Y416 + 3*Y516 + 3*Y616 + 3*Y716 + 3*Y816 + 3*Y916 + 3*Y1016 + 3*Y1116 + 3*Y1216
+ 3*Y1316 + 3*Y1416 + 3*Y1516 + 3*Y1616 + 3*Y1716 + 3*Y1816
+ 3*Y1916 + 3*Y2016 + 3*Y2116 + 3*Y2216 + 3*Y2316 + 3*Y2416 + 3*Y2516 + 3*Y2616 + 3*Y2716 + 3*Y2816 + 3*Y2916
>=3;

4*Y116 + 3*Y216 + 1*Y316 + 4*Y416 + 3*Y516 + 1*Y616 + 3*Y716 + 4*Y816 + 2*Y916 + 1*Y1016 + 4*Y1116 + 2*Y1216
+ 4*Y1316 + 3*Y1416 + 2*Y1516 + 4*Y1616 + 1*Y1716 + 2*Y1816
+ 3*Y1916 + 4*Y2016 + 3*Y2116 + 3*Y2216 + 2*Y2316 + 4*Y2416 + 3*Y2516 + 4*Y2616 + 2*Y2716 + 3*Y2816 + 3*Y2916
>=4;

@Free(X16);
Y116 >=0; Y216 >=0; Y316 >=0; Y416 >=0; Y516 >=0; Y616 >=0; Y716 >=0; Y816 >=0; Y916 >=0; Y1016 >=0; Y1116
>=0; Y1216 >=0; Y1316 >=0; Y1416 >=0; Y1516 >=0; Y1616 >=0; Y1716 >=0; Y1816 >=0; Y1916 >=0; Y2016 >=0; Y2116
>=0; Y2216 >=0; Y2316 >=0; Y2416 >=0; Y2516 >=0; Y2616 >=0; Y2716 >=0; Y2816 >=0; Y2916 >=0;

```

## Solutions of Dual Problem

Global optimal solution found.			
Variable	Value	Reduced Cost	
X16	0.5858887	0.000000	
Y116	0.000000	0.8886477	
Y216	1.201945	0.000000	
Y316	0.000000	0.2669380	
Y416	0.000000	1.782270	
Y516	0.1313885	0.000000	
Y616	0.000000	0.2635911	
Y716	0.000000	0.1722298	
Y816	0.000000	0.4171868	
Y916	0.000000	0.1295341	
Y1016	0.000000	0.719131E-01	
Y1116	0.000000	3.514428	
Y1216	0.000000	0.8725464	
Y1316	0.000000	1.874808	
Y1416	0.000000	0.7417458E-02	
Y1516	0.000000	0.1488919	
Y1616	0.000000	0.4141113	
Y1716	0.000000	0.2649480	
Y1816	0.000000	0.5421981	
Y1916	0.000000	0.5847128	
Y2016	0.000000	2.398824	

Y2116	0.000000	0.6805970
Y2216	0.000000	0.5819086
Y2316	0.000000	0.1368611
Y2416	0.000000	8.585256
Y2516	0.000000	1.295884
Y2616	0.000000	0.1875170
Y2716	0.000000	0.1266395
Y2816	0.000000	0.8593397E-02
Y2916	0.000000	1.206965

## SUMMARY

Efficiency score of Warehouse 16 (Jaipur) = 0.5858887

Warehouse 16 (Jaipur) is not an efficient or inefficient warehouse.

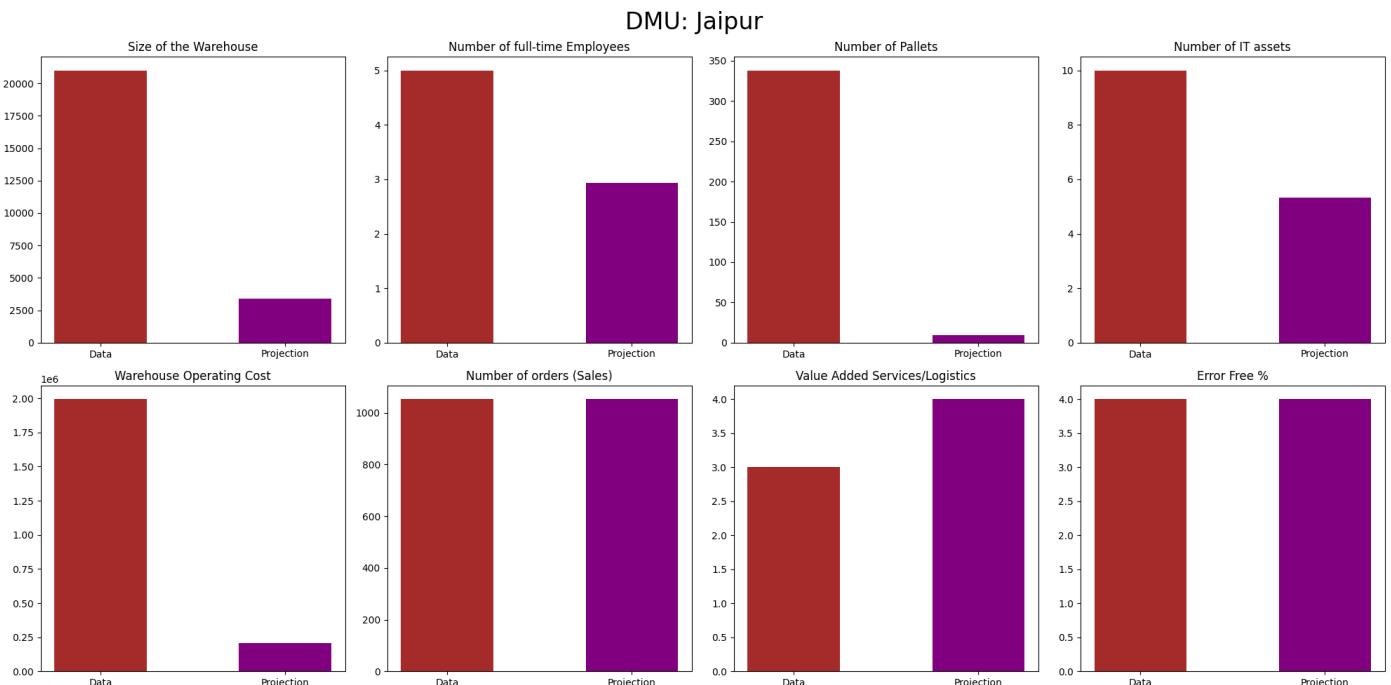
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	21000	3389.3	8914.36
No. of Full-time Employees	5	2.92944	0
No. of Pallets	338	9.33333	188.697
No. of IT assets	10	5.33333	0.526
Warehouse Operating Cost	1994765	208708	960003
No. of Orders (Sales)	1053	1053	0
Level of Value-Added Services	3	4	1
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 2 (Ahmedabad)	1.201945
Warehouse 5 (Bhiwandi)	0.1313885

In order to make warehouse 16 (Jaipur) efficient, they need to decrease size of the warehouse by 83.86%, No of full-time employees by 41.411%, number of pallets by 97.239%, IT Assets by 46.667%, operating cost by 89.537%, whereas value-added logistics needs to be increased by 33.333%.



# WAREHOUSE 17 (JAMMU)

## Primal Problem Formulation

```

!Objective Function;

MAX = 137*VF17 + 3*VG17 + 1*VH17;

!Subject to;

500*UA17 + 2*UB17 + 2*UC17 + 2*UD17 + 29538*UE17 = 1;
(229*VF17 + 3*VG17 + 4*VH17) - (13100*UA17 + 7*UB17 + 320*UC17 + 9*UD17 + 820931*UE17) <=0;
(354*VF17 + 3*VG17 + 3*VH17) - (2000*UA17 + 2*UB17 + 7*UC17 + 4*UD17 + 147596*UE17) <=0;
(115*VF17 + 3*VG17 + 1*VH17) - (550*UA17 + 2*UB17 + 2*UC17 + 2*UD17 + 86404*UE17) <=0;
(5827*VF17 + 3*VG17 + 4*VH17) - (9800*UA17 + 14*UB17 + 10*UC17 + 9*UD17 + 584300*UE17) <=0;
(4776*VF17 + 3*VG17 + 3*VH17) - (7500*UA17 + 4*UB17 + 7*UC17 + 4*UD17 + 238265*UE17) <=0;
(152*VF17 + 3*VG17 + 1*VH17) - (550*UA17 + 2*UB17 + 2*UC17 + 3*UD17 + 147473*UE17) <=0;
(661*VF17 + 3*VG17 + 3*VH17) - (4800*UA17 + 3*UB17 + 7*UC17 + 6*UD17 + 420908*UE17) <=0;
(1019*VF17 + 3*VG17 + 4*VH17) - (10250*UA17 + 5*UB17 + 20*UC17 + 7*UD17 + 239046*UE17) <=0;
(278*VF17 + 3*VG17 + 2*VH17) - (2300*UA17 + 2*UB17 + 7*UC17 + 4*UD17 + 171183*UE17) <=0;
(60*VF17 + 3*VG17 + 1*VH17) - (1000*UA17 + 1*UB17 + 30*UC17 + 4*UD17 + 86967*UE17) <=0;
(2155*VF17 + 3*VG17 + 4*VH17) - (20700*UA17 + 21*UB17 + 200*UC17 + 11*UD17 + 142521*UE17) <=0;
(908*VF17 + 3*VG17 + 2*VH17) - (1200*UA17 + 6*UB17 + 7*UC17 + 5*UD17 + 1372680*UE17) <=0;
(2593*VF17 + 3*VG17 + 4*VH17) - (11000*UA17 + 13*UB17 + 200*UC17 + 12*UD17 + 119500*UE17) <=0;
(272*VF17 + 3*VG17 + 3*VH17) - (4100*UA17 + 2*UB17 + 7*UC17 + 3*UD17 + 247573*UE17) <=0;
(64*VF17 + 3*VG17 + 2*VH17) - (2000*UA17 + 2*UB17 + 2*UC17 + 3*UD17 + 93157*UE17) <=0;
(1053*VF17 + 3*VG17 + 4*VH17) - (21000*UA17 + 5*UB17 + 338*UC17 + 10*UD17 + 1994765*UE17) <=0;
(137*VF17 + 3*VG17 + 1*VH17) - (500*UA17 + 2*UB17 + 2*UC17 + 2*UD17 + 29538*UE17) <=0;
(138*VF17 + 3*VG17 + 2*VH17) - (2152*UA17 + 4*UB17 + 48*UC17 + 7*UD17 + 226845*UE17) <=0;
(523*VF17 + 3*VG17 + 3*VH17) - (9700*UA17 + 5*UB17 + 7*UC17 + 5*UD17 + 117310*UE17) <=0;
(1222*VF17 + 3*VG17 + 4*VH17) - (15000*UA17 + 15*UB17 + 200*UC17 + 12*UD17 + 955890*UE17) <=0;
(1674*VF17 + 3*VG17 + 3*VH17) - (9000*UA17 + 6*UB17 + 7*UC17 + 7*UD17 + 3333230*UE17) <=0;
(554*VF17 + 3*VG17 + 3*VH17) - (4600*UA17 + 5*UB17 + 7*UC17 + 5*UD17 + 2349633*UE17) <=0;
(197*VF17 + 3*VG17 + 2*VH17) - (2000*UA17 + 2*UB17 + 7*UC17 + 2*UD17 + 139434*UE17) <=0;
(5794*VF17 + 3*VG17 + 4*VH17) - (37324*UA17 + 48*UB17 + 550*UC17 + 25*UD17 + 2090879*UE17) <=0;
(1505*VF17 + 3*VG17 + 3*VH17) - (11000*UA17 + 9*UB17 + 200*UC17 + 9*UD17 + 755723*UE17) <=0;
(1347*VF17 + 3*VG17 + 4*VH17) - (10000*UA17 + 4*UB17 + 7*UC17 + 5*UD17 + 374615*UE17) <=0;
(310*VF17 + 3*VG17 + 2*VH17) - (4000*UA17 + 2*UB17 + 2*UC17 + 2*UD17 + 224382*UE17) <=0;
(259*VF17 + 3*VG17 + 3*VH17) - (5500*UA17 + 2*UB17 + 50*UC17 + 5*UD17 + 194903*UE17) <=0;
(277*VF17 + 3*VG17 + 3*VH17) - (2000*UA17 + 8*UB17 + 2*UC17 + 6*UD17 + 173934*UE17) <=0;

UA17 >=0;
UB17 >=0;
UC17 >=0;
UD17 >=0;
UE17 >=0;
VF17 >=0;
VG17 >=0;
VH17 >=0;

```

## Solutions/Weights of Primal Problem



Variable	Value	Reduced Cost
VF17	0.2245179E-03	0.000000
VG17	0.3103781	0.000000
VH17	0.3810687E-01	0.000000
UA17	0.000000	0.000000
UB17	0.000000	0.000000
UC17	0.000000	0.000000
UD17	0.000000	0.000000
UE17	0.3385469E-06	0.000000

## Dual Problem Formulation

```

!Dual Objective Function;
MIN = X17;

!Subject to;
13100*Y117 + 2000*Y217 + 550*Y317 + 9800*Y417 + 7500*Y517 + 550*Y617 + 4800*Y717 + 10250*Y817 + 2300*Y917 +
10000*Y1017 + 20700*Y1117 + 1200*Y1217 + 11000*Y1317 + 4100*Y1417 + 2000*Y1517 +
21000*Y1617 + 500*Y1717 + 2152*Y1817 + 9700*Y1917 + 15000*Y2017 + 9000*Y2117 + 4600*Y2217 + 2000*Y2317 +
37324*Y2417 + 11000*Y2517 + 10000*Y2617 + 4000*Y2717 + 5500*Y2817 + 2000*Y2917
-500*X17 <=0;

7*Y117 + 2*Y217 + 2*Y317 + 14*Y417 + 4*Y517 + 2*Y617 + 3*Y717 + 5*Y817 + 2*Y917 + 1*Y1017 + 21*Y1117 +
6*Y1217 + 13*Y1317 + 2*Y1417 + 2*Y1517 + 5*Y1617 + 2*Y1717 + 4*Y1817 + 5*Y1917 + 15*Y2017 + 6*Y2117 + 5*Y2217 +
+ 2*Y2317 + 48*Y2417 + 9*Y2517 + 4*Y2617 + 2*Y2717 + 2*Y2817 + 8*Y2917 -2*X17 <=0;

320*Y117 + 7*Y217 + 2*Y317 + 10*Y417 + 7*Y517 + 2*Y617 + 7*Y717 + 20*Y817 + 7*Y917 + 30*Y1017 + 200*Y1117 +
7*Y1217 + 200*Y1317 + 7*Y1417 + 2*Y1517 + 338*Y1617 + 2*Y1717 + 48*Y1817 +
7*Y1917 + 200*Y2017 + 7*Y2117 + 7*Y2217 + 7*Y2317 + 550*Y2417 + 200*Y2517 + 7*Y2617 + 2*Y2717 + 50*Y2817 +
2*Y2917 -2*X17 <=0;

9*Y117 + 4*Y217 + 2*Y317 + 9*Y417 + 4*Y517 + 3*Y617 + 6*Y717 + 7*Y817 + 4*Y917 + 4*Y1017 + 11*Y1117 + 5*Y1217 +
+ 12*Y1317 + 3*Y1417 + 3*Y1517 + 10*Y1617 + 2*Y1717 + 7*Y1817 + 5*Y1917 +
12*Y2017 + 7*Y2117 + 5*Y2217 + 2*Y2317 + 25*Y2417 + 9*Y2517 + 5*Y2617 + 2*Y2717 + 5*Y2817 + 6*Y2917 -2*X17
<=0;

820931*Y117 + 147596*Y217 + 86404*Y317 + 584300*Y417 + 238265*Y517 + 147473*Y617 + 420908*Y717 +
239046*Y817 + 171183*Y917 + 86967*Y1017 + 142521*Y1117 + 1372680*Y1217
+ 119500*Y1317 + 247573*Y1417 + 93157*Y1517 + 1994765*Y1617 + 29538*Y1717 + 226845*Y1817 + 117310*Y1917
+ 955890*Y2017 + 3333230*Y2117 + 2349633*Y2217 + 139434*Y2317
+ 2090879*Y2417 + 755723*Y2517 + 374615*Y2617 + 224382*Y2717 + 194903*Y2817 + 173934*Y2917 -29538*X17
<=0;

229*Y117 + 354*Y217 + 115*Y317 + 5827*Y417 + 4776*Y517 + 152*Y617 + 661*Y717 + 1019*Y817 + 278*Y917 +
60*Y1017 + 2155*Y1117 + 908*Y1217 + 2593*Y1317 + 272*Y1417 + 64*Y1517 +
1053*Y1617 + 137*Y1717 + 138*Y1817 + 523*Y1917 + 1222*Y2017 + 1674*Y2117 + 554*Y2217 + 197*Y2317 + 5794*Y2417
+ 1505*Y2517 + 1347*Y2617 + 310*Y2717 + 259*Y2817 + 277*Y2917 >=137;

3*Y117 + 3*Y217 + 3*Y317 + 3*Y417 + 3*Y517 + 3*Y617 + 3*Y717 + 3*Y817 + 3*Y917 + 3*Y1017 + 3*Y1117 + 3*Y1217 +
+ 3*Y1317 + 3*Y1417 + 3*Y1517 + 3*Y1617 + 3*Y1717 + 3*Y1817
+ 3*Y1917 + 3*Y2017 + 3*Y2117 + 3*Y2217 + 3*Y2317 + 3*Y2417 + 3*Y2517 + 3*Y2617 + 3*Y2717 + 3*Y2817 + 3*Y2917
>=3;

4*Y117 + 3*Y217 + 1*Y317 + 4*Y417 + 3*Y517 + 1*Y617 + 3*Y717 + 4*Y817 + 2*Y917 + 1*Y1017 + 4*Y1117 + 2*Y1217 +
+ 4*Y1317 + 3*Y1417 + 2*Y1517 + 4*Y1617 + 1*Y1717 + 2*Y1817
+ 3*Y1917 + 4*Y2017 + 3*Y2117 + 3*Y2217 + 2*Y2317 + 4*Y2417 + 3*Y2517 + 4*Y2617 + 2*Y2717 + 3*Y2817 + 3*Y2917
>=1;

@Free(X17);
Y117 >=0; Y217 >=0; Y317 >=0; Y417 >=0; Y517 >=0; Y617 >=0; Y717 >=0; Y817 >=0; Y917 >=0; Y1017 >=0; Y1117
>=0; Y1217 >=0; Y1317 >=0; Y1417 >=0; Y1517 >=0; Y1617 >=0; Y1717 >=0; Y1817 >=0; Y1917 >=0; Y2017 >=0; Y2117
>=0; Y2217 >=0; Y2317 >=0; Y2417 >=0; Y2517 >=0; Y2617 >=0; Y2717 >=0; Y2817 >=0; Y2917 >=0;

```

## Solutions of Dual Problem Formulation



Variable	Value	Reduced Cost
X17	1.000000	0.000000
Y117	0.000000	26.79237
Y217	0.000000	3.996818
Y317	0.000000	1.925181
Y417	0.000000	18.78130
Y517	0.000000	7.066389
Y617	0.000000	3.992654
Y717	0.000000	13.24971
Y817	0.000000	7.092830
Y917	0.000000	4.795348
Y1017	0.000000	1.944241
Y1117	0.000000	3.825005
Y1217	0.000000	45.47166
Y1317	0.000000	3.045636
Y1417	0.000000	7.381509
Y1517	0.000000	2.153802
Y1617	0.000000	66.53216

Y1717	1.000000	0.000000
Y1817	0.000000	6.679768
Y1917	0.000000	2.971494
Y2017	0.000000	31.36137
Y2117	0.000000	111.8455
Y2217	0.000000	78.54611
Y2317	0.000000	3.720496
Y2417	0.000000	69.78607
Y2517	0.000000	24.58477
Y2617	0.000000	11.68248
Y2717	0.000000	6.596384
Y2817	0.000000	5.598382
Y2917	0.000000	4.888483

## SUMMARY

Efficiency score of Warehouse 17 (Jammu) = 1

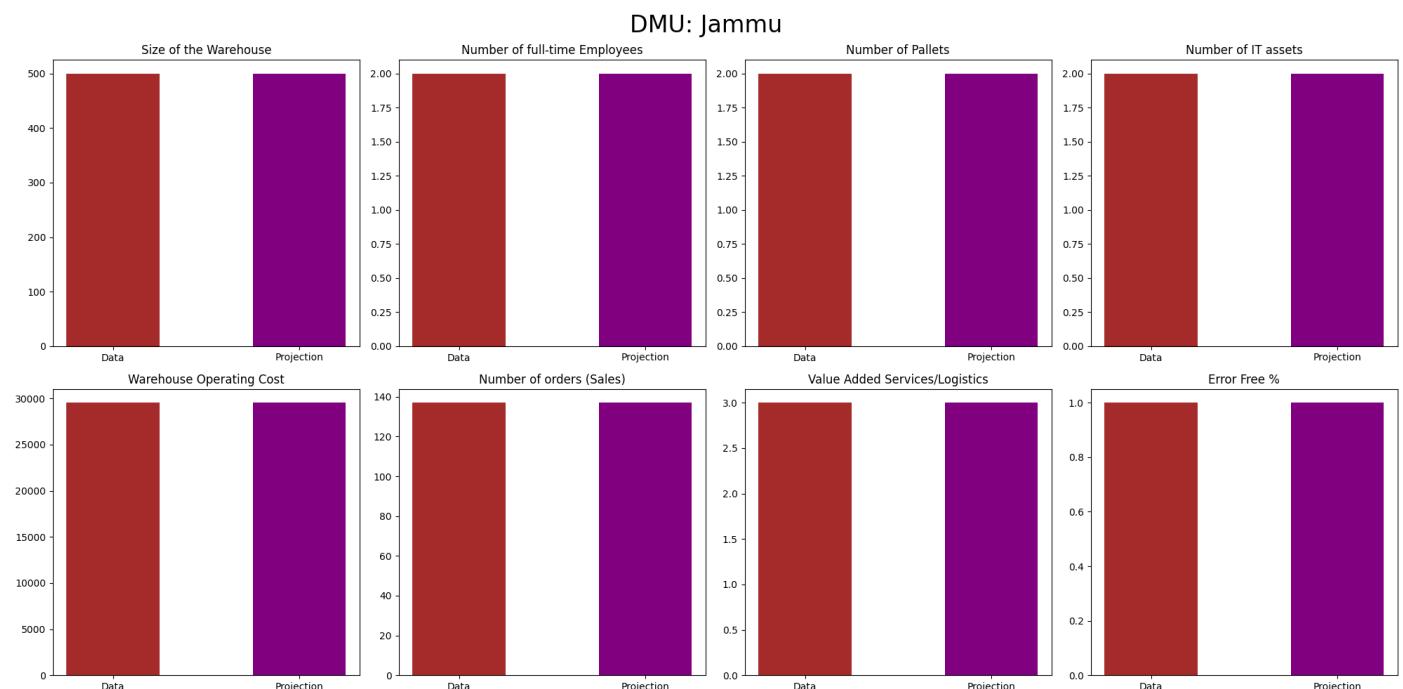
Warehouse 17 (Jammu) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	500	500	0
No. of Full-time Employees	2	2	0
No. of Pallets	2	2	0
No. of IT assets	2	2	0
Warehouse Operating Cost	29538	29538	0
No. of Orders (Sales)	137	137	0
Level of Value-Added Services	3	3	0
Error Free (%)	1	1	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 17 (Jammu)	1



# WAREHOUSE 18 (KANPUR)

## Primal Problem Formulation

```

!Objective Function;

MAX = 138*VF18 + 3*VG18 + 2*VH18;

!Subject to;

2152*UA18 + 4*UB18 + 48*UC18 + 7*UD18 + 226845*UE18 = 1;
(229*VF18 + 3*VG18 + 4*VH18) - (13100*UA18 + 7*UB18 + 320*UC18 + 9*UD18 + 820931*UE18) <=0;
(354*VF18 + 3*VG18 + 3*VH18) - (2000*UA18 + 2*UB18 + 7*UC18 + 4*UD18 + 147596*UE18) <=0;
(115*VF18 + 3*VG18 + 1*VH18) - (550*UA18 + 2*UB18 + 2*UC18 + 2*UD18 + 86404*UE18) <=0;
(5827*VF18 + 3*VG18 + 4*VH18) - (9800*UA18 + 14*UB18 + 10*UC18 + 9*UD18 + 584300*UE18) <=0;
(4776*VF18 + 3*VG18 + 3*VH18) - (7500*UA18 + 4*UB18 + 7*UC18 + 4*UD18 + 238265*UE18) <=0;
(152*VF18 + 3*VG18 + 1*VH18) - (550*UA18 + 2*UB18 + 2*UC18 + 3*UD18 + 147473*UE18) <=0;
(661*VF18 + 3*VG18 + 3*VH18) - (4800*UA18 + 3*UB18 + 7*UC18 + 6*UD18 + 420908*UE18) <=0;
(1019*VF18 + 3*VG18 + 4*VH18) - (10250*UA18 + 5*UB18 + 20*UC18 + 7*UD18 + 239046*UE18) <=0;
(278*VF18 + 3*VG18 + 2*VH18) - (2300*UA18 + 2*UB18 + 7*UC18 + 4*UD18 + 171183*UE18) <=0;
(60*VF18 + 3*VG18 + 1*VH18) - (1000*UA18 + 1*UB18 + 30*UC18 + 4*UD18 + 86967*UE18) <=0;
(2155*VF18 + 3*VG18 + 4*VH18) - (20700*UA18 + 21*UB18 + 200*UC18 + 11*UD18 + 142521*UE18) <=0;
(908*VF18 + 3*VG18 + 2*VH18) - (1200*UA18 + 6*UB18 + 7*UC18 + 5*UD18 + 1372680*UE18) <=0;
(2593*VF18 + 3*VG18 + 4*VH18) - (11000*UA18 + 13*UB18 + 200*UC18 + 12*UD18 + 119500*UE18) <=0;
(272*VF18 + 3*VG18 + 3*VH18) - (4100*UA18 + 2*UB18 + 7*UC18 + 3*UD18 + 247573*UE18) <=0;
(64*VF18 + 3*VG18 + 2*VH18) - (2000*UA18 + 2*UB18 + 2*UC18 + 3*UD18 + 93157*UE18) <=0;
(1053*VF18 + 3*VG18 + 4*VH18) - (21000*UA18 + 5*UB18 + 338*UC18 + 10*UD18 + 1994765*UE18) <=0;
(137*VF18 + 3*VG18 + 1*VH18) - (500*UA18 + 2*UB18 + 2*UC18 + 2*UD18 + 29538*UE18) <=0;
(138*VF18 + 3*VG18 + 2*VH18) - (2152*UA18 + 4*UB18 + 48*UC18 + 7*UD18 + 226845*UE18) <=0;
(523*VF18 + 3*VG18 + 3*VH18) - (9700*UA18 + 5*UB18 + 7*UC18 + 5*UD18 + 117310*UE18) <=0;
(1222*VF18 + 3*VG18 + 4*VH18) - (15000*UA18 + 15*UB18 + 200*UC18 + 12*UD18 + 955890*UE18) <=0;
(1674*VF18 + 3*VG18 + 3*VH18) - (9000*UA18 + 6*UB18 + 7*UC18 + 7*UD18 + 3333230*UE18) <=0;
(554*VF18 + 3*VG18 + 3*VH18) - (4600*UA18 + 5*UB18 + 7*UC18 + 5*UD18 + 2349633*UE18) <=0;
(197*VF18 + 3*VG18 + 2*VH18) - (2000*UA18 + 2*UB18 + 7*UC18 + 2*UD18 + 139434*UE18) <=0;
(5794*VF18 + 3*VG18 + 4*VH18) - (37324*UA18 + 48*UB18 + 550*UC18 + 25*UD18 + 2090879*UE18) <=0;
(1505*VF18 + 3*VG18 + 3*VH18) - (11000*UA18 + 9*UB18 + 200*UC18 + 9*UD18 + 755723*UE18) <=0;
(1347*VF18 + 3*VG18 + 4*VH18) - (10000*UA18 + 4*UB18 + 7*UC18 + 5*UD18 + 374615*UE18) <=0;
(310*VF18 + 3*VG18 + 2*VH18) - (4000*UA18 + 2*UB18 + 2*UC18 + 2*UD18 + 224382*UE18) <=0;
(259*VF18 + 3*VG18 + 3*VH18) - (5500*UA18 + 2*UB18 + 50*UC18 + 5*UD18 + 194903*UE18) <=0;
(277*VF18 + 3*VG18 + 3*VH18) - (2000*UA18 + 8*UB18 + 2*UC18 + 6*UD18 + 173934*UE18) <=0;

UA18 >=0;
UB18 >=0;
UC18 >=0;
UD18 >=0;
UE18 >=0;
VF18 >=0;
VG18 >=0;
VH18 >=0;

```

## Solutions of Primal Problem Formulation

LINGO 11.0 - [Solution Report - warehouse 18 PP]

**File Edit LINGO Window Help**

Global optimal solution found.

Objective value:	0.5656109	
Infeasibilities:	0.000000	
Total solver iterations:	6	
Variable	Value	Reduced Cost
VF18	0.000000	111.2398
VG18	0.000000	0.3936652
VH18	0.2828054	0.000000
UA18	0.3770739E-03	0.000000
UB18	0.4713424E-01	-0.1110223E-15
UC18	0.000000	22.71493
UD18	0.000000	0.8280543
UE18	0.000000	43608.86

## Dual Problem Formulation

```

!Dual Objective Function;

MIN = X18;

!Subject to;
13100*Y118 + 2000*Y218 + 550*Y318 + 9800*Y418 + 7500*Y518 + 550*Y618 + 4800*Y718 + 10250*Y818 + 2300*Y918 +
1000*Y1018 + 20700*Y1118 + 1200*Y1218 + 11000*Y1318 + 4100*Y1418 + 2000*Y1518 +
21000*Y1618 + 500*Y1718 + 2152*Y1818 + 9700*Y1918 + 15000*Y2018 + 9000*Y2118 + 4600*Y2218 + 2000*Y2318 +
37324*Y2418 + 11000*Y2518 + 10000*Y2618 + 4000*Y2718 + 5500*Y2818 + 2000*Y2918
-2152*X18 <=0;

7*Y118 + 2*Y218 + 2*Y318 + 14*Y418 + 4*Y518 + 2*Y618 + 3*Y718 + 5*Y818 + 2*Y918 + 1*Y1018 + 21*Y1118 +
6*Y1218 + 13*Y1318 + 2*Y1418 + 2*Y1518 + 5*Y1618 + 2*Y1718 + 4*Y1818 + 5*Y1918 + 15*Y2018 + 6*Y2118 + 5*Y2218 +
2*Y2318 + 48*Y2418 + 9*Y2518 + 4*Y2618 + 2*Y2718 + 2*Y2818 + 8*Y2918 - 4*X18 <=0;

320*Y118 + 7*Y218 + 2*Y318 + 10*Y418 + 7*Y518 + 2*Y618 + 7*Y718 + 20*Y818 + 7*Y918 + 30*Y1018 + 200*Y1118 +
7*Y1218 + 200*Y1318 + 7*Y1418 + 2*Y1518 + 338*Y1618 + 2*Y1718 + 48*Y1818 +
7*Y1918 + 200*Y2018 + 7*Y2118 + 7*Y2218 + 7*Y2318 + 550*Y2418 + 200*Y2518 + 7*Y2618 + 2*Y2718 + 50*Y2818 +
2*Y2918 - 48*X18 <=0;

9*Y118 + 4*Y218 + 2*Y318 + 9*Y418 + 4*Y518 + 3*Y618 + 6*Y718 + 7*Y818 + 4*Y918 + 4*Y1018 + 11*Y1118 + 5*Y1218 +
12*Y1318 + 3*Y1418 + 3*Y1518 + 10*Y1618 + 2*Y1718 + 7*Y1818 + 5*Y1918 +
12*Y2018 + 7*Y2118 + 5*Y2218 + 2*Y2318 + 25*Y2418 + 9*Y2518 + 5*Y2618 + 2*Y2718 + 5*Y2818 + 6*Y2918 - 7*X18
<=0;

820931*Y118 + 147596*Y218 + 86404*Y318 + 584300*Y418 + 238265*Y518 + 147473*Y618 + 420908*Y718 +
239046*Y818 + 171183*Y918 + 86967*Y1018 + 142521*Y1118 + 1372680*Y1218 +
+ 119500*Y1318 + 247573*Y1418 + 93157*Y1518 + 1994765*Y1618 + 29538*Y1718 + 226845*Y1818 + 117310*Y1918 +
+ 955890*Y2018 + 3333230*Y2118 + 2349633*Y2218 + 139434*Y2318 +
+ 2090879*Y2418 + 755723*Y2518 + 374615*Y2618 + 224382*Y2718 + 194903*Y2818 + 173934*Y2918 - 226845*X18
<=0;

229*Y118 + 354*Y218 + 115*Y318 + 5827*Y418 + 4776*Y518 + 152*Y618 + 661*Y718 + 1019*Y818 + 278*Y918 +
60*Y1018 + 2155*Y1118 + 908*Y1218 + 2593*Y1318 + 272*Y1418 + 64*Y1518 +
1053*Y1618 + 137*Y1718 + 138*Y1818 + 523*Y1918 + 1222*Y2018 + 1674*Y2118 + 554*Y2218 + 197*Y2318 + 5794*Y2418 +
+ 1505*Y2518 + 1347*Y2618 + 310*Y2718 + 259*Y2818 + 277*Y2918 >=138;

3*Y118 + 3*Y218 + 3*Y318 + 3*Y418 + 3*Y518 + 3*Y618 + 3*Y718 + 3*Y818 + 3*Y918 + 3*Y1018 + 3*Y1118 + 3*Y1218 +
+ 3*Y1318 + 3*Y1418 + 3*Y1518 + 3*Y1618 + 3*Y1718 + 3*Y1818 +
+ 3*Y1918 + 3*Y2018 + 3*Y2118 + 3*Y2218 + 3*Y2318 + 3*Y2418 + 3*Y2518 + 3*Y2618 + 3*Y2718 + 3*Y2818 + 3*Y2918
>=3;

4*Y118 + 3*Y218 + 1*Y318 + 4*Y418 + 3*Y518 + 1*Y618 + 3*Y718 + 4*Y818 + 2*Y918 + 1*Y1018 + 4*Y1118 + 2*Y1218 +
+ 4*Y1318 + 3*Y1418 + 2*Y1518 + 4*Y1618 + 1*Y1718 + 2*Y1818 +
+ 3*Y1918 + 4*Y2018 + 3*Y2118 + 3*Y2218 + 2*Y2318 + 4*Y2418 + 3*Y2518 + 4*Y2618 + 2*Y2718 + 3*Y2818 + 3*Y2918
>=2;

```

```

@Free(X18);
Y118 >=0; Y218 >=0; Y318 >=0; Y418 >=0; Y518 >=0; Y618 >=0; Y718 >=0; Y818 >=0; Y918 >=0; Y1018 >=0; Y1118
>=0; Y1218 >=0; Y1318 >=0; Y1418 >=0; Y1518 >=0; Y1618 >=0; Y1718 >=0; Y1818 >=0; Y1918 >=0; Y2018 >=0; Y2118
>=0; Y2218 >=0; Y2318 >=0; Y2418 >=0; Y2518 >=0; Y2618 >=0; Y2718 >=0; Y2818 >=0; Y2918 >=0;

```

## Solutions of Dual Problem Formulation

File Edit LINGO Window Help		
□	□	□
Global optimal solution found.		
Objective value:	0.5656109	
Infeasibilities:	0.000000	
Total solver iterations:	3	
Variable	Value	Reduced Cost
X18	0.5656109	0.1110223E-15
Y118	0.000000	4.138386
Y218	0.4343891	-0.9714451E-16
Y318	0.000000	0.1885370E-01
Y418	0.000000	3.223982
Y518	0.000000	2.168175
Y618	0.000000	0.1885370E-01
Y718	0.000000	1.102941
Y818	0.000000	2.969457
Y918	0.000000	0.3959276
Y1018	0.000000	0.1414027
Y1118	0.000000	7.664027
Y1218	0.000000	0.1696833
Y1318	0.000000	3.629336
Y1418	0.000000	0.7918552
Y1518	0.000000	0.2828054
Y1618	0.000000	7.023002
Y1718	0.6968326	0.000000
Y1818	0.000000	0.4343891
Y1918	0.000000	3.044872

Y2018	0.000000	5.231900
Y2118	0.000000	2.828054
Y2218	0.000000	1.121795
Y2318	0.000000	0.2828054
Y2418	0.000000	15.20513
Y2518	0.000000	3.723605
Y2618	0.000000	2.828054
Y2718	0.000000	1.036953
Y2818	0.000000	1.319759
Y2918	0.000000	0.2828054

## SUMMARY

Efficiency score of Warehouse 18 (Kanpur) = 0.5656109

Warehouse 18 (Kanpur) is not an efficient or inefficient warehouse.

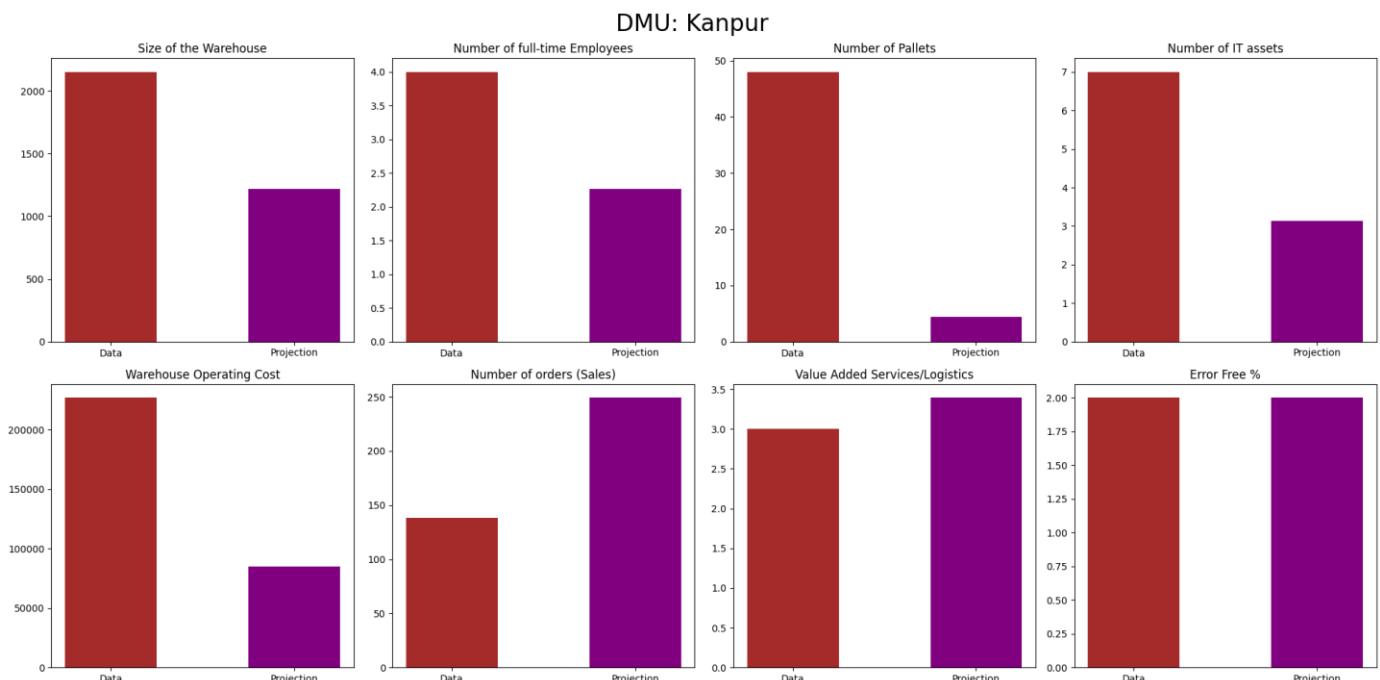
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	2152	1217.19	0
No. of Full-time Employees	4	2.26244	0
No. of Pallets	48	4.43439	22.715
No. of IT assets	7	3.13122	0.828
Warehouse Operating Cost	226845	84697.1	43608.9
No. of Orders (Sales)	138	249.24	111.24
Level of Value-Added Services	3	3.39367	0.394
Error Free (%)	2	2	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 2 (Ahmedabad)	0.4343891
Warehouse 17 (Jammu)	0.6968326

In order to make warehouse 18 (Kapur) efficient, they need to decrease size of the warehouse by 43.439%, No of full-time employees by 43.439%, number of pallets by 90.762%, IT Assets by 55.268%, operating cost by 62.663%, whereas No.of needs to be increased by 80.609% and level Added logistics by 13.122%.



## WAREHOUSE 19 (KARNAL)

### Primal Problem Formulation

```

!Objective Function;

MAX = 523*VF19 + 3*VG19 + 3*VH19;

!Subject to;

9700*UA19 + 5*UB19 + 7*UC19 + 5*UD19 + 117310*UE19 = 1;
(229*VF19 + 3*VG19 + 4*VH19) - (13100*UA19 + 7*UB19 + 320*UC19 + 9*UD19 + 820931*UE19) <=0;
(354*VF19 + 3*VG19 + 3*VH19) - (2000*UA19 + 2*UB19 + 7*UC19 + 4*UD19 + 147596*UE19) <=0;
(115*VF19 + 3*VG19 + 1*VH19) - (550*UA19 + 2*UB19 + 2*UC19 + 2*UD19 + 86404*UE19) <=0;
(5827*VF19 + 3*VG19 + 4*VH19) - (9800*UA19 + 14*UB19 + 10*UC19 + 9*UD19 + 584300*UE19) <=0;
(4776*VF19 + 3*VG19 + 3*VH19) - (7500*UA19 + 4*UB19 + 7*UC19 + 4*UD19 + 238265*UE19) <=0;
(152*VF19 + 3*VG19 + 1*VH19) - (550*UA19 + 2*UB19 + 2*UC19 + 3*UD19 + 147473*UE19) <=0;
(661*VF19 + 3*VG19 + 3*VH19) - (4800*UA19 + 3*UB19 + 7*UC19 + 6*UD19 + 420908*UE19) <=0;
(1019*VF19 + 3*VG19 + 4*VH19) - (10250*UA19 + 5*UB19 + 20*UC19 + 7*UD19 + 239046*UE19) <=0;
(278*VF19 + 3*VG19 + 2*VH19) - (2300*UA19 + 2*UB19 + 7*UC19 + 4*UD19 + 171183*UE19) <=0;
(60*VF19 + 3*VG19 + 1*VH19) - (1000*UA19 + 1*UB19 + 30*UC19 + 4*UD19 + 86967*UE19) <=0;
(2155*VF19 + 3*VG19 + 4*VH19) - (20700*UA19 + 21*UB19 + 200*UC19 + 11*UD19 + 142521*UE19) <=0;
(908*VF19 + 3*VG19 + 2*VH19) - (1200*UA19 + 6*UB19 + 7*UC19 + 5*UD19 + 1372680*UE19) <=0;
(2593*VF19 + 3*VG19 + 4*VH19) - (11000*UA19 + 13*UB19 + 200*UC19 + 12*UD19 + 119500*UE19) <=0;
(272*VF19 + 3*VG19 + 3*VH19) - (4100*UA19 + 2*UB19 + 7*UC19 + 3*UD19 + 247573*UE19) <=0;
(64*VF19 + 3*VG19 + 2*VH19) - (2000*UA19 + 2*UB19 + 2*UC19 + 3*UD19 + 93157*UE19) <=0;
(1053*VF19 + 3*VG19 + 4*VH19) - (21000*UA19 + 5*UB19 + 338*UC19 + 10*UD19 + 1994765*UE19) <=0;
(137*VF19 + 3*VG19 + 1*VH19) - (500*UA19 + 2*UB19 + 2*UC19 + 2*UD19 + 29538*UE19) <=0;
(138*VF19 + 3*VG19 + 2*VH19) - (2152*UA19 + 4*UB19 + 48*UC19 + 7*UD19 + 226845*UE19) <=0;
(523*VF19 + 3*VG19 + 3*VH19) - (9700*UA19 + 5*UB19 + 7*UC19 + 5*UD19 + 117310*UE19) <=0;
(1222*VF19 + 3*VG19 + 4*VH19) - (15000*UA19 + 15*UB19 + 200*UC19 + 12*UD19 + 955890*UE19) <=0;
(1674*VF19 + 3*VG19 + 3*VH19) - (9000*UA19 + 6*UB19 + 7*UC19 + 7*UD19 + 3333230*UE19) <=0;
(554*VF19 + 3*VG19 + 3*VH19) - (4600*UA19 + 5*UB19 + 7*UC19 + 5*UD19 + 2349633*UE19) <=0;
(197*VF19 + 3*VG19 + 2*VH19) - (2000*UA19 + 2*UB19 + 7*UC19 + 2*UD19 + 139434*UE19) <=0;
(5794*VF19 + 3*VG19 + 4*VH19) - (37324*UA19 + 48*UB19 + 550*UC19 + 25*UD19 + 2090879*UE19) <=0;
(1505*VF19 + 3*VG19 + 3*VH19) - (11000*UA19 + 9*UB19 + 200*UC19 + 9*UD19 + 755723*UE19) <=0;
(1347*VF19 + 3*VG19 + 4*VH19) - (10000*UA19 + 4*UB19 + 7*UC19 + 5*UD19 + 374615*UE19) <=0;
(310*VF19 + 3*VG19 + 2*VH19) - (4000*UA19 + 2*UB19 + 2*UC19 + 2*UD19 + 224382*UE19) <=0;
(259*VF19 + 3*VG19 + 3*VH19) - (5500*UA19 + 2*UB19 + 50*UC19 + 5*UD19 + 194903*UE19) <=0;
(277*VF19 + 3*VG19 + 3*VH19) - (2000*UA19 + 8*UB19 + 2*UC19 + 6*UD19 + 173934*UE19) <=0;

UA19 >=0;
UB19 >=0;
UC19 >=0;
UD19 >=0;
UE19 >=0;
VF19 >=0;
VG19 >=0;
VH19 >=0;

```

### Solutions/Weights of Primal Problem

```

Global optimal solution found.
Objective value: 1.000000
Infeasibilities: 0.000000
Total solver iterations: 12

```

Variable	Value	Reduced Cost
VF19	0.7167603E-04	0.000000
VG19	0.4283187E-02	0.000000
VH19	0.3165546	0.000000
UA19	0.000000	0.000000
UB19	0.1580765E-01	0.000000
UC19	0.000000	0.000000
UD19	0.8970695E-01	0.000000
UE19	0.4027166E-05	0.000000

### Dual Problem Formulation

```

!Dual Objective Function;

MIN = X19;

!Subject to;
13100*Y119 + 2000*Y219 + 550*Y319 + 9800*Y419 + 7500*Y519 + 550*Y619 + 4800*Y719 + 10250*Y819 + 2300*Y919 +
1000*Y1019 + 20700*Y1119 + 1200*Y1219 + 11000*Y1319 + 4100*Y1419 + 2000*Y1519 +
21000*Y1619 + 500*Y1719 + 2152*Y1819 + 9700*Y1919 + 15000*Y2019 + 9000*Y2119 + 4600*Y2219 + 2000*Y2319 +
37324*Y2419 + 11000*Y2519 + 10000*Y2619 + 4000*Y2719 + 5500*Y2819 + 2000*Y2919
-9700*X19 <=0;

7*Y119 + 2*Y219 + 2*Y319 + 14*Y419 + 4*Y519 + 2*Y619 + 3*Y719 + 5*Y819 + 2*Y919 + 1*Y1019 + 21*Y1119 +
6*Y1219 + 13*Y1319 + 2*Y1419 + 2*Y1519 + 5*Y1619 + 2*Y1719 + 4*Y1819 + 5*Y1919 + 15*Y2019 + 6*Y2119 + 5*Y2219 +
2*Y2319 + 48*Y2419 + 9*Y2519 + 4*Y2619 + 2*Y2719 + 2*Y2819 + 8*Y2919 -5*X19 <= 0;

320*Y119 + 7*Y219 + 2*Y319 + 10*Y419 + 7*Y519 + 2*Y619 + 7*Y719 + 20*Y819 + 7*Y919 + 30*Y1019 + 200*Y1119 +
7*Y1219 + 200*Y1319 + 7*Y1419 + 2*Y1519 + 338*Y1619 + 2*Y1719 + 48*Y1819 +
7*Y1919 + 200*Y2019 + 7*Y2119 + 7*Y2219 + 7*Y2319 + 550*Y2419 + 200*Y2519 + 7*Y2619 + 2*Y2719 + 50*Y2819 +
2*Y2919 - 7*X19 <=0;

9*Y119 + 4*Y219 + 2*Y319 + 9*Y419 + 4*Y519 + 3*Y619 + 6*Y719 + 7*Y819 + 4*Y919 + 4*Y1019 + 11*Y1119 + 5*Y1219 +
+ 12*Y1319 + 3*Y1419 + 3*Y1519 + 10*Y1619 + 2*Y1719 + 7*Y1819 + 5*Y1919 +
12*Y2019 + 7*Y2119 + 5*Y2219 + 2*Y2319 + 25*Y2419 + 9*Y2519 + 5*Y2619 + 2*Y2719 + 5*Y2819 + 6*Y2919 - 5*X19
<=0;

820931*Y119 + 147596*Y219 + 86404*Y319 + 584300*Y419 + 238265*Y519 + 147473*Y619 + 420908*Y719 +
239046*Y819 + 171183*Y919 + 86967*Y1019 + 142521*Y1119 + 1372680*Y1219
+ 119500*Y1319 + 247573*Y1419 + 93157*Y1519 + 1994765*Y1619 + 29538*Y1719 + 226845*Y1819 + 117310*Y1919
+ 955890*Y2019 + 3333230*Y2119 + 2349633*Y2219 + 139434*Y2319
+ 2090879*Y2419 + 755723*Y2519 + 374615*Y2619 + 224382*Y2719 + 194903*Y2819 + 173934*Y2919 - 117310*X19
<=0;

229*Y119 + 354*Y219 + 115*Y319 + 5827*Y419 + 4776*Y519 + 152*Y619 + 661*Y719 + 1019*Y819 + 278*Y919 +
60*Y1019 + 2155*Y1119 + 908*Y1219 + 2593*Y1319 + 272*Y1419 + 64*Y1519 +
1053*Y1619 + 137*Y1719 + 138*Y1819 + 523*Y1919 + 1222*Y2019 + 1674*Y2119 + 554*Y2219 + 197*Y2319 + 5794*Y2419
+ 1505*Y2519 + 1347*Y2619 + 310*Y2719 + 259*Y2819 + 277*Y2919 >=523;

3*Y119 + 3*Y219 + 3*Y319 + 3*Y419 + 3*Y519 + 3*Y619 + 3*Y719 + 3*Y819 + 3*Y919 + 3*Y1019 + 3*Y1119 + 3*Y1219
+ 3*Y1319 + 3*Y1419 + 3*Y1519 + 3*Y1619 + 3*Y1719 + 3*Y1819
+ 3*Y1919 + 3*Y2019 + 3*Y2119 + 3*Y2219 + 3*Y2319 + 3*Y2419 + 3*Y2519 + 3*Y2619 + 3*Y2719 + 3*Y2819 + 3*Y2919
>= 3;

4*Y119 + 3*Y219 + 1*Y319 + 4*Y419 + 3*Y519 + 1*Y619 + 3*Y719 + 4*Y819 + 2*Y919 + 1*Y1019 + 4*Y1119 + 2*Y1219
+ 4*Y1319 + 3*Y1419 + 2*Y1519 + 4*Y1619 + 1*Y1719 + 2*Y1819
+ 3*Y1919 + 4*Y2019 + 3*Y2119 + 3*Y2219 + 2*Y2319 + 4*Y2419 + 3*Y2519 + 4*Y2619 + 2*Y2719 + 3*Y2819 + 3*Y2919
>= 3;

@Free(X19);
Y119 >=0; Y219 >=0; Y319 >=0; Y419 >=0; Y519 >=0; Y619 >=0; Y719 >=0; Y819 >=0; Y919 >=0; Y1019 >=0; Y1119
>=0; Y1219 >=0; Y1319 >=0; Y1419 >=0; Y1519 >=0; Y1619 >=0; Y1719 >=0; Y1819 >=0; Y1919 >=0; Y2019 >=0; Y2119
>=0; Y2219 >=0; Y2319 >=0; Y2419 >=0; Y2519 >=0; Y2619 >=0; Y2719 >=0; Y2819 >=0; Y2919 >=0;

```

## Solutions of Dual Problem



Global optimal solution found.

Objective value:	1.000000
Infeasibilities:	0.000000
Total solver iterations:	4

Variable	Value	Reduced Cost
X19	1.000000	0.000000
Y119	0.000000	2.932729
Y219	0.000000	0.3330669E-15
Y319	0.000000	0.2309828
Y419	0.000000	1.588162
Y519	0.000000	-0.1165734E-14
Y619	0.000000	0.5633050
Y719	0.000000	1.268350
Y819	0.000000	0.3074709
Y919	0.000000	0.4194994
Y1019	0.000000	0.4017911
Y1119	0.000000	0.4285738
Y1219	0.000000	5.354540

Y1319	0.000000	0.2598115
Y1419	0.000000	0.3202744
Y1519	0.000000	0.3476939E-01
Y1619	0.000000	7.644114
Y1719	0.000000	-0.5551115E-16
Y1819	0.000000	0.9569569
Y1919	1.000000	0.000000
Y2019	0.000000	3.782719
Y2119	0.000000	13.04300
Y2219	0.000000	8.987155
Y2319	0.000000	0.1194945
Y2419	0.000000	9.631139
Y2519	0.000000	2.904946
Y2619	0.000000	0.6287792
Y2719	0.000000	0.4514556
Y2819	0.000000	0.2887438
Y2919	0.000000	0.3872360

## SUMMARY

Efficiency score of Warehouse 19 (Karnal) = 1

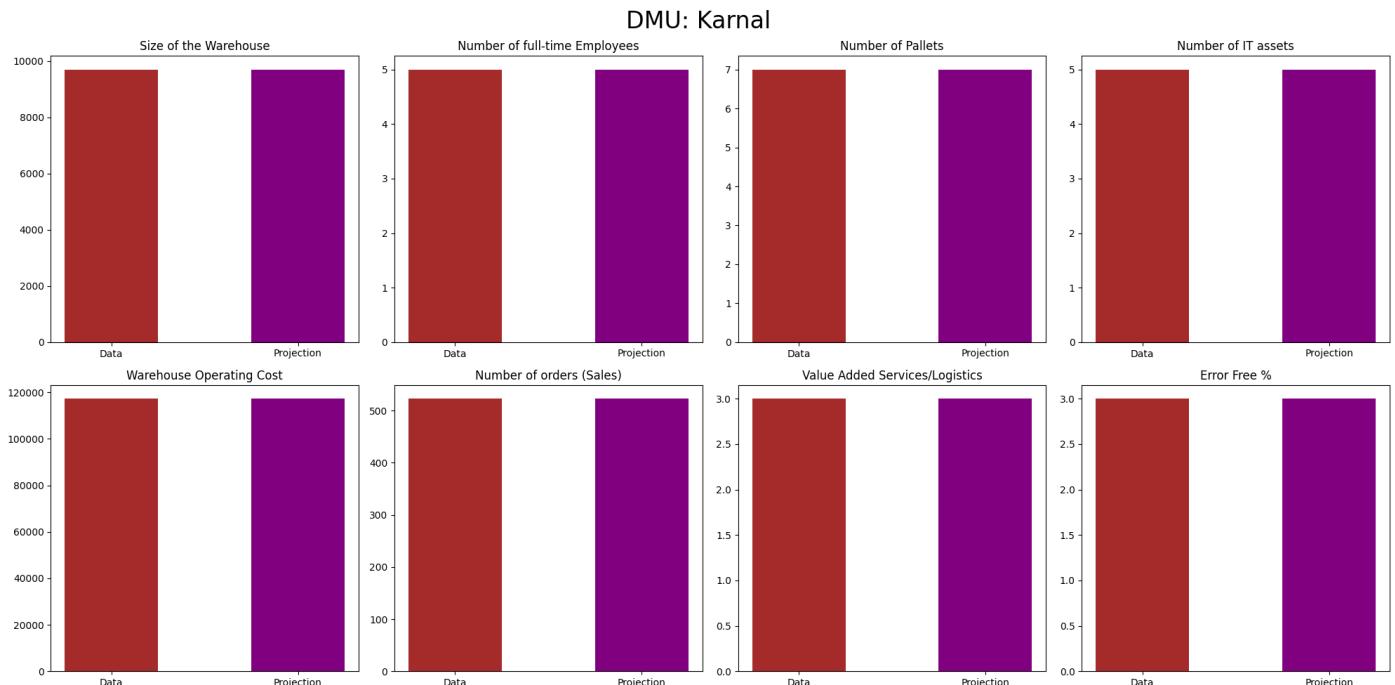
Warehouse 19 (Karnal) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	9700	9700	0
No. of Full-time Employees	5	5	0
No. of Pallets	7	7	0
No. of IT assets	5	5	0
Warehouse Operating Cost	117310	117310	0
No. of Orders (Sales)	523	523	0
Level of Value-Added Services	3	3	0
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 19 (Karnal)	1



# WAREHOUSE 20 (KOLKATA)

## Primal Problem Formulation

```

!Objective Function;

MAX = 1222*VF20 + 3*VG20 + 4*VH20;

!Subject to;

15000*UA20 + 15*UB20 + 200*UC20 + 12*UD20 + 955890*UE20 = 1;
(229*VF20 + 3*VG20 + 4*VH20) - (13100*UA20 + 7*UB20 + 320*UC20 + 9*UD20 + 820931*UE20) <=0;
(354*VF20 + 3*VG20 + 3*VH20) - (2000*UA20 + 2*UB20 + 7*UC20 + 4*UD20 + 147596*UE20) <=0;
(115*VF20 + 3*VG20 + 1*VH20) - (550*UA20 + 2*UB20 + 2*UC20 + 2*UD20 + 86404*UE20) <=0;
(5827*VF20 + 3*VG20 + 4*VH20) - (9800*UA20 + 14*UB20 + 10*UC20 + 9*UD20 + 584300*UE20) <=0;
(4776*VF20 + 3*VG20 + 3*VH20) - (7500*UA20 + 4*UB20 + 7*UC20 + 4*UD20 + 238265*UE20) <=0;
(152*VF20 + 3*VG20 + 1*VH20) - (550*UA20 + 2*UB20 + 2*UC20 + 3*UD20 + 147473*UE20) <=0;
(661*VF20 + 3*VG20 + 3*VH20) - (4800*UA20 + 3*UB20 + 7*UC20 + 6*UD20 + 420908*UE20) <=0;
(1019*VF20 + 3*VG20 + 4*VH20) - (10250*UA20 + 5*UB20 + 20*UC20 + 7*UD20 + 239046*UE20) <=0;
(278*VF20 + 3*VG20 + 2*VH20) - (2300*UA20 + 2*UB20 + 7*UC20 + 4*UD20 + 171183*UE20) <=0;
(60*VF20 + 3*VG20 + 1*VH20) - (1000*UA20 + 1*UB20 + 30*UC20 + 4*UD20 + 86967*UE20) <=0;
(2155*VF20 + 3*VG20 + 4*VH20) - (20700*UA20 + 21*UB20 + 200*UC20 + 11*UD20 + 142521*UE20) <=0;
(908*VF20 + 3*VG20 + 2*VH20) - (1200*UA20 + 6*UB20 + 7*UC20 + 5*UD20 + 1372680*UE20) <=0;
(2593*VF20 + 3*VG20 + 4*VH20) - (11000*UA20 + 13*UB20 + 200*UC20 + 12*UD20 + 119500*UE20) <=0;
(272*VF20 + 3*VG20 + 3*VH20) - (4100*UA20 + 2*UB20 + 7*UC20 + 3*UD20 + 247573*UE20) <=0;
(64*VF20 + 3*VG20 + 2*VH20) - (2000*UA20 + 2*UB20 + 2*UC20 + 3*UD20 + 93157*UE20) <=0;
(1053*VF20 + 3*VG20 + 4*VH20) - (21000*UA20 + 5*UB20 + 338*UC20 + 10*UD20 + 1994765*UE20) <=0;
(137*VF20 + 3*VG20 + 1*VH20) - (500*UA20 + 2*UB20 + 2*UC20 + 2*UD20 + 29538*UE20) <=0;
(138*VF20 + 3*VG20 + 2*VH20) - (2152*UA20 + 4*UB20 + 48*UC20 + 7*UD20 + 226845*UE20) <=0;
(523*VF20 + 3*VG20 + 3*VH20) - (9700*UA20 + 5*UB20 + 7*UC20 + 5*UD20 + 117310*UE20) <=0;
(1222*VF20 + 3*VG20 + 4*VH20) - (15000*UA20 + 15*UB20 + 200*UC20 + 12*UD20 + 955890*UE20) <=0;
(1674*VF20 + 3*VG20 + 3*VH20) - (9000*UA20 + 6*UB20 + 7*UC20 + 7*UD20 + 3333230*UE20) <=0;
(554*VF20 + 3*VG20 + 3*VH20) - (4600*UA20 + 5*UB20 + 7*UC20 + 5*UD20 + 2349633*UE20) <=0;
(197*VF20 + 3*VG20 + 2*VH20) - (2000*UA20 + 2*UB20 + 7*UC20 + 2*UD20 + 139434*UE20) <=0;
(5794*VF20 + 3*VG20 + 4*VH20) - (37324*UA20 + 48*UB20 + 550*UC20 + 25*UD20 + 2090879*UE20) <=0;
(1505*VF20 + 3*VG20 + 3*VH20) - (11000*UA20 + 9*UB20 + 200*UC20 + 9*UD20 + 755723*UE20) <=0;
(1347*VF20 + 3*VG20 + 4*VH20) - (10000*UA20 + 4*UB20 + 7*UC20 + 5*UD20 + 374615*UE20) <=0;
(310*VF20 + 3*VG20 + 2*VH20) - (4000*UA20 + 2*UB20 + 2*UC20 + 2*UD20 + 224382*UE20) <=0;
(259*VF20 + 3*VG20 + 3*VH20) - (5500*UA20 + 2*UB20 + 50*UC20 + 5*UD20 + 194903*UE20) <=0;
(277*VF20 + 3*VG20 + 3*VH20) - (2000*UA20 + 8*UB20 + 2*UC20 + 6*UD20 + 173934*UE20) <=0;

UA20 >=0;
UB20 >=0;
UC20 >=0;
UD20 >=0;
UE20 >=0;
VF20 >=0;
VG20 >=0;
VH20 >=0;

```

## Solutions/Weights of Primal Problem

Variable	Value	Reduced Cost
VF20	0.1939394E-04	0.000000
VG20	0.000000	2.730676
VH20	0.8114909E-01	0.1110223E-15
UA20	0.1095758E-05	-0.2273737E-12
UB20	0.000000	1.044887
UC20	0.000000	57.32874
UD20	0.8196364E-01	0.000000
UE20	0.000000	31148.09

## Dual Problem Formulation

```

!Dual Objective Function;

MIN = X20;

!Subject to;
13100*Y120 + 2000*Y220 + 550*Y320 + 9800*Y420 + 7500*Y520 + 550*Y620 + 4800*Y720 + 10250*Y820 + 2300*Y920 +
1000*Y1020 + 20700*Y1120 + 1200*Y1220 + 11000*Y1320 + 4100*Y1420 + 2000*Y1520 +
21000*Y1620 + 500*Y1720 + 2152*Y1820 + 9700*Y1920 + 15000*Y2020 + 9000*Y2120 + 4600*Y2220 + 2000*Y2320 +
37324*Y2420 + 11000*Y2520 + 10000*Y2620 + 4000*Y2720 + 5500*Y2820 + 2000*Y2920
-X20 <=0;

7*Y120 + 2*Y220 + 2*Y320 + 14*Y420 + 4*Y520 + 2*Y620 + 3*Y720 + 5*Y820 + 2*Y920 + 1*Y1020 + 21*Y1120 +
6*Y1220 + 13*Y1320 + 2*Y1420 + 2*Y1520 + 5*Y1620 + 2*Y1720 + 4*Y1820 + 5*Y1920 + 15*Y2020 + 6*Y2120 + 5*Y2220 +
2*Y2320 + 48*Y2420 + 9*Y2520 + 4*Y2620 + 2*Y2720 + 2*Y2820 + 8*Y2920 - 15*X20 <= 0;

320*Y120 + 7*Y220 + 2*Y320 + 10*Y420 + 7*Y520 + 2*Y620 + 7*Y720 + 20*Y820 + 7*Y920 + 30*Y1020 + 200*Y1120 +
7*Y1220 + 200*Y1320 + 7*Y1420 + 2*Y1520 + 338*Y1620 + 2*Y1720 + 48*Y1820 +
7*Y1920 + 200*Y2020 + 7*Y2120 + 7*Y2220 + 7*Y2320 + 550*Y2420 + 200*Y2520 + 7*Y2620 + 2*Y2720 + 50*Y2820 +
2*Y2920 - 200*X20 <= 0;

9*Y120 + 4*Y220 + 2*Y320 + 9*Y420 + 4*Y520 + 3*Y620 + 6*Y720 + 7*Y820 + 4*Y920 + 4*Y1020 + 11*Y1120 + 5*Y1220 +
12*Y1320 + 3*Y1420 + 3*Y1520 + 10*Y1620 + 2*Y1720 + 7*Y1820 + 5*Y1920 +
12*Y2020 + 7*Y2120 + 5*Y2220 + 25*Y2420 + 9*Y2520 + 5*Y2620 + 2*Y2720 + 5*Y2820 + 6*Y2920 - 12*X20
<= 0;

820931*Y120 + 147596*Y220 + 86404*Y320 + 584300*Y420 + 238265*Y520 + 147473*Y620 + 420908*Y720 +
239046*Y820 + 171183*Y920 + 86967*Y1020 + 142521*Y1120 + 1372680*Y1220 +
119500*Y1320 + 247573*Y1420 + 93157*Y1520 + 1994765*Y1620 + 29538*Y1720 + 226845*Y1820 + 117310*Y1920 +
955890*Y2020 + 3333230*Y2120 + 2349633*Y2220 + 139434*Y2320 +
2090879*Y2420 + 755723*Y2520 + 374615*Y2620 + 224382*Y2720 + 194903*Y2820 + 173934*Y2920 - 955890*X20
<= 0;

229*Y120 + 354*Y220 + 115*Y320 + 5827*Y420 + 4776*Y520 + 152*Y620 + 661*Y720 + 1019*Y820 + 278*Y920 +
60*Y1020 + 2155*Y1120 + 908*Y1220 + 2593*Y1320 + 272*Y1420 + 64*Y1520 +
1053*Y1620 + 137*Y1720 + 138*Y1820 + 523*Y1920 + 1222*Y2020 + 1674*Y2120 + 554*Y2220 + 197*Y2320 + 5794*Y2420 +
1505*Y2520 + 1347*Y2620 + 310*Y2720 + 259*Y2820 + 277*Y2920 >= 1222;

3*Y120 + 3*Y220 + 3*Y320 + 3*Y420 + 3*Y520 + 3*Y620 + 3*Y720 + 3*Y820 + 3*Y920 + 3*Y1020 + 3*Y1120 + 3*Y1220 +
3*Y1320 + 3*Y1420 + 3*Y1520 + 3*Y1620 + 3*Y1720 + 3*Y1820 +
3*Y1920 + 3*Y2020 + 3*Y2120 + 3*Y2220 + 3*Y2320 + 3*Y2420 + 3*Y2520 + 3*Y2620 + 3*Y2720 + 3*Y2820 + 3*Y2920
>= 3;

4*Y120 + 3*Y220 + 1*Y320 + 4*Y420 + 3*Y520 + 1*Y620 + 3*Y720 + 4*Y820 + 2*Y920 + 1*Y1020 + 4*Y1120 + 2*Y1220 +
4*Y1320 + 3*Y1420 + 2*Y1520 + 4*Y1620 + 1*Y1720 + 2*Y1820 +
3*Y1920 + 4*Y2020 + 3*Y2120 + 3*Y2220 + 2*Y2320 + 4*Y2420 + 3*Y2520 + 4*Y2620 + 2*Y2720 + 3*Y2820 + 3*Y2920
>= 4;

@Free(X20);
Y120 >=0; Y220 >=0; Y320 >=0; Y420 >=0; Y520 >=0; Y620 >=0; Y720 >=0; Y820 >=0; Y920 >=0; Y1020 >=0; Y1120
>=0; Y1220 >=0; Y1320 >=0; Y1420 >=0; Y1520 >=0; Y1620 >=0; Y1720 >=0; Y1820 >=0;
Y1920 >=0; Y2020 >=0; Y2120 >=0; Y2220 >=0; Y2320 >=0; Y2420 >=0; Y2520 >=0; Y2620 >=0;
Y2720 >=0; Y2820 >=0; Y2920 >=0;

```

## Solution of Dual Problem

Global optimal solution found.		
Objective value:	0.3482958	
Infeasibilities:	0.000000	
Total solver iterations:	9	
Variable		
X20	0.3482958	-0.1318390E-15
Y120	0.000000	0.4229896
Y220	0.000000	0.7973333E-01
Y320	0.000000	0.8115055E-01
Y420	0.000000	0.3108063
Y520	0.1795491	0.4440892E-15
Y620	0.000000	0.1623966
Y720	0.000000	0.2407748
Y820	0.000000	0.2406182
Y920	0.000000	0.1626851
Y1020	0.000000	0.2466376
Y1120	0.000000	0.5578919
Y1220	0.000000	0.2312252
Y1320	0.000000	0.6207321
Y1420	0.000000	0.1661091E-02
Y1520	0.000000	0.8454303E-01
Y1620	0.000000	0.4976291
Y1720	0.000000	0.8066909E-01
Y1820	0.000000	0.4111290

Y1920	0.000000	0.1668567
Y2020	0.000000	0.6517042
Y2120	0.000000	0.3076945
Y2220	0.000000	0.1606672
Y2320	1.522444	0.5204170E-17
Y2420	0.000000	1.653024
Y2520	0.000000	0.4770909
Y2620	0.000000	0.7005576E-01
Y2720	0.2082327	0.2775558E-16
Y2820	0.000000	0.1673745
Y2920	0.000000	0.2451539

## SUMMARY

Efficiency score of Warehouse 20 (Kolkata) = 0.3482958

Warehouse 20 (Kolkata) is not an efficient or inefficient warehouse.

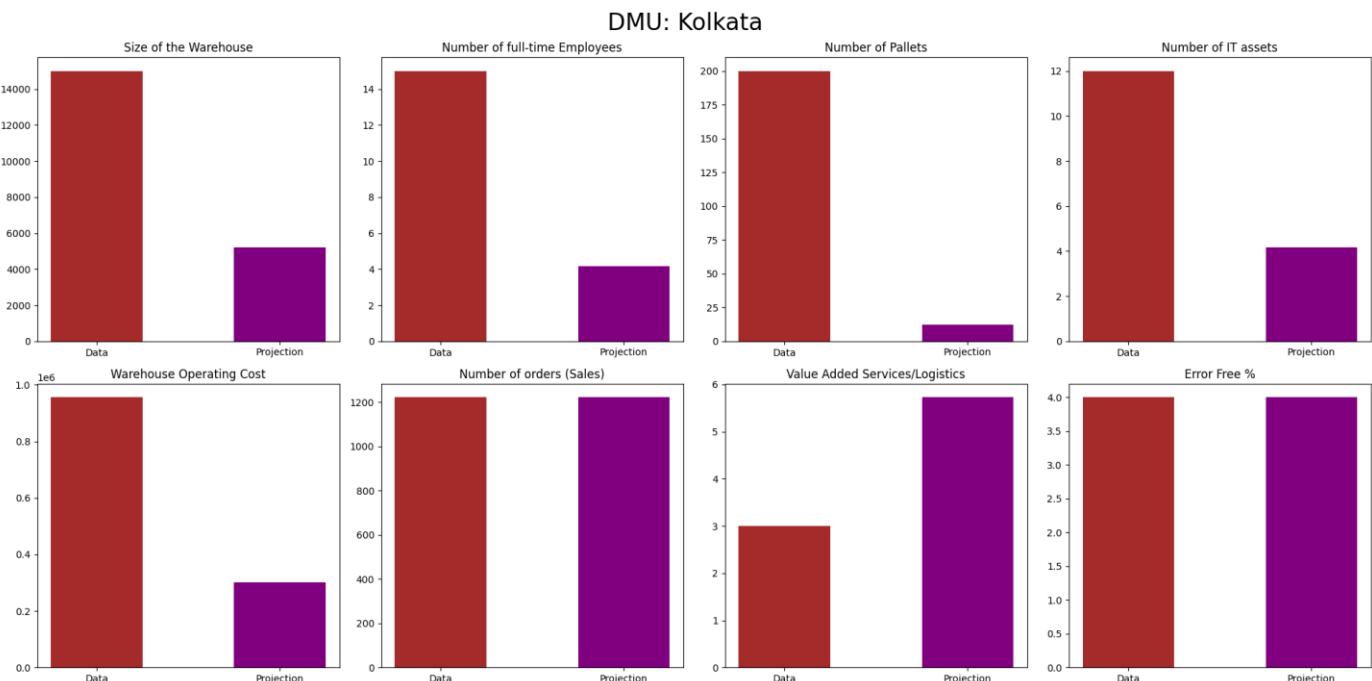
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	15000	5224.44	0
No. of Full-time Employees	15	4.17955	1.045
No. of Pallets	200	12.3304	57.329
No. of IT assets	12	4.17955	0
Warehouse Operating Cost	955890	301784	31148.1
No. of Orders (Sales)	1222	1222	0
Level of Value-Added Services	3	5.73068	2.731
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 5 (Bhiwandi)	0.1795491
Warehouse 23 (Nagpur)	1.522444
Warehouse 27 (Raipur)	0.2082327

In order to make warehouse 20 (Kolkata) efficient, they need to decrease size of the warehouse by 65.17%, No of full-time employees by 72.136%, number of pallets by 93.835%, IT Assets by 65.17% , operating cost by 68.429%, whereas value-added logistics needs to be increased by 91.023%.



# WAREHOUSE 21 (LUCKNOW)

## Primal Problem Formulation

```

!Objective Function;

MAX = 1674*VF21 + 3*VG21 + 3*VH21;

!Subject to;

9000*UA21 + 6*UB21 + 7*UC21 + 7*UD21 + 3333230*UE21 = 1;
(229*VF21 + 3*VG21 + 4*VH21) - (13100*UA21 + 7*UB21 + 320*UC21 + 9*UD21 + 820931*UE21) <=0;
(354*VF21 + 3*VG21 + 3*VH21) - (2000*UA21 + 2*UB21 + 7*UC21 + 4*UD21 + 147596*UE21) <=0;
(115*VF21 + 3*VG21 + 1*VH21) - (550*UA21 + 2*UB21 + 2*UC21 + 2*UD21 + 86404*UE21) <=0;
(5827*VF21 + 3*VG21 + 4*VH21) - (9800*UA21 + 14*UB21 + 10*UC21 + 9*UD21 + 584300*UE21) <=0;
(4776*VF21 + 3*VG21 + 3*VH21) - (7500*UA21 + 4*UB21 + 7*UC21 + 4*UD21 + 238265*UE21) <=0;
(152*VF21 + 3*VG21 + 1*VH21) - (550*UA21 + 2*UB21 + 2*UC21 + 3*UD21 + 147473*UE21) <=0;
(661*VF21 + 3*VG21 + 3*VH21) - (4800*UA21 + 3*UB21 + 7*UC21 + 6*UD21 + 420908*UE21) <=0;
(1019*VF21 + 3*VG21 + 4*VH21) - (10250*UA21 + 5*UB21 + 20*UC21 + 7*UD21 + 239046*UE21) <=0;
(278*VF21 + 3*VG21 + 2*VH21) - (2300*UA21 + 2*UB21 + 7*UC21 + 4*UD21 + 171183*UE21) <=0;
(60*VF21 + 3*VG21 + 1*VH21) - (1000*UA21 + 1*UB21 + 30*UC21 + 4*UD21 + 86967*UE21) <=0;
(2155*VF21 + 3*VG21 + 4*VH21) - (20700*UA21 + 21*UB21 + 200*UC21 + 11*UD21 + 142521*UE21) <=0;
(908*VF21 + 3*VG21 + 2*VH21) - (1200*UA21 + 6*UB21 + 7*UC21 + 5*UD21 + 1372680*UE21) <=0;
(2593*VF21 + 3*VG21 + 4*VH21) - (11000*UA21 + 13*UB21 + 200*UC21 + 12*UD21 + 119500*UE21) <=0;
(272*VF21 + 3*VG21 + 3*VH21) - (4100*UA21 + 2*UB21 + 7*UC21 + 3*UD21 + 247573*UE21) <=0;
(64*VF21 + 3*VG21 + 2*VH21) - (2000*UA21 + 2*UB21 + 2*UC21 + 3*UD21 + 93157*UE21) <=0;
(1053*VF21 + 3*VG21 + 4*VH21) - (21000*UA21 + 5*UB21 + 338*UC21 + 10*UD21 + 1994765*UE21) <=0;
(137*VF21 + 3*VG21 + 1*VH21) - (500*UA21 + 2*UB21 + 2*UC21 + 2*UD21 + 29538*UE21) <=0;
(138*VF21 + 3*VG21 + 2*VH21) - (2152*UA21 + 4*UB21 + 48*UC21 + 7*UD21 + 226845*UE21) <=0;
(523*VF21 + 3*VG21 + 3*VH21) - (9700*UA21 + 5*UB21 + 7*UC21 + 5*UD21 + 117310*UE21) <=0;
(1222*VF21 + 3*VG21 + 4*VH21) - (15000*UA21 + 15*UB21 + 200*UC21 + 12*UD21 + 955890*UE21) <=0;
(1674*VF21 + 3*VG21 + 3*VH21) - (9000*UA21 + 6*UB21 + 7*UC21 + 7*UD21 + 3333230*UE21) <=0;
(554*VF21 + 3*VG21 + 3*VH21) - (4600*UA21 + 5*UB21 + 7*UC21 + 5*UD21 + 2349633*UE21) <=0;
(197*VF21 + 3*VG21 + 2*VH21) - (2000*UA21 + 2*UB21 + 7*UC21 + 2*UD21 + 139434*UE21) <=0;
(5794*VF21 + 3*VG21 + 4*VH21) - (37324*UA21 + 48*UB21 + 550*UC21 + 25*UD21 + 2090879*UE21) <=0;
(1505*VF21 + 3*VG21 + 3*VH21) - (11000*UA21 + 9*UB21 + 200*UC21 + 9*UD21 + 755723*UE21) <=0;
(1347*VF21 + 3*VG21 + 4*VH21) - (10000*UA21 + 4*UB21 + 7*UC21 + 5*UD21 + 374615*UE21) <=0;
(310*VF21 + 3*VG21 + 2*VH21) - (4000*UA21 + 2*UB21 + 2*UC21 + 2*UD21 + 224382*UE21) <=0;
(259*VF21 + 3*VG21 + 3*VH21) - (5500*UA21 + 2*UB21 + 50*UC21 + 5*UD21 + 194903*UE21) <=0;
(277*VF21 + 3*VG21 + 3*VH21) - (2000*UA21 + 8*UB21 + 2*UC21 + 6*UD21 + 173934*UE21) <=0;

UA21 >=0;
UB21 >=0;
UC21 >=0;
UD21 >=0;
UE21 >=0;
VF21 >=0;
VG21 >=0;
VH21 >=0;

```

## Solutions/Weights of Primal Problem



Variable	Value	Reduced Cost
VF21	0.1062745E-03	-0.5684342E-13
VG21	0.000000	0.9567134
VH21	0.1395840	0.1665335E-15
UA21	0.1307176E-04	0.9663381E-12
UB21	0.2703674E-01	0.1110223E-15
UC21	0.1028762	-0.2220446E-15
UD21	0.000000	0.2685291
UE21	0.000000	1748670.

## Dual Problem Formulation

```

!Dual Objective Function;

MIN = X21;

!Subject to;
13100*Y121 + 2000*Y221 + 550*Y321 + 9800*Y421 + 7500*Y521 + 550*Y621 + 4800*Y721 + 10250*Y821 + 2300*Y921 +
1000*Y1021 + 20700*Y1121 + 1200*Y1221 + 11000*Y1321 + 4100*Y1421 + 2000*Y1521 +
21000*Y1621 + 500*Y1721 + 2152*Y1821 + 9700*Y1921 + 15000*Y2021 + 9000*Y2121 + 4600*Y2221 + 2000*Y2321 +
37324*Y2421 + 11000*Y2521 + 10000*Y2621 + 4000*Y2721 + 5500*Y2821 + 2000*Y2921
-9000*X21 <= 0;

7*Y121 + 2*Y221 + 2*Y321 + 14*Y421 + 4*Y521 + 2*Y621 + 3*Y721 + 5*Y821 + 2*Y921 + 1*Y1021 + 21*Y1121 +
6*Y1221 + 13*Y1321 + 2*Y1421 + 2*Y1521 + 5*Y1621 + 2*Y1721 + 4*Y1821 + 5*Y1921 + 15*Y2021 + 6*Y2121 + 5*Y2221 +
2*Y2321 + 48*Y2421 + 9*Y2521 + 4*Y2621 + 2*Y2721 + 2*Y2821 + 8*Y2921 - 6*X21 <= 0;

320*Y121 + 7*Y221 + 2*Y321 + 10*Y421 + 7*Y521 + 2*Y621 + 7*Y721 + 20*Y821 + 7*Y921 + 30*Y1021 + 200*Y1121 +
7*Y1221 + 200*Y1321 + 7*Y1421 + 2*Y1521 + 338*Y1621 + 2*Y1721 + 48*Y1821 +
7*Y1921 + 200*Y2021 + 7*Y2121 + 7*Y2221 + 7*Y2321 + 550*Y2421 + 200*Y2521 + 7*Y2621 + 2*Y2721 + 50*Y2821 +
2*Y2921 - 7*X21 <= 0;

9*Y121 + 4*Y221 + 2*Y321 + 9*Y421 + 4*Y521 + 3*Y621 + 6*Y721 + 7*Y821 + 4*Y921 + 4*Y1021 + 11*Y1121 + 5*Y1221 +
12*Y1321 + 3*Y1421 + 3*Y1521 + 10*Y1621 + 2*Y1721 + 7*Y1821 + 5*Y1921 +
12*Y2021 + 7*Y2121 + 5*Y2221 + 2*Y2321 + 25*Y2421 + 9*Y2521 + 5*Y2621 + 2*Y2721 + 5*Y2821 + 6*Y2921 - 7*X21
<= 0;

820931*Y121 + 147596*Y221 + 86404*Y321 + 584300*Y421 + 238265*Y521 + 147473*Y621 + 420908*Y721 +
239046*Y821 + 171183*Y921 + 86967*Y1021 + 142521*Y1121 + 1372680*Y1221 +
119500*Y1321 + 247573*Y1421 + 93157*Y1521 + 1994765*Y1621 + 29538*Y1721 + 226845*Y1821 + 117310*Y1921 +
955890*Y2021 + 3333230*Y2121 + 2349633*Y2221 + 139434*Y2321 +
2090879*Y2421 + 755723*Y2521 + 374615*Y2621 + 224382*Y2721 + 194903*Y2821 + 173934*Y2921 -
3333230*X21 <= 0;

229*Y121 + 354*Y221 + 115*Y321 + 5827*Y421 + 4776*Y521 + 152*Y621 + 661*Y721 + 1019*Y821 + 278*Y921 +
60*Y1021 + 2155*Y1121 + 908*Y1221 + 2593*Y1321 + 272*Y1421 + 64*Y1521 +
1053*Y1621 + 137*Y1721 + 138*Y1821 + 523*Y1921 + 1222*Y2021 + 1674*Y2121 + 554*Y2221 + 197*Y2321 + 5794*Y2421 +
1505*Y2521 + 1347*Y2621 + 310*Y2721 + 259*Y2821 + 277*Y2921 >= 1674;

3*Y121 + 3*Y221 + 3*Y321 + 3*Y421 + 3*Y521 + 3*Y621 + 3*Y721 + 3*Y821 + 3*Y921 + 3*Y1021 + 3*Y1121 + 3*Y1221 +
3*Y1321 + 3*Y1421 + 3*Y1521 + 3*Y1621 + 3*Y1721 + 3*Y1821 +
3*Y1921 + 3*Y2021 + 3*Y2121 + 3*Y2221 + 3*Y2321 + 3*Y2421 + 3*Y2521 + 3*Y2621 + 3*Y2721 + 3*Y2821 + 3*Y2921
>= 3;

4*Y121 + 3*Y221 + 1*Y321 + 4*Y421 + 3*Y521 + 1*Y621 + 3*Y721 + 4*Y821 + 2*Y921 + 1*Y1021 + 4*Y1121 + 2*Y1221 +
4*Y1321 + 3*Y1421 + 2*Y1521 + 4*Y1621 + 1*Y1721 + 2*Y1821 +
3*Y1921 + 4*Y2021 + 3*Y2121 + 3*Y2221 + 2*Y2321 + 4*Y2421 + 3*Y2521 + 4*Y2621 + 2*Y2721 + 3*Y2821 + 3*Y2921
>= 3;

@Free(X21);
Y121 >=0; Y221 >=0; Y321 >=0; Y421 >=0; Y521 >=0; Y621 >=0; Y721 >=0; Y821 >=0; Y921 >=0; Y1021 >=0; Y1121
>=0; Y1221 >=0; Y1321 >=0; Y1421 >=0; Y1521 >=0; Y1621 >=0; Y1721 >=0; Y1821 >=0; Y1921 >=0; Y2021 >=0; Y2121
>=0; Y2221 >=0; Y2321 >=0; Y2421 >=0; Y2521 >=0; Y2621 >=0; Y2721 >=0; Y2821 >=0; Y2921 >=0;

```

## Solutions of Dual Problem

File Edit LINGO Window Help			
□	□	□	□
Global optimal solution found.			
Objective value:	0.5966554	Infeasibilities:	0.000000
Total solver iterations:	13		
Variable	Value	Reduced Cost	
X21	0.5966554	-0.1387779E-15	
Y121	0.000000	32.69822	
Y221	0.000000	0.3439777	
Y321	0.000000	0.1152099	
Y421	0.000000	0.3577827	
Y521	0.3077558	-0.3330669E-15	
Y621	0.000000	0.1112777	
Y721	0.000000	0.3749891	
Y821	0.000000	1.660065	
Y921	0.000000	0.4955600	
Y1021	0.000000	2.980435	
Y1121	0.000000	20.62625	
Y1221	0.000000	0.5223751	
Y1321	0.000000	20.23661	
Y1421	0.000000	0.3801429	
Y1521	0.4369969	0.5204170E-17	
Y1621	0.000000	34.51162	
Y1721	0.000000	0.1122183	
Y1821	0.000000	4.780503	
Y1921	0.000000	0.5077801	
Y2021	0.000000	20.48867	

Y2121	0.000000	0.4033446
Y2221	0.000000	0.4378196
Y2321	0.000000	0.5002467
Y2421	0.000000	57.19350
Y2521	0.000000	20.38367
Y2621	0.000000	0.2575107
Y2721	0.5197164	0.000000
Y2821	0.000000	4.823503
Y2921	0.5443532E-01	-0.5551115E-16

## SUMMARY

Efficiency score of Warehouse 21 (Lucknow) = 0.5966554

Warehouse 21 (Lucknow) is not an efficient or inefficient warehouse.

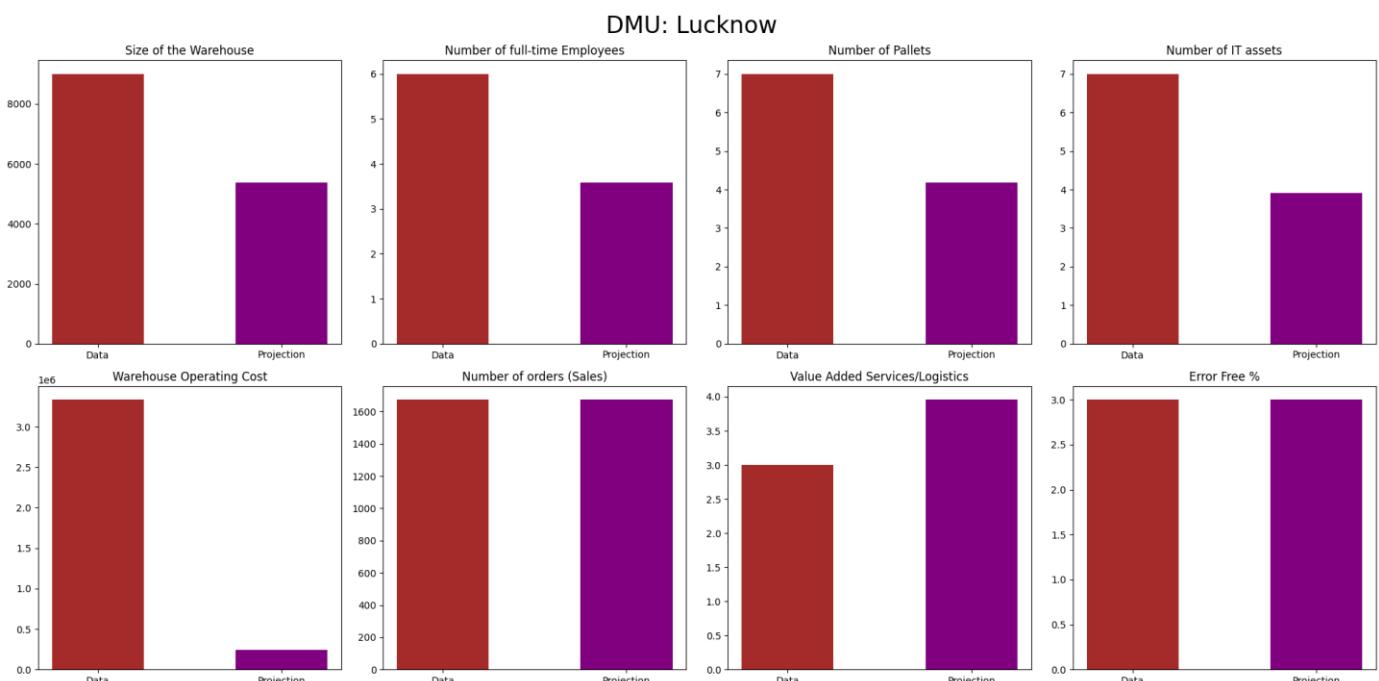
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	9700	9700	0
No. of Full-time Employees	6	3.57993	0
No. of Pallets	7	4.17659	0
No. of IT assets	7	3.90806	0.269
Warehouse Operating Cost	3333230	240120	1748670
No. of Orders (Sales)	1674	1674	0
Level of Value-Added Services	3	3.95671	0.957
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 5 (Bhiwandi)	0.3077558
Warehouse 15 (Jabalpur)	0.4369969
Warehouse 27 (Raipur)	0.5197164
Warehouse 29 (Varanasi)	0.05443532

In order to make warehouse 21 (Lucknow) efficient, they need to decrease size of the warehouse by 40.334%, No of full-time employees by 40.344%, number of pallets by 40.334%, IT Assets by 44.171% , operating cost by 92.796%, whereas value-added logistics needs to be increased by 31.89%.



# WAREHOUSE 22 (LUDHIANA)

## Primal Problem Formulation

```

!Objective Function;
MAX = 554*VF22 + 3*VG22 + 3*VH22;

!Subject to;
4600*UA22 + 5*UB22 + 7*UC22 + 5*UD22 + 2349633*UE22= 1;
(229*VF22 + 3*VG22 + 4*VH22) - (13100*UA22 + 7*UB22 + 320*UC22 + 9*UD22 + 820931*UE22) <=0;
(354*VF22 + 3*VG22 + 3*VH22) - (2000*UA22 + 2*UB22 + 7*UC22 + 4*UD22 + 147596*UE22) <=0;
(115*VF22 + 3*VG22 + 1*VH22) - (550*UA22 + 2*UB22 + 2*UC22 + 2*UD22 + 86404*UE22) <=0;
(5827*VF22 + 3*VG22 + 4*VH22) - (9800*UA22 + 14*UB22 + 10*UC22 + 9*UD22 + 584300*UE22) <=0;
(4776*VF22 + 3*VG22 + 3*VH22) - (7500*UA22 + 4*UB22 + 7*UC22 + 4*UD22 + 238265*UE22) <=0;
(152*VF22 + 3*VG22 + 1*VH22) - (550*UA22 + 2*UB22 + 2*UC22 + 3*UD22 + 147473*UE22) <=0;
(661*VF22 + 3*VG22 + 3*VH22) - (4800*UA22 + 3*UB22 + 7*UC22 + 6*UD22 + 420908*UE22) <=0;
(1019*VF22 + 3*VG22 + 4*VH22) - (10250*UA22 + 5*UB22 + 20*UC22 + 7*UD22 + 239046*UE22) <=0;
(278*VF22 + 3*VG22 + 2*VH22) - (2300*UA22 + 2*UB22 + 7*UC22 + 4*UD22 + 171183*UE22) <=0;
(60*VF22 + 3*VG22 + 1*VH22) - (1000*UA22 + 1*UB22 + 30*UC22 + 4*UD22 + 86967*UE22) <=0;
(2155*VF22 + 3*VG22 + 4*VH22) - (20700*UA22 + 21*UB22 + 200*UC22 + 11*UD22 + 142521*UE22) <=0;
(908*VF22 + 3*VG22 + 2*VH22) - (1200*UA22 + 6*UB22 + 7*UC22 + 5*UD22 + 1372680*UE22) <=0;
(2593*VF22 + 3*VG22 + 4*VH22) - (11000*UA22 + 13*UB22 + 200*UC22 + 12*UD22 + 119500*UE22) <=0;
(272*VF22 + 3*VG22 + 3*VH22) - (4100*UA22 + 2*UB22 + 7*UC22 + 3*UD22 + 247573*UE22) <=0;
(64*VF22 + 3*VG22 + 2*VH22) - (2000*UA22 + 2*UB22 + 2*UC22 + 3*UD22 + 93157*UE22) <=0;
(1053*VF22 + 3*VG22 + 4*VH22) - (21000*UA22 + 5*UB22 + 338*UC22 + 10*UD22 + 1994765*UE22) <=0;
(137*VF22 + 3*VG22 + 1*VH22) - (500*UA22 + 2*UB22 + 2*UC22 + 2*UD22 + 29538*UE22) <=0;
(138*VF22 + 3*VG22 + 2*VH22) - (2152*UA22 + 4*UB22 + 48*UC22 + 7*UD22 + 226845*UE22) <=0;
(523*VF22 + 3*VG22 + 3*VH22) - (9700*UA22 + 5*UB22 + 7*UC22 + 5*UD22 + 117310*UE22) <=0;
(1222*VF22 + 3*VG22 + 4*VH22) - (15000*UA22 + 15*UB22 + 200*UC22 + 12*UD22 + 955890*UE22) <=0;
(1674*VF22 + 3*VG22 + 3*VH22) - (9000*UA22 + 6*UB22 + 7*UC22 + 7*UD22 + 3333230*UE22) <=0;
(554*VF22 + 3*VG22 + 3*VH22) - (4600*UA22 + 5*UB22 + 7*UC22 + 5*UD22 + 2349633*UE22) <=0;
(197*VF22 + 3*VG22 + 2*VH22) - (2000*UA22 + 2*UB22 + 7*UC22 + 2*UD22 + 139434*UE22) <=0;
(5794*VF22 + 3*VG22 + 4*VH22) - (37324*UA22 + 48*UB22 + 550*UC22 + 25*UD22 + 2090879*UE22) <=0;
(1505*VF22 + 3*VG22 + 3*VH22) - (11000*UA22 + 9*UB22 + 200*UC22 + 9*UD22 + 755723*UE22) <=0;
(1347*VF22 + 3*VG22 + 4*VH22) - (10000*UA22 + 4*UB22 + 7*UC22 + 5*UD22 + 374615*UE22) <=0;
(310*VF22 + 3*VG22 + 2*VH22) - (4000*UA22 + 2*UB22 + 2*UC22 + 2*UD22 + 224382*UE22) <=0;
(259*VF22 + 3*VG22 + 3*VH22) - (5500*UA22 + 2*UB22 + 50*UC22 + 5*UD22 + 194903*UE22) <=0;
(277*VF22 + 3*VG22 + 3*VH22) - (2000*UA22 + 8*UB22 + 2*UC22 + 6*UD22 + 173934*UE22) <=0;

UA22 >=0;
UB22 >=0;
UC22 >=0;
UD22 >=0;
UE22 >=0;
VF22 >=0;
VG22 >=0;
VH22 >=0;

```

## Solutions/Weights of Primal Problem

LINGO 11.0 - [Solution Report - warehouse 22 PP]

**File Edit LINGO Window Help**

**Global optimal solution found.**

<b>Objective value:</b>	0.7601236
<b>Infeasibilities:</b>	0.000000
<b>Total solver iterations:</b>	11

Variable	Value	Reduced Cost
VF22	0.7375366E-04	0.2842171E-12
VG22	0.000000	0.6296755
VH22	0.2397547	0.1110223E-14
UA22	0.5929794E-04	0.4547474E-12
UB22	0.000000	1.286930
UC22	0.3213816E-01	-0.7771561E-15
UD22	0.1004525	0.2220446E-15
UE22	0.000000	1583751.

## Dual Problem Formulation

```

!Dual Objective Function;

MIN = X22;

!Subject to;
13100*Y122 + 2000*Y222 + 550*Y322 + 9800*Y422 + 7500*Y522 + 550*Y622 + 4800*Y722 + 10250*Y822 + 2300*Y922 +
1000*Y1022 + 20700*Y1122 + 1200*Y1222 + 11000*Y1322 + 4100*Y1422 + 2000*Y1522 +
21000*Y1622 + 500*Y1722 + 2152*Y1822 + 9700*Y1922 + 15000*Y2022 + 9000*Y2122 + 4600*Y2222 + 2000*Y2322 +
37324*Y2422 + 11000*Y2522 + 10000*Y2622 + 4000*Y2722 + 5500*Y2822 + 2000*Y2922
-4600*X22 <= 0;

7*Y122 + 2*Y222 + 2*Y322 + 14*Y422 + 4*Y522 + 2*Y622 + 3*Y722 + 5*Y822 + 2*Y922 + 1*Y1022 + 21*Y1122 +
6*Y1222 + 13*Y1322 + 2*Y1422 + 2*Y1522 + 5*Y1622 + 2*Y1722 + 4*Y1822 + 5*Y1922 + 15*Y2022 + 6*Y2122 + 5*Y2222 +
2*Y2322 + 48*Y2422 + 9*Y2522 + 4*Y2622 + 2*Y2722 + 2*Y2822 + 8*Y2922 - 5*X22 <= 0;

320*Y122 + 7*Y222 + 2*Y322 + 10*Y422 + 7*Y522 + 2*Y622 + 7*Y722 + 20*Y822 + 7*Y922 + 30*Y1022 + 200*Y1122 +
7*Y1222 + 200*Y1322 + 7*Y1422 + 2*Y1522 + 338*Y1622 + 2*Y1722 + 48*Y1822 +
7*Y1922 + 200*Y2022 + 7*Y2122 + 7*Y2222 + 7*Y2322 + 550*Y2422 + 200*Y2522 + 7*Y2622 + 2*Y2722 + 50*Y2822 +
2*Y2922 - 7*X22 <= 0;

9*Y122 + 4*Y222 + 2*Y322 + 9*Y422 + 4*Y522 + 3*Y622 + 6*Y722 + 7*Y822 + 4*Y922 + 4*Y1022 + 11*Y1122 + 5*Y1222 +
12*Y1322 + 3*Y1422 + 3*Y1522 + 10*Y1622 + 2*Y1722 + 7*Y1822 + 5*Y1922 +
12*Y2022 + 7*Y2122 + 5*Y2222 + 25*Y2422 + 9*Y2522 + 5*Y2622 + 2*Y2722 + 5*Y2822 + 6*Y2922 - 5*X22
<= 0;

820931*Y122 + 147596*Y222 + 86404*Y322 + 584300*Y422 + 238265*Y522 + 147473*Y622 + 420908*Y722 +
239046*Y822 + 171183*Y922 + 86967*Y1022 + 142521*Y1122 + 1372680*Y1222 +
+ 119500*Y1322 + 247573*Y1422 + 93157*Y1522 + 1994765*Y1622 + 29538*Y1722 + 226845*Y1822 + 117310*Y1922 +
+ 955890*Y2022 + 3333230*Y2122 + 2349633*Y2222 + 139434*Y2322 +
+ 2090879*Y2422 + 755723*Y2522 + 374615*Y2622 + 224382*Y2722 + 194903*Y2822 + 173934*Y2922 -
2349633*X22 <= 0;

229*Y122 + 354*Y222 + 115*Y322 + 5827*Y422 + 4776*Y522 + 152*Y622 + 661*Y722 + 1019*Y822 + 278*Y922 +
60*Y1022 + 2155*Y1122 + 908*Y1222 + 2593*Y1322 + 272*Y1422 + 64*Y1522 +
1053*Y1622 + 137*Y1722 + 138*Y1822 + 523*Y1922 + 1222*Y2022 + 1674*Y2122 + 554*Y2222 + 197*Y2322 + 5794*Y2422 +
+ 1505*Y2522 + 1347*Y2622 + 310*Y2722 + 259*Y2822 + 277*Y2922 >= 554;

3*Y122 + 3*Y222 + 3*Y322 + 3*Y422 + 3*Y522 + 3*Y622 + 3*Y722 + 3*Y822 + 3*Y922 + 3*Y1022 + 3*Y1122 + 3*Y1222 +
+ 3*Y1322 + 3*Y1422 + 3*Y1522 + 3*Y1622 + 3*Y1722 + 3*Y1822 +
+ 3*Y1922 + 3*Y2022 + 3*Y2122 + 3*Y2222 + 3*Y2322 + 3*Y2422 + 3*Y2522 + 3*Y2622 + 3*Y2722 + 3*Y2822 + 3*Y2922
>= 3;

4*Y122 + 3*Y222 + 1*Y322 + 4*Y422 + 3*Y522 + 1*Y622 + 3*Y722 + 4*Y822 + 2*Y922 + 1*Y1022 + 4*Y1122 + 2*Y1222 +
+ 4*Y1322 + 3*Y1422 + 2*Y1522 + 4*Y1622 + 1*Y1722 + 2*Y1822 +
+ 3*Y1922 + 4*Y2022 + 3*Y2122 + 3*Y2222 + 2*Y2322 + 4*Y2422 + 3*Y2522 + 4*Y2622 + 2*Y2722 + 3*Y2822 + 3*Y2922
>= 3;

@Free(X22);
Y122 >=0; Y222 >=0; Y322 >=0; Y422 >=0; Y522 >=0; Y622 >=0; Y722 >=0; Y822 >=0; Y922 >=0; Y1022 >=0; Y1122
>=0; Y1222 >=0; Y1322 >=0; Y1422 >=0; Y1522 >=0; Y1622 >=0; Y1722 >=0; Y1822 >=0; Y1922 >=0; Y2022 >=0; Y2122
>=0; Y2222 >=0; Y2322 >=0; Y2422 >=0; Y2522 >=0; Y2622 >=0; Y2722 >=0; Y2822 >=0; Y2922 >=0;

```

## Solutions of Dual Problem

Global optimal solution found.		
Objective value:	0.7601236	
Infeasibilities:	0.000000	
Total solver iterations:	12	
Variable	Value	Reduced Cost
X22	0.7601236	0.000000
Y122	0.000000	10.98918
Y222	0.5332641	0.5551115E-15
Y322	0.000000	0.4955877E-01
Y422	0.000000	0.4177923
Y522	0.4695225E-01	0.1554312E-14
Y622	0.000000	0.1472824
Y722	0.000000	0.3442968
Y822	0.000000	0.9195606
Y922	0.000000	0.2631494
Y1022	0.000000	1.181073
Y1122	0.000000	7.642118
Y1222	0.000000	0.2519093
Y1322	0.000000	7.135076
Y1422	0.000000	0.3012099E-01
Y1522	0.2204017	-0.2498002E-15
Y1622	0.000000	12.07580
Y1722	0.000000	0.4497129E-01
Y1822	0.000000	1.883721
Y1922	0.000000	0.5445822
Y2022	0.000000	7.473384

Y2122	0.000000	0.6190882
Y2222	0.000000	0.2398764
Y2322	0.000000	0.5042906E-01
Y2422	0.000000	21.01419
Y2522	0.000000	7.153717
Y2622	0.000000	0.2618439
Y2722	0.4092738	-0.1110223E-15
Y2822	0.000000	1.696943
Y2922	0.000000	0.4589321E-01

## SUMMARY

Efficiency score of Warehouse 22 (Ludhiana) = 0.7601236

Warehouse 22 (Ludhiana) is not an efficient or inefficient warehouse.

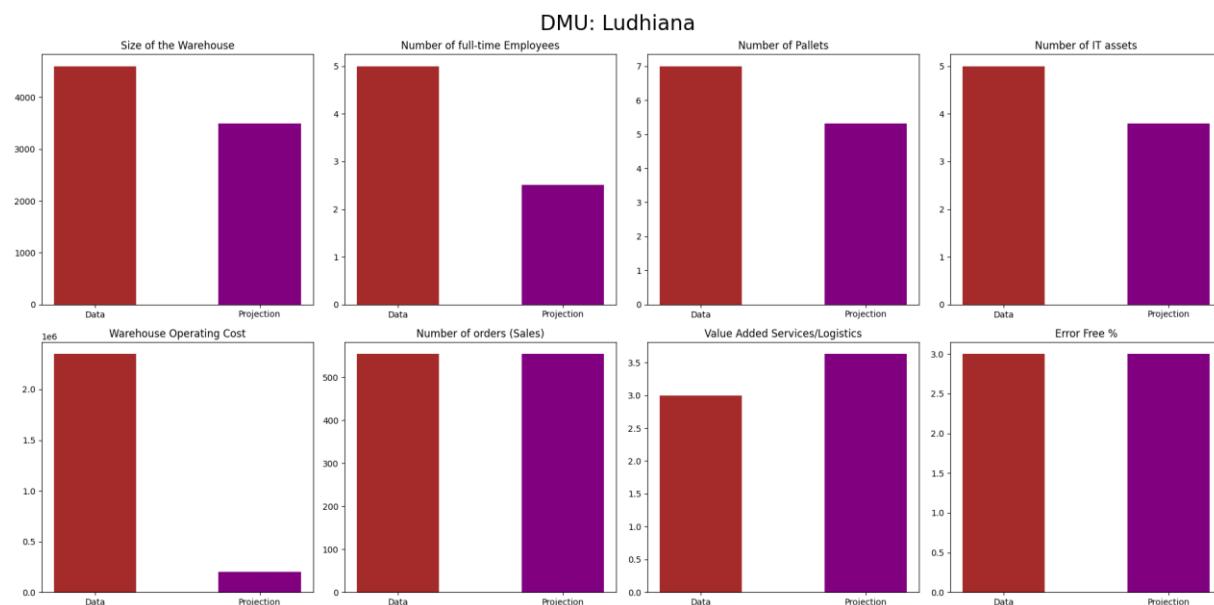
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	4600	3496.57	0
No. of Full-time Employees	5	2.51369	1.287
No. of Pallets	7	5.32087	0
No. of IT assets	5	3.80062	0
Warehouse Operating Cost	2349633	202260	1583751
No. of Orders (Sales)	554	554	0
Level of Value-Added Services	3	3.62968	0.63
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 2 (Ahmedabad)	0.5332641
Warehouse 5 (Bhiwandi)	0.04695225
Warehouse 27 (Jabalpur)	0.2204017
Warehouse 29 (Raipur)	0.4092738

In order to make warehouse 22 (Ludhiana) efficient, they need to decrease size of the warehouse by 23.988%, No of full-time employees by 49.726%, number of pallets by 23.988%, IT Assets by 23.988% ,operating cost by 91.392%, whereas value-added logistics needs to be increased by 20.989%.



## WAREHOUSE 23 (NAGPUR)

### Primal Problem Formulation

```

!Objective Function;

MAX = 197*VF23 + 3*VG23 + 2*VH23;

!Subject to;

2000*UA23 + 2*UB23 + 7*UC23 + 2*UD23 + 139434*UE23 = 1;
(229*VF23 + 3*VG23 + 4*VH23) - (13100*UA23 + 7*UB23 + 320*UC23 + 9*UD23 + 820931*UE23) <=0;
(354*VF23 + 3*VG23 + 3*VH23) - (2000*UA23 + 2*UB23 + 7*UC23 + 4*UD23 + 147596*UE23) <=0;
(115*VF23 + 3*VG23 + 1*VH23) - (550*UA23 + 2*UB23 + 2*UC23 + 2*UD23 + 86404*UE23) <=0;
(5827*VF23 + 3*VG23 + 4*VH23) - (9800*UA23 + 14*UB23 + 10*UC23 + 9*UD23 + 584300*UE23) <=0;
(4776*VF23 + 3*VG23 + 3*VH23) - (7500*UA23 + 4*UB23 + 7*UC23 + 4*UD23 + 238265*UE23) <=0;
(152*VF23 + 3*VG23 + 1*VH23) - (550*UA23 + 2*UB23 + 2*UC23 + 3*UD23 + 147473*UE23) <=0;
(661*VF23 + 3*VG23 + 3*VH23) - (4800*UA23 + 3*UB23 + 7*UC23 + 6*UD23 + 420908*UE23) <=0;
(1019*VF23 + 3*VG23 + 4*VH23) - (10250*UA23 + 5*UB23 + 20*UC23 + 7*UD23 + 239046*UE23) <=0;
(278*VF23 + 3*VG23 + 2*VH23) - (2300*UA23 + 2*UB23 + 7*UC23 + 4*UD23 + 171183*UE23) <=0;
(60*VF23 + 3*VG23 + 1*VH23) - (1000*UA23 + 1*UB23 + 30*UC23 + 4*UD23 + 86967*UE23) <=0;
(2155*VF23 + 3*VG23 + 4*VH23) - (20700*UA23 + 21*UB23 + 200*UC23 + 11*UD23 + 142521*UE23) <=0;
(908*VF23 + 3*VG23 + 2*VH23) - (1200*UA23 + 6*UB23 + 7*UC23 + 5*UD23 + 1372680*UE23) <=0;
(2593*VF23 + 3*VG23 + 4*VH23) - (11000*UA23 + 13*UB23 + 200*UC23 + 12*UD23 + 119500*UE23) <=0;
(272*VF23 + 3*VG23 + 3*VH23) - (4100*UA23 + 2*UB23 + 7*UC23 + 3*UD23 + 247573*UE23) <=0;
(64*VF23 + 3*VG23 + 2*VH23) - (2000*UA23 + 2*UB23 + 2*UC23 + 3*UD23 + 93157*UE23) <=0;
(1053*VF23 + 3*VG23 + 4*VH23) - (21000*UA23 + 5*UB23 + 338*UC23 + 10*UD23 + 1994765*UE23) <=0;
(137*VF23 + 3*VG23 + 1*VH23) - (500*UA23 + 2*UB23 + 2*UC23 + 2*UD23 + 29538*UE23) <=0;
(138*VF23 + 3*VG23 + 2*VH23) - (2152*UA23 + 4*UB23 + 48*UC23 + 7*UD23 + 226845*UE23) <=0;
(523*VF23 + 3*VG23 + 3*VH23) - (9700*UA23 + 5*UB23 + 7*UC23 + 5*UD23 + 117310*UE23) <=0;
(1222*VF23 + 3*VG23 + 4*VH23) - (15000*UA23 + 15*UB23 + 200*UC23 + 12*UD23 + 955890*UE23) <=0;
(1674*VF23 + 3*VG23 + 3*VH23) - (9000*UA23 + 6*UB23 + 7*UC23 + 7*UD23 + 3333230*UE23) <=0;
(554*VF23 + 3*VG23 + 3*VH23) - (4600*UA23 + 5*UB23 + 7*UC23 + 5*UD23 + 2349633*UE23) <=0;
(197*VF23 + 3*VG23 + 2*VH23) - (2000*UA23 + 2*UB23 + 7*UC23 + 2*UD23 + 139434*UE23) <=0;
(5794*VF23 + 3*VG23 + 4*VH23) - (37324*UA23 + 48*UB23 + 550*UC23 + 25*UD23 + 2090879*UE23) <=0;
(1505*VF23 + 3*VG23 + 3*VH23) - (11000*UA23 + 9*UB23 + 200*UC23 + 9*UD23 + 755723*UE23) <=0;
(1347*VF23 + 3*VG23 + 4*VH23) - (10000*UA23 + 4*UB23 + 7*UC23 + 5*UD23 + 374615*UE23) <=0;
(310*VF23 + 3*VG23 + 2*VH23) - (4000*UA23 + 2*UB23 + 2*UC23 + 2*UD23 + 224382*UE23) <=0;
(259*VF23 + 3*VG23 + 3*VH23) - (5500*UA23 + 2*UB23 + 50*UC23 + 5*UD23 + 194903*UE23) <=0;
(277*VF23 + 3*VG23 + 3*VH23) - (2000*UA23 + 8*UB23 + 2*UC23 + 6*UD23 + 173934*UE23) <=0;

UA23 >=0;
UB23 >=0;
UC23 >=0;
UD23 >=0;
UE23 >=0;
VF23 >=0;
VG23 >=0;
VH23 >=0;

```

### Solutions/Weights of the Primal Problem

Global optimal solution found.

Objective value: 1.000000

Infeasibilities: 0.000000

Total solver iterations: 11

Variable	Value	Reduced Cost
VF23	0.000000	0.000000
VG23	0.4761904E-01	0.000000
VH23	0.428571	0.000000
UA23	0.2857143E-03	0.000000
UB23	0.000000	0.000000
UC23	0.000000	0.000000
UD23	0.214286	0.000000
UE23	0.000000	0.000000

### Dual Problem Formulation

```

!Dual Objective Function;

MIN = X23;

!Subject to;
13100*Y123 + 2000*Y223 + 550*Y323 + 9800*Y423 + 7500*Y523 + 550*Y623 + 4800*Y723 + 10250*Y823 + 2300*Y923 +
1000*Y1023 + 20700*Y1123 + 1200*Y1223 + 11000*Y1323 + 4100*Y1423 + 2000*Y1523 +
21000*Y1623 + 500*Y1723 + 2152*Y1823 + 9700*Y1923 + 15000*Y2023 + 9000*Y2123 + 4600*Y2223 + 2000*Y2323 +
37324*Y2423 + 11000*Y2523 + 10000*Y2623 + 4000*Y2723 + 5500*Y2823 + 2000*Y2923
-2000*X23 <= 0;

7*Y123 + 2*Y223 + 2*Y323 + 14*Y423 + 4*Y523 + 2*Y623 + 3*Y723 + 5*Y823 + 2*Y923 + 1*Y1023 + 21*Y1123 +
6*Y1223 + 13*Y1323 + 2*Y1423 + 2*Y1523 + 5*Y1623 + 2*Y1723 + 4*Y1823 + 5*Y1923
+ 15*Y2023 + 6*Y2123 + 5*Y2223 + 2*Y2323 + 48*Y2423 + 9*Y2523 + 4*Y2623 + 2*Y2723 + 2*Y2823 + 8*Y2923 -2*X23
<=0;

320*Y123 + 7*Y223 + 2*Y323 + 10*Y423 + 7*Y523 + 2*Y623 + 7*Y723 + 20*Y823 + 7*Y923 + 30*Y1023 + 200*Y1123 +
7*Y1223 + 200*Y1323 + 7*Y1423 + 2*Y1523 + 338*Y1623 + 2*Y1723 + 48*Y1823 +
7*Y1923 + 200*Y2023 + 7*Y2123 + 7*Y2223 + 7*Y2323 + 550*Y2423 + 200*Y2523 + 7*Y2623 + 2*Y2723 + 50*Y2823 +
2*Y2923 - 7*X23 <=0;

9*Y123 + 4*Y223 + 2*Y323 + 9*Y423 + 4*Y523 + 3*Y623 + 6*Y723 + 7*Y823 + 4*Y923 + 4*Y1023 + 11*Y1123 + 5*Y1223
+ 12*Y1323 + 3*Y1423 + 3*Y1523 + 10*Y1623 + 2*Y1723 + 7*Y1823 + 5*Y1923 +
12*Y2023 + 7*Y2123 + 5*Y2223 + 2*Y2323 + 25*Y2423 + 9*Y2523 + 5*Y2623 + 2*Y2723 + 5*Y2823 + 6*Y2923 - 2*X23
<=0;

820931*Y123 + 147596*Y223 + 86404*Y323 + 584300*Y423 + 238265*Y523 + 147473*Y623 + 420908*Y723 +
239046*Y823 + 171183*Y923 + 86967*Y1023 + 142521*Y1123 + 1372680*Y1223
+ 119500*Y1323 + 247573*Y1423 + 93157*Y1523 + 1994765*Y1623 + 29538*Y1723 + 226845*Y1823 + 117310*Y1923
+ 955890*Y2023 + 3333230*Y2123 + 2349633*Y2223 + 139434*Y2323
+ 2090879*Y2423 + 755723*Y2523 + 374615*Y2623 + 224382*Y2723 + 194903*Y2823 + 173934*Y2923 - 139434*X23
<=0;

229*Y123 + 354*Y223 + 115*Y323 + 5827*Y423 + 4776*Y523 + 152*Y623 + 661*Y723 + 1019*Y823 + 278*Y923 +
60*Y1023 + 2155*Y1123 + 908*Y1223 + 2593*Y1323 + 272*Y1423 + 64*Y1523 +
1053*Y1623 + 137*Y1723 + 138*Y1823 + 523*Y1923 + 1222*Y2023 + 1674*Y2123 + 554*Y2223 + 197*Y2323 + 5794*Y2423
+ 1505*Y2523 + 1347*Y2623 + 310*Y2723 + 259*Y2823 + 277*Y2923 >= 197;

3*Y123 + 3*Y223 + 3*Y323 + 3*Y423 + 3*Y523 + 3*Y623 + 3*Y723 + 3*Y823 + 3*Y923 + 3*Y1023 + 3*Y1123 + 3*Y1223
+ 3*Y1323 + 3*Y1423 + 3*Y1523 + 3*Y1623 + 3*Y1723 + 3*Y1823
+ 3*Y1923 + 3*Y2023 + 3*Y2123 + 3*Y2223 + 3*Y2323 + 3*Y2423 + 3*Y2523 + 3*Y2623 + 3*Y2723 + 3*Y2823 + 3*Y2923
>= 3;

4*Y123 + 3*Y223 + 1*Y323 + 4*Y423 + 3*Y523 + 1*Y623 + 3*Y723 + 4*Y823 + 2*Y923 + 1*Y1023 + 4*Y1123 + 2*Y1223
+ 4*Y1323 + 3*Y1423 + 2*Y1523 + 4*Y1623 + 1*Y1723 + 2*Y1823
+ 3*Y1923 + 4*Y2023 + 3*Y2123 + 3*Y2223 + 2*Y2323 + 4*Y2423 + 3*Y2523 + 4*Y2623 + 2*Y2723 + 3*Y2823 + 3*Y2923
>= 2;

@Free(X23);
Y123 >=0; Y223 >=0; Y323 >=0; Y423 >=0; Y523 >=0; Y623 >=0; Y723 >=0; Y823 >=0; Y923 >=0; Y1023 >=0; Y1123
>=0; Y1223 >=0; Y1323 >=0; Y1423 >=0; Y1523 >=0; Y1623 >=0; Y1723 >=0; Y1823 >=0; Y1923 >=0; Y2023 >=0; Y2123
>=0; Y2223 >=0; Y2323 >=0; Y2423 >=0; Y2523 >=0; Y2623 >=0; Y2723 >=0; Y2823 >=0; Y2923 >=0;

```

## Solutions of Dual Problem

Variable	Value	Reduced Cost
X23	1.000000	0.2775558E-16
Y123	0.000000	2.884015
Y223	0.000000	-0.5551115E-16
Y323	0.000000	0.1016383
Y423	0.000000	4.452414
Y523	0.000000	0.7310087
Y623	0.000000	0.3017048
Y723	0.000000	0.9548074
Y823	0.000000	1.093209
Y923	0.000000	0.2385781
Y1023	0.000000	0.5551115E-16
Y1123	0.000000	5.835979
Y1223	0.000000	3.614872

Y1323	0.000000	3.609935
Y1423	0.000000	0.8777574E-01
Y1523	0.000000	0.8203841E-02
Y1623	0.000000	4.504005
Y1723	0.000000	-0.7216450E-15
Y1823	0.000000	1.179766
Y1923	0.000000	0.8902151
Y2023	0.000000	5.673793
Y2123	0.000000	7.104432
Y2223	0.000000	4.880111
Y2323	1.000000	0.000000
Y2423	0.000000	18.27203
Y2523	0.000000	3.532840
Y2623	0.000000	0.8692068
Y2723	0.000000	0.1518300
Y2823	0.000000	0.1754693
Y2923	0.000000	1.935767

## SUMMARY

Efficiency score of Warehouse 23 (Nagpur) = 1

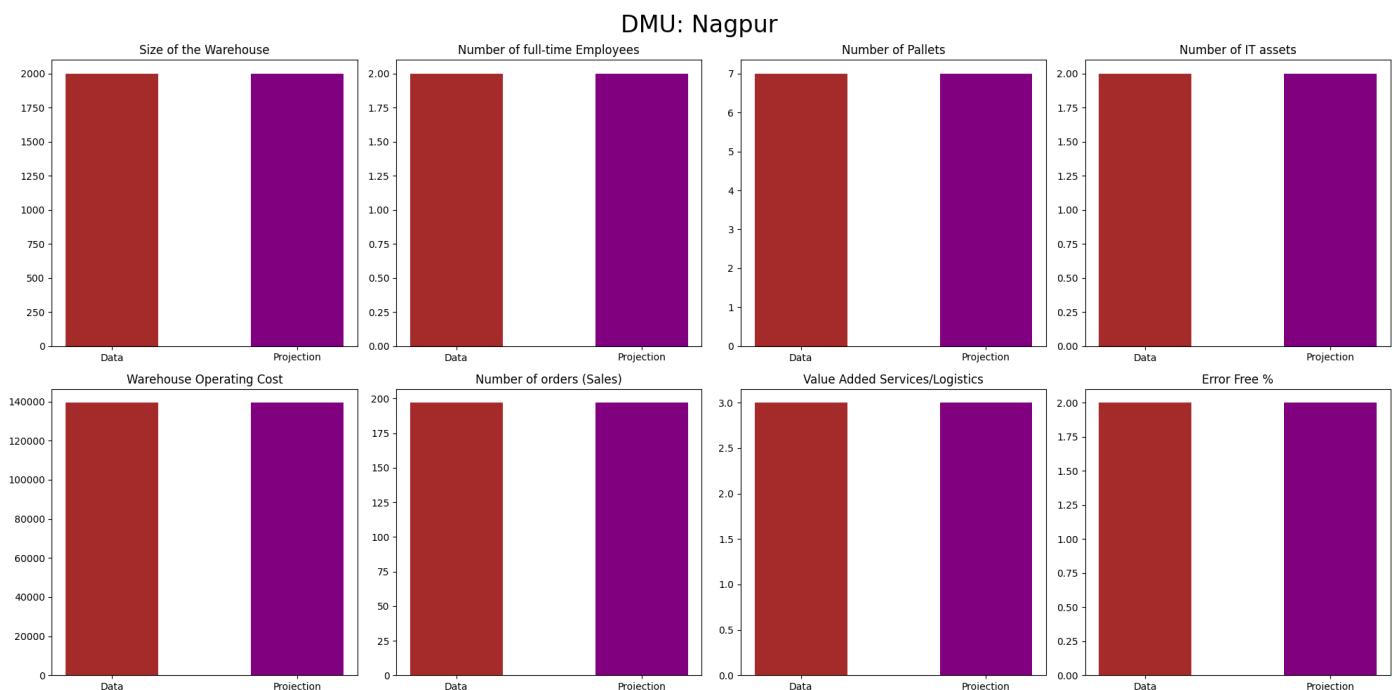
Warehouse 23 (Nagpur) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	2000	2000	0
No. of Full-time Employees	2	2	0
No. of Pallets	7	7	0
No. of IT assets	2	2	0
Warehouse Operating Cost	139434	139434	0
No. of Orders (Sales)	197	197	0
Level of Value-Added Services	3	3	0
Error Free (%)	2	2	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 23 (Nagpur)	1



# WAREHOUSE 24 (NEW DELHI)

## Primal Problem Formulation

**!Objective Function;**

**MAX = 5794\*VF24 + 3\*VG24 + 4\*VH24;**

**!Subject to;**

```

37324*UA24 + 48*UB24 + 550*UC24 + 25*UD24 + 2090879*UE24 = 1;
(229*VF24 + 3*VG24 + 4*VH24) - (13100*UA24 + 7*UB24 + 320*UC24 + 9*UD24 + 820931*UE24) <=0;
(354*VF24 + 3*VG24 + 3*VH24) - (2000*UA24 + 2*UB24 + 7*UC24 + 4*UD24 + 147596*UE24) <=0;
(115*VF24 + 3*VG24 + 1*VH24) - (550*UA24 + 2*UB24 + 2*UC24 + 2*UD24 + 86404*UE24) <=0;
(5827*VF24 + 3*VG24 + 4*VH24) - (9800*UA24 + 14*UB24 + 10*UC24 + 9*UD24 + 584300*UE24) <=0;
(4776*VF24 + 3*VG24 + 3*VH24) - (7500*UA24 + 4*UB24 + 7*UC24 + 4*UD24 + 238265*UE24) <=0;
(152*VF24 + 3*VG24 + 1*VH24) - (550*UA24 + 2*UB24 + 2*UC24 + 3*UD24 + 147473*UE24) <=0;
(661*VF24 + 3*VG24 + 3*VH24) - (4800*UA24 + 3*UB24 + 7*UC24 + 6*UD24 + 420908*UE24) <=0;
(1019*VF24 + 3*VG24 + 4*VH24) - (10250*UA24 + 5*UB24 + 20*UC24 + 7*UD24 + 239046*UE24) <=0;
(278*VF24 + 3*VG24 + 2*VH24) - (2300*UA24 + 2*UB24 + 7*UC24 + 4*UD24 + 171183*UE24) <=0;
(60*VF24 + 3*VG24 + 1*VH24) - (1000*UA24 + 1*UB24 + 30*UC24 + 4*UD24 + 86967*UE24) <=0;
(2155*VF24 + 3*VG24 + 4*VH24) - (20700*UA24 + 21*UB24 + 200*UC24 + 11*UD24 + 142521*UE24) <=0;
(908*VF24 + 3*VG24 + 2*VH24) - (1200*UA24 + 6*UB24 + 7*UC24 + 5*UD24 + 1372680*UE24) <=0;
(2593*VF24 + 3*VG24 + 4*VH24) - (11000*UA24 + 13*UB24 + 200*UC24 + 12*UD24 + 119500*UE24) <=0;
(272*VF24 + 3*VG24 + 3*VH24) - (4100*UA24 + 2*UB24 + 7*UC24 + 3*UD24 + 247573*UE24) <=0;
(64*VF24 + 3*VG24 + 2*VH24) - (2000*UA24 + 2*UB24 + 2*UC24 + 3*UD24 + 93157*UE24) <=0;
(1053*VF24 + 3*VG24 + 4*VH24) - (21000*UA24 + 5*UB24 + 338*UC24 + 10*UD24 + 1994765*UE24) <=0;
(137*VF24 + 3*VG24 + 1*VH24) - (500*UA24 + 2*UB24 + 2*UC24 + 2*UD24 + 29538*UE24) <=0;
(138*VF24 + 3*VG24 + 2*VH24) - (2152*UA24 + 4*UB24 + 48*UC24 + 7*UD24 + 226845*UE24) <=0;
(523*VF24 + 3*VG24 + 3*VH24) - (9700*UA24 + 5*UB24 + 7*UC24 + 5*UD24 + 117310*UE24) <=0;
(1222*VF24 + 3*VG24 + 4*VH24) - (15000*UA24 + 15*UB24 + 200*UC24 + 12*UD24 + 955890*UE24) <=0;
(1674*VF24 + 3*VG24 + 3*VH24) - (9000*UA24 + 6*UB24 + 7*UC24 + 7*UD24 + 3333230*UE24) <=0;
(554*VF24 + 3*VG24 + 3*VH24) - (4600*UA24 + 5*UB24 + 7*UC24 + 5*UD24 + 2349633*UE24) <=0;
(197*VF24 + 3*VG24 + 2*VH24) - (2000*UA24 + 2*UB24 + 7*UC24 + 2*UD24 + 139434*UE24) <=0;
(5794*VF24 + 3*VG24 + 4*VH24) - (37324*UA24 + 48*UB24 + 550*UC24 + 25*UD24 + 2090879*UE24) <=0;
(1505*VF24 + 3*VG24 + 3*VH24) - (11000*UA24 + 9*UB24 + 200*UC24 + 9*UD24 + 755723*UE24) <=0;
(1347*VF24 + 3*VG24 + 4*VH24) - (10000*UA24 + 4*UB24 + 7*UC24 + 5*UD24 + 374615*UE24) <=0;
(310*VF24 + 3*VG24 + 2*VH24) - (4000*UA24 + 2*UB24 + 2*UC24 + 2*UD24 + 224382*UE24) <=0;
(259*VF24 + 3*VG24 + 3*VH24) - (5500*UA24 + 2*UB24 + 50*UC24 + 5*UD24 + 194903*UE24) <=0;
(277*VF24 + 3*VG24 + 3*VH24) - (2000*UA24 + 8*UB24 + 2*UC24 + 6*UD24 + 173934*UE24) <=0;

```

```

UA24 >=0;
UB24 >=0;
UC24 >=0;
UD24 >=0;
UE24 >=0;
VF24 >=0;
VG24 >=0;
VH24 >=0;

```

## Solutions/Weights of Primal Problem



```

Global optimal solution found.
Objective value: 0.2438350
Infeasibilities: 0.000000
Total solver iterations: 14

```

Variable	Value	Reduced Cost
VF24	0.3624999E-04	0.8775203E-12
VG24	0.000000	1.439999
VH24	0.8450636E-02	0.4440892E-15
UA24	0.2603436E-04	-0.9521273E-12
UB24	0.000000	5.732183
UC24	0.000000	124.4393
UD24	0.000000	0.2879438
UE24	0.1353195E-07	0.2637535E-10

## Dual Problem Formulation

```

!Dual Objective Function;

MIN = X24;

!Subject to;
13100*Y124 + 2000*Y224 + 550*Y324 + 9800*Y424 + 7500*Y524 + 550*Y624 + 4800*Y724 + 10250*Y824 + 2300*Y924 +
1000*Y1024 + 20700*Y1124 + 1200*Y1224 + 11000*Y1324 + 4100*Y1424 + 2000*Y1524 +
21000*Y1624 + 500*Y1724 + 2152*Y1824 + 9700*Y1924 + 15000*Y2024 + 9000*Y2124 + 4600*Y2224 + 2000*Y2324 +
37324*Y2424 + 11000*Y2524 + 10000*Y2624 + 4000*Y2724 + 5500*Y2824 + 2000*Y2924
-37324*X24 <=0;

7*Y124 + 2*Y224 + 2*Y324 + 14*Y424 + 4*Y524 + 2*Y624 + 3*Y724 + 5*Y824 + 2*Y924 + 1*Y1024 + 21*Y1124 +
6*Y1224 + 13*Y1324 + 2*Y1424 + 2*Y1524 + 5*Y1624 + 2*Y1724 + 4*Y1824 + 5*Y1924 + 15*Y2024 + 6*Y2124 + 5*Y2224 +
+ 2*Y2324 + 48*Y2424 + 9*Y2524 + 4*Y2624 + 2*Y2724 + 2*Y2824 + 8*Y2924 - 48*X24 <= 0;

320*Y124 + 7*Y224 + 2*Y324 + 10*Y424 + 7*Y524 + 2*Y624 + 7*Y724 + 20*Y824 + 7*Y924 + 30*Y1024 + 200*Y1124 +
7*Y1224 + 200*Y1324 + 7*Y1424 + 2*Y1524 + 338*Y1624 + 2*Y1724 + 48*Y1824 +
7*Y1924 + 200*Y2024 + 7*Y2124 + 7*Y2224 + 7*Y2324 + 550*Y2424 + 200*Y2524 + 7*Y2624 + 2*Y2724 + 50*Y2824 +
2*Y2924 - 550*X24 <=0;

9*Y124 + 4*Y224 + 2*Y324 + 9*Y424 + 4*Y524 + 3*Y624 + 6*Y724 + 7*Y824 + 4*Y924 + 4*Y1024 + 11*Y1124 + 5*Y1224 +
+ 12*Y1324 + 3*Y1424 + 3*Y1524 + 10*Y1624 + 2*Y1724 + 7*Y1824 + 5*Y1924 +
12*Y2024 + 7*Y2124 + 5*Y2224 + 2*Y2324 + 25*Y2424 + 9*Y2524 + 5*Y2624 + 2*Y2724 + 5*Y2824 + 6*Y2924 - 25*X24
<=0;

820931*Y124 + 147596*Y224 + 86404*Y324 + 584300*Y424 + 238265*Y524 + 147473*Y624 + 420908*Y724 +
239046*Y824 + 171183*Y924 + 86967*Y1024 + 142521*Y1124 + 1372680*Y1224
+ 119500*Y1324 + 247573*Y1424 + 93157*Y1524 + 1994765*Y1624 + 29538*Y1724 + 226845*Y1824 + 117310*Y1924
+ 955890*Y2024 + 3333230*Y2124 + 2349633*Y2224 + 139434*Y2324
+ 2090879*Y2424 + 755723*Y2524 + 374615*Y2624 + 224382*Y2724 + 194903*Y2824 + 173934*Y2924 -
2090879*X24 <=0;

229*Y124 + 354*Y224 + 115*Y324 + 5827*Y424 + 4776*Y524 + 152*Y624 + 661*Y724 + 1019*Y824 + 278*Y924 +
60*Y1024 + 2155*Y1124 + 908*Y1224 + 2593*Y1324 + 272*Y1424 + 64*Y1524 +
1053*Y1624 + 137*Y1724 + 138*Y1824 + 523*Y1924 + 1222*Y2024 + 1674*Y2124 + 554*Y2224 + 197*Y2324 + 5794*Y2424 +
+ 1505*Y2524 + 1347*Y2624 + 310*Y2724 + 259*Y2824 + 277*Y2924 >=5794;

3*Y124 + 3*Y224 + 3*Y324 + 3*Y424 + 3*Y524 + 3*Y624 + 3*Y724 + 3*Y824 + 3*Y924 + 3*Y1024 + 3*Y1124 + 3*Y1224
+ 3*Y1324 + 3*Y1424 + 3*Y1524 + 3*Y1624 + 3*Y1724 + 3*Y1824
+ 3*Y1924 + 3*Y2024 + 3*Y2124 + 3*Y2224 + 3*Y2324 + 3*Y2424 + 3*Y2524 + 3*Y2624 + 3*Y2724 + 3*Y2824 + 3*Y2924
>= 3;

4*Y124 + 3*Y224 + 1*Y324 + 4*Y424 + 3*Y524 + 1*Y624 + 3*Y724 + 4*Y824 + 2*Y924 + 1*Y1024 + 4*Y1124 + 2*Y1224
+ 4*Y1324 + 3*Y1424 + 2*Y1524 + 4*Y1624 + 1*Y1724 + 2*Y1824
+ 3*Y1924 + 4*Y2024 + 3*Y2124 + 3*Y2224 + 2*Y2324 + 4*Y2424 + 3*Y2524 + 4*Y2624 + 2*Y2724 + 3*Y2824 + 3*Y2924
>= 4;

@Free(X24);
Y124 >=0; Y224 >=0; Y324 >=0; Y424 >=0; Y524 >=0; Y624 >=0; Y724 >=0; Y824 >=0; Y924 >=0; Y1024 >=0; Y1124
>=0; Y1224 >=0; Y1324 >=0; Y1424 >=0; Y1524 >=0; Y1624 >=0; Y1724 >=0; Y1824 >=0; Y1924 >=0; Y2024 >=0; Y2124
>=0; Y2224 >=0; Y2324 >=0; Y2424 >=0; Y2524 >=0; Y2624 >=0;
Y2724 >=0; Y2824 >=0; Y2924 >=0;

```

## Solutions of Dual Problem

File Edit LINGO Window Help			
Global optimal solution found.			
Objective value:			
Infeasibilities:	0.000000		
Total solver iterations:	5		
Variable	Value	Reduced Cost	
X24	0.2438350	0.000000	
Y124	0.000000	0.3100551	
Y224	0.000000	0.1588157E-01	
Y324	0.000000	0.2868725E-02	
Y424	0.000000	0.1801217E-01	
Y524	1.178017	-0.8326673E-16	
Y624	0.000000	0.2353858E-02	
Y724	0.000000	0.8134747E-01	
Y824	0.000000	0.1993456	
Y924	0.000000	0.3521669E-01	
Y1024	0.000000	0.1658555E-01	
Y1124	0.000000	0.4289185	
Y1224	0.1639657	0.3469447E-17	
Y1324	0.000000	0.1601962	
Y1424	0.000000	0.7487910E-01	
Y1524	0.000000	0.3410804E-01	
Y1624	0.000000	0.5017408	
Y1724	0.1380166	0.1734723E-17	
Y1824	0.000000	0.3719182E-01	
Y1924	0.000000	0.2098100	

Y2024	0.000000	0.3253504
Y2124	0.000000	0.1933799
Y2224	0.000000	0.1061188
Y2324	0.000000	0.2991301E-01
Y2424	0.000000	0.7561650
Y2524	0.000000	0.2166962
Y2624	0.000000	0.1827816
Y2724	0.000000	0.7903498E-01
Y2824	0.000000	0.1110857
Y2924	0.000000	0.1902922E-01

## SUMMARY

Efficiency score of Warehouse 24 (New Delhi) = 0.243835

Warehouse 24 (New Delhi) is not an efficient or inefficient warehouse.

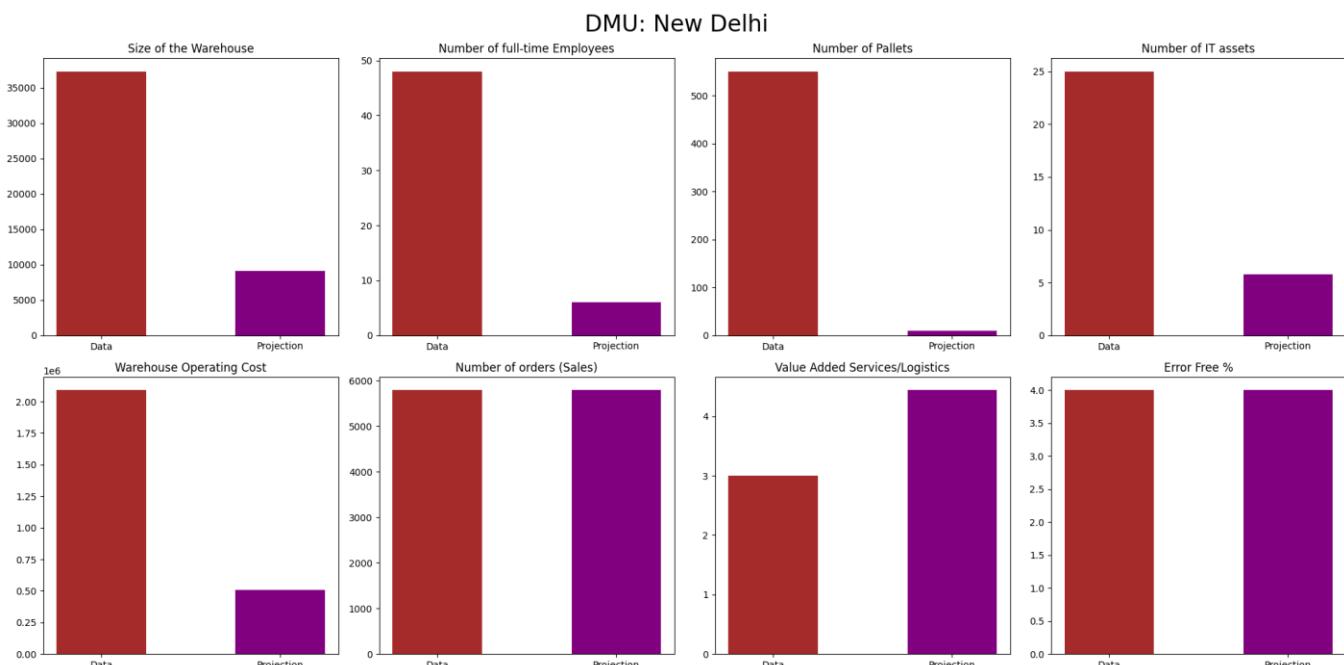
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	37324	9100.9	0
No. of Full-time Employees	48	5.9719	5.732
No. of Pallets	550	9.66991	124.439
No. of IT assets	25	5.80793	0.288
Warehouse Operating Cost	2090879	509829	0
No. of Orders (Sales)	5794	5794	0
Level of Value-Added Services	3	4.44	1.44
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 5 (Bhiwandi)	1.178017
Warehouse 12 (Gorakhpur)	0.1639657
Warehouse 17 (Jammu)	0.1380166

In order to make warehouse 24 (New Delhi) efficient, they need to decrease size of the warehouse by 75.617%, No of full-time employees by 87.559%, number of pallets by 98.242%, IT Assets by 76.768% , operating cost by 75.617%, whereas value-added logistics needs to be increased by 48%.



# WAREHOUSE 25 (PATNA)

## Primal Problem Formulation

```

!Objective Function;

MAX = 1505*VF25 + 3*VG25 + 3*VH25;

!Subject to;

11000*UA25 + 9*UB25 + 200*UC25 + 9*UD25 + 755723*UE25 = 1;
(229*VF25 + 3*VG25 + 4*VH25) - (13100*UA25 + 7*UB25 + 320*UC25 + 9*UD25 + 820931*UE25) <=0;
(354*VF25 + 3*VG25 + 3*VH25) - (2000*UA25 + 2*UB25 + 7*UC25 + 4*UD25 + 147596*UE25) <=0;
(115*VF25 + 3*VG25 + 1*VH25) - (550*UA25 + 2*UB25 + 2*UC25 + 2*UD25 + 86404*UE25) <=0;
(5827*VF25 + 3*VG25 + 4*VH25) - (9800*UA25 + 14*UB25 + 10*UC25 + 9*UD25 + 584300*UE25) <=0;
(4776*VF25 + 3*VG25 + 3*VH25) - (7500*UA25 + 4*UB25 + 7*UC25 + 4*UD25 + 238265*UE25) <=0;
(152*VF25 + 3*VG25 + 1*VH25) - (550*UA25 + 2*UB25 + 2*UC25 + 3*UD25 + 147473*UE25) <=0;
(661*VF25 + 3*VG25 + 3*VH25) - (4800*UA25 + 3*UB25 + 7*UC25 + 6*UD25 + 420908*UE25) <=0;
(1019*VF25 + 3*VG25 + 4*VH25) - (10250*UA25 + 5*UB25 + 20*UC25 + 7*UD25 + 239046*UE25) <=0;
(278*VF25 + 3*VG25 + 2*VH25) - (2300*UA25 + 2*UB25 + 7*UC25 + 4*UD25 + 171183*UE25) <=0;
(60*VF25 + 3*VG25 + 1*VH25) - (1000*UA25 + 1*UB25 + 30*UC25 + 4*UD25 + 86967*UE25) <=0;
(2155*VF25 + 3*VG25 + 4*VH25) - (20700*UA25 + 21*UB25 + 200*UC25 + 11*UD25 + 142521*UE25) <=0;
(908*VF25 + 3*VG25 + 2*VH25) - (1200*UA25 + 6*UB25 + 7*UC25 + 5*UD25 + 1372680*UE25) <=0;
(2593*VF25 + 3*VG25 + 4*VH25) - (11000*UA25 + 13*UB25 + 200*UC25 + 12*UD25 + 119500*UE25) <=0;
(272*VF25 + 3*VG25 + 3*VH25) - (4100*UA25 + 2*UB25 + 7*UC25 + 3*UD25 + 247573*UE25) <=0;
(64*VF25 + 3*VG25 + 2*VH25) - (2000*UA25 + 2*UB25 + 2*UC25 + 3*UD25 + 93157*UE25) <=0;
(1053*VF25 + 3*VG25 + 4*VH25) - (21000*UA25 + 5*UB25 + 338*UC25 + 10*UD25 + 1994765*UE25) <=0;
(137*VF25 + 3*VG25 + 1*VH25) - (500*UA25 + 2*UB25 + 2*UC25 + 2*UD25 + 29538*UE25) <=0;
(138*VF25 + 3*VG25 + 2*VH25) - (2152*UA25 + 4*UB25 + 48*UC25 + 7*UD25 + 226845*UE25) <=0;
(523*VF25 + 3*VG25 + 3*VH25) - (9700*UA25 + 5*UB25 + 7*UC25 + 5*UD25 + 117310*UE25) <=0;
(1222*VF25 + 3*VG25 + 4*VH25) - (15000*UA25 + 15*UB25 + 200*UC25 + 12*UD25 + 955890*UE25) <=0;
(1674*VF25 + 3*VG25 + 3*VH25) - (9000*UA25 + 6*UB25 + 7*UC25 + 7*UD25 + 3333230*UE25) <=0;
(554*VF25 + 3*VG25 + 3*VH25) - (4600*UA25 + 5*UB25 + 7*UC25 + 5*UD25 + 2349633*UE25) <=0;
(197*VF25 + 3*VG25 + 2*VH25) - (2000*UA25 + 2*UB25 + 7*UC25 + 2*UD25 + 139434*UE25) <=0;
(5794*VF25 + 3*VG25 + 4*VH25) - (37324*UA25 + 48*UB25 + 550*UC25 + 25*UD25 + 2090879*UE25) <=0;
(1505*VF25 + 3*VG25 + 3*VH25) - (11000*UA25 + 9*UB25 + 200*UC25 + 9*UD25 + 755723*UE25) <=0;
(1347*VF25 + 3*VG25 + 4*VH25) - (10000*UA25 + 4*UB25 + 7*UC25 + 5*UD25 + 374615*UE25) <=0;
(310*VF25 + 3*VG25 + 2*VH25) - (4000*UA25 + 2*UB25 + 2*UC25 + 2*UD25 + 224382*UE25) <=0;
(259*VF25 + 3*VG25 + 3*VH25) - (5500*UA25 + 2*UB25 + 50*UC25 + 5*UD25 + 194903*UE25) <=0;
(277*VF25 + 3*VG25 + 3*VH25) - (2000*UA25 + 8*UB25 + 2*UC25 + 6*UD25 + 173934*UE25) <=0;

UA25 >=0;
UB25 >=0;
UC25 >=0;
UD25 >=0;
UE25 >=0;
VF25 >=0;
VG25 >=0;
VH25 >=0;

```

## Solutions/Weights of Primal Problem



Variable	Value	Reduced Cost
VF25	0.6021738E-04	0.7105427E-13
VG25	0.000000	0.9524885
VH25	0.9442086E-01	-0.2220446E-15
UA25	0.4841478E-04	0.4263256E-12
UB25	0.000000	0.1926354
UC25	0.000000	65.55548
UD25	0.5193749E-01	0.000000
UE25	0.000000	71512.27

## Dual Problem Formulation

```

!Dual Objective Function;

MIN = X25;

!Subject to;
13100*Y125 + 2000*Y225 + 550*Y325 + 9800*Y425 + 7500*Y525 + 550*Y625 + 4800*Y725 + 10250*Y825 + 2300*Y925 +
1000*Y1025 + 20700*Y1125 + 1200*Y1225 + 11000*Y1325 + 4100*Y1425 + 2000*Y1525 +
21000*Y1625 + 500*Y1725 + 2152*Y1825 + 9700*Y1925 + 15000*Y2025 + 9000*Y2125 + 4600*Y2225 + 2000*Y2325 +
37324*Y2425 + 11000*Y2525 + 10000*Y2625 + 4000*Y2725 + 5500*Y2825 + 2000*Y2925
-X25 <=0;

7*Y125 + 2*Y225 + 2*Y325 + 14*Y425 + 4*Y525 + 2*Y625 + 3*Y725 + 5*Y825 + 2*Y925 + 1*Y1025 + 21*Y1125 +
6*Y1225 + 13*Y1325 + 2*Y1425 + 2*Y1525 + 5*Y1625 + 2*Y1725 + 4*Y1825 + 5*Y1925
+ 15*Y2025 + 6*Y2125 + 5*Y2225 + 2*Y2325 + 48*Y2425 + 9*Y2525 + 4*Y2625 + 2*Y2725 + 2*Y2825 + 8*Y2925 - 9*X25
<=0;

320*Y125 + 7*Y225 + 2*Y325 + 10*Y425 + 7*Y525 + 2*Y625 + 7*Y725 + 20*Y825 + 7*Y925 + 30*Y1025 + 200*Y1125 +
7*Y1225 + 200*Y1325 + 7*Y1425 + 2*Y1525 + 338*Y1625 + 2*Y1725 + 48*Y1825 +
7*Y1925 + 200*Y2025 + 7*Y2125 + 7*Y2225 + 7*Y2325 + 550*Y2425 + 200*Y2525 + 7*Y2625 + 2*Y2725 + 50*Y2825 +
2*Y2925 - 200*X25 <=0;

9*Y125 + 4*Y225 + 2*Y325 + 9*Y425 + 4*Y525 + 3*Y625 + 6*Y725 + 7*Y825 + 4*Y925 + 4*Y1025 + 11*Y1125 + 5*Y1225
+ 12*Y1325 + 3*Y1425 + 3*Y1525 + 10*Y1625 + 2*Y1725 + 7*Y1825 + 5*Y1925 +
12*Y2025 + 7*Y2125 + 5*Y2225 + 2*Y2325 + 25*Y2425 + 9*Y2525 + 5*Y2625 + 2*Y2725 + 5*Y2825 + 6*Y2925 - 9*X25
<= 0;

820931*Y125 + 147596*Y225 + 86404*Y325 + 584300*Y425 + 238265*Y525 + 147473*Y625 + 420908*Y725 +
239046*Y825 + 171183*Y925 + 86967*Y1025 + 142521*Y1125 + 1372680*Y1225
+ 119500*Y1325 + 247573*Y1425 + 93157*Y1525 + 1994765*Y1625 + 29538*Y1725 + 226845*Y1825 + 117310*Y1925
+ 955890*Y2025 + 3333230*Y2125 + 2349633*Y2225 + 139434*Y2325
+ 2090879*Y2425 + 755723*Y2525 + 374615*Y2625 + 224382*Y2725 + 194903*Y2825 + 173934*Y2925 - 755723*X25
<= 0;

229*Y125 + 354*Y225 + 115*Y325 + 5827*Y425 + 4776*Y525 + 152*Y625 + 661*Y725 + 1019*Y825 + 278*Y925 +
60*Y1025 + 2155*Y1125 + 908*Y1225 + 2593*Y1325 + 272*Y1425 + 64*Y1525 +
1053*Y1625 + 137*Y1725 + 138*Y1825 + 523*Y1925 + 1222*Y2025 + 1674*Y2125 + 554*Y2225 + 197*Y2325 + 5794*Y2425
+ 1505*Y2525 + 1347*Y2625 + 310*Y2725 + 259*Y2825 + 277*Y2925 >= 1505;

3*Y125 + 3*Y225 + 3*Y325 + 3*Y425 + 3*Y525 + 3*Y625 + 3*Y725 + 3*Y825 + 3*Y925 + 3*Y1025 + 3*Y1125 + 3*Y1225
+ 3*Y1325 + 3*Y1425 + 3*Y1525 + 3*Y1625 + 3*Y1725 + 3*Y1825
+ 3*Y1925 + 3*Y2025 + 3*Y2125 + 3*Y2225 + 3*Y2325 + 3*Y2425 + 3*Y2525 + 3*Y2625 + 3*Y2725 + 3*Y2825 + 3*Y2925
>= 3;

4*Y125 + 3*Y225 + 1*Y325 + 4*Y425 + 3*Y525 + 1*Y625 + 3*Y725 + 4*Y825 + 2*Y925 + 1*Y1025 + 4*Y1125 + 2*Y1225
+ 4*Y1325 + 3*Y1425 + 2*Y1525 + 4*Y1625 + 1*Y1725 + 2*Y1825
+ 3*Y1925 + 4*Y2025 + 3*Y2125 + 3*Y2225 + 2*Y2325 + 4*Y2425 + 3*Y2525 + 4*Y2625 + 2*Y2725 + 3*Y2825 + 3*Y2925
>= 3;

@Free(X25);
Y125 >=0; Y225 >=0; Y325 >=0; Y425 >=0; Y525 >=0; Y625 >=0; Y725 >=0; Y825 >=0; Y925 >=0; Y1025 >=0; Y1125
>=0; Y1225 >=0; Y1325 >=0; Y1425 >=0; Y1525 >=0; Y1625 >=0; Y1725 >=0; Y1825 >=0; Y1925 >=0; Y2025 >=0; Y2125
>=0; Y2225 >=0; Y2325 >=0; Y2425 >=0; Y2525 >=0; Y2625 >=0; Y2725 >=0; Y2825 >=0; Y2925 >=0;

```

## Solutions of Dual Problem

File Edit LINGO Window Help		
Global optimal solution found.		
Objective value:	0.3738897	
Infeasibilities:	0.000000	
Total solver iterations:	9	
Variable	Value	Reduced Cost
X25	0.3738897	0.1110223E-15
Y125	0.000000	0.7101978
Y225	0.9631771E-01	-0.5551115E-16
Y325	0.000000	0.2915726E-01
Y425	0.000000	0.2133321
Y525	0.2686900	-0.3330669E-15
Y625	0.000000	0.7886671E-01
Y725	0.000000	0.2209496
Y825	0.000000	0.4207690
Y925	0.000000	0.1135218
Y1025	0.000000	0.1581309
Y1125	0.000000	1.066046
Y1225	0.000000	0.7426610E-01
Y1325	0.000000	0.6219854
Y1425	0.000000	0.5467136E-01
Y1525	0.000000	0.5994641E-01
Y1625	0.000000	1.094993
Y1725	0.000000	0.2541174E-01
Y1825	0.000000	0.2705993

Y1925	0.000000	0.4145545
Y2025	0.000000	0.8982025
Y2125	0.000000	0.4152290
Y2225	0.000000	0.1657724
Y2325	0.9524885	0.000000
Y2425	0.000000	2.378888
Y2525	0.000000	0.6261103
Y2625	0.000000	0.2850390
Y2725	0.000000	0.9002499E-01
Y2825	0.000000	0.2271099
Y2925	0.000000	0.1085117

## SUMMARY

Efficiency score of Warehouse 25 (Patna) = 0.3738897

Warehouse 25 (Patna) is not an efficient or inefficient warehouse.

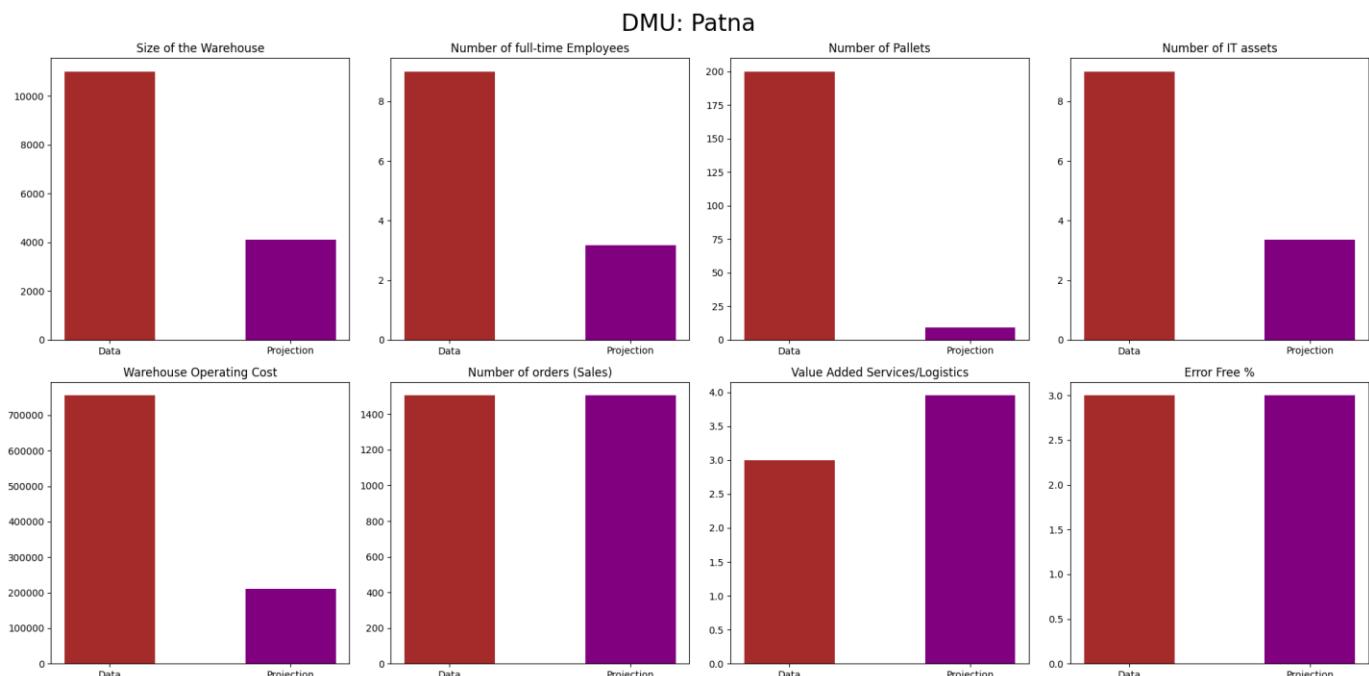
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	11000	4112.79	0
No. of Full-time Employees	9	3.17237	5.732
No. of Pallets	200	9.22247	124.439
No. of IT assets	9	3.36501	0.288
Warehouse Operating Cost	755723	211045	0
No. of Orders (Sales)	1505	1505	0
Level of Value-Added Services	3	3.95249	1.44
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 2 (Ahmedabad)	0.09631771
Warehouse 5 (Bhiwandi)	0.26869
Warehouse 23 (Nagpur)	0.9524885

In order to make warehouse 25 (Patna) efficient, they need to decrease size of the warehouse by 62.611%, No of full-time employees by 64.751%, number of pallets by 95.389%, IT Assets by 62.611% , operating cost by 72.074%, whereas value-added logistics needs to be increased by 31.75%.



## WAREHOUSE 26 (PUNE)

### Primal Problem Formulation

```

!Objective Function;

MAX = 1347*VF26 + 3*VG26 + 4*VH26;

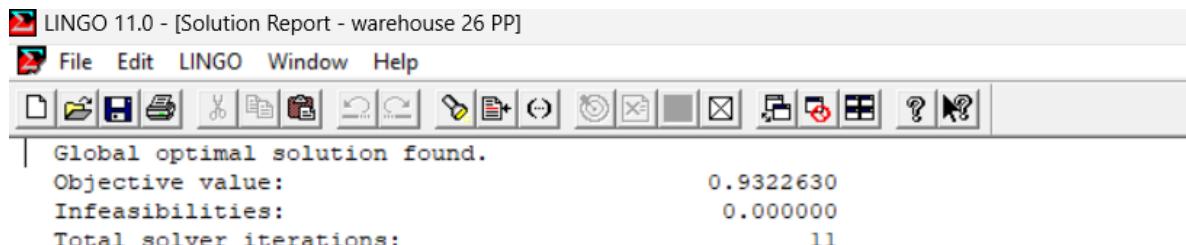
!Subject to;

10000*UA26 + 4*UB26 + 7*UC26 + 5*UD26 + 374615*UE26 = 1;
(229*VF26 + 3*VG26 + 4*VH26) - (13100*UA26 + 7*UB26 + 320*UC26 + 9*UD26 + 820931*UE26) <=0;
(354*VF26 + 3*VG26 + 3*VH26) - (2000*UA26 + 2*UB26 + 7*UC26 + 4*UD26 + 147596*UE26) <=0;
(115*VF26 + 3*VG26 + 1*VH26) - (550*UA26 + 2*UB26 + 2*UC26 + 2*UD26 + 86404*UE26) <=0;
(5827*VF26 + 3*VG26 + 4*VH26) - (9800*UA26 + 14*UB26 + 10*UC26 + 9*UD26 + 584300*UE26) <=0;
(4776*VF26 + 3*VG26 + 3*VH26) - (7500*UA26 + 4*UB26 + 7*UC26 + 4*UD26 + 238265*UE26) <=0;
(152*VF26 + 3*VG26 + 1*VH26) - (550*UA26 + 2*UB26 + 2*UC26 + 3*UD26 + 147473*UE26) <=0;
(661*VF26 + 3*VG26 + 3*VH26) - (4800*UA26 + 3*UB26 + 7*UC26 + 6*UD26 + 420908*UE26) <=0;
(1019*VF26 + 3*VG26 + 4*VH26) - (10250*UA26 + 5*UB26 + 20*UC26 + 7*UD26 + 239046*UE26) <=0;
(278*VF26 + 3*VG26 + 2*VH26) - (2300*UA26 + 2*UB26 + 7*UC26 + 4*UD26 + 171183*UE26) <=0;
(60*VF26 + 3*VG26 + 1*VH26) - (1000*UA26 + 1*UB26 + 30*UC26 + 4*UD26 + 86967*UE26) <=0;
(2155*VF26 + 3*VG26 + 4*VH26) - (20700*UA26 + 21*UB26 + 200*UC26 + 11*UD26 + 142521*UE26) <=0;
(908*VF26 + 3*VG26 + 2*VH26) - (1200*UA26 + 6*UB26 + 7*UC26 + 5*UD26 + 1372680*UE26) <=0;
(2593*VF26 + 3*VG26 + 4*VH26) - (11000*UA26 + 13*UB26 + 200*UC26 + 12*UD26 + 119500*UE26) <=0;
(272*VF26 + 3*VG26 + 3*VH26) - (4100*UA26 + 2*UB26 + 7*UC26 + 3*UD26 + 247573*UE26) <=0;
(64*VF26 + 3*VG26 + 2*VH26) - (2000*UA26 + 2*UB26 + 2*UC26 + 3*UD26 + 93157*UE26) <=0;
(1053*VF26 + 3*VG26 + 4*VH26) - (21000*UA26 + 5*UB26 + 338*UC26 + 10*UD26 + 1994765*UE26) <=0;
(137*VF26 + 3*VG26 + 1*VH26) - (500*UA26 + 2*UB26 + 2*UC26 + 2*UD26 + 29538*UE26) <=0;
(138*VF26 + 3*VG26 + 2*VH26) - (2152*UA26 + 4*UB26 + 48*UC26 + 7*UD26 + 226845*UE26) <=0;
(523*VF26 + 3*VG26 + 3*VH26) - (9700*UA26 + 5*UB26 + 7*UC26 + 5*UD26 + 117310*UE26) <=0;
(1222*VF26 + 3*VG26 + 4*VH26) - (15000*UA26 + 15*UB26 + 200*UC26 + 12*UD26 + 955890*UE26) <=0;
(1674*VF26 + 3*VG26 + 3*VH26) - (9000*UA26 + 6*UB26 + 7*UC26 + 7*UD26 + 3333230*UE26) <=0;
(554*VF26 + 3*VG26 + 3*VH26) - (4600*UA26 + 5*UB26 + 7*UC26 + 5*UD26 + 2349633*UE26) <=0;
(197*VF26 + 3*VG26 + 2*VH26) - (2000*UA26 + 2*UB26 + 7*UC26 + 2*UD26 + 139434*UE26) <=0;
(5794*VF26 + 3*VG26 + 4*VH26) - (37324*UA26 + 48*UB26 + 550*UC26 + 25*UD26 + 2090879*UE26) <=0;
(1505*VF26 + 3*VG26 + 3*VH26) - (11000*UA26 + 9*UB26 + 200*UC26 + 9*UD26 + 755723*UE26) <=0;
(1347*VF26 + 3*VG26 + 4*VH26) - (10000*UA26 + 4*UB26 + 7*UC26 + 5*UD26 + 374615*UE26) <=0;
(310*VF26 + 3*VG26 + 2*VH26) - (4000*UA26 + 2*UB26 + 2*UC26 + 2*UD26 + 224382*UE26) <=0;
(259*VF26 + 3*VG26 + 3*VH26) - (5500*UA26 + 2*UB26 + 50*UC26 + 5*UD26 + 194903*UE26) <=0;
(277*VF26 + 3*VG26 + 3*VH26) - (2000*UA26 + 8*UB26 + 2*UC26 + 6*UD26 + 173934*UE26) <=0;

UA26 >=0;
UB26 >=0;
UC26 >=0;
UD26 >=0;
UE26 >=0;
VF26 >=0;
VG26 >=0;
VH26 >=0;

```

### Solutions/Weights of Primal Problem Formulation



Variable	Value	Reduced Cost
VF26	0.7987858E-04	0.6252776E-12
VG26	0.000000	2.052810
VH26	0.2061666	0.2220446E-15
UA26	0.000000	2857.062
UB26	0.1766116	0.1110223E-15
UC26	0.4193626E-01	-0.4440892E-15
UD26	0.000000	0.2985462E-01
UE26	0.000000	3463.507

### Dual Problem Formulation

```

!Dual Objective Function;

MIN = X26;

!Subject to;
13100*Y126 + 2000*Y226 + 550*Y326 + 9800*Y426 + 7500*Y526 + 550*Y626 + 4800*Y726 + 10250*Y826 + 2300*Y926 +
1000*Y1026 + 20700*Y1126 + 1200*Y1226 + 11000*Y1326 + 4100*Y1426 + 2000*Y1526 +
21000*Y1626 + 500*Y1726 + 2152*Y1826 + 9700*Y1926 + 15000*Y2026 + 9000*Y2126 + 4600*Y2226 + 2000*Y2326 +
37324*Y2426 + 11000*Y2526 + 10000*Y2626 + 4000*Y2726 + 5500*Y2826 + 2000*Y2926
-10000*X26 <=0;

7*Y126 + 2*Y226 + 2*Y326 + 14*Y426 + 4*Y526 + 2*Y626 + 3*Y726 + 5*Y826 + 2*Y926 + 1*Y1026 + 21*Y1126 +
6*Y1226 + 13*Y1326 + 2*Y1426 + 2*Y1526 + 5*Y1626 + 2*Y1726 + 4*Y1826 + 5*Y1926 + 15*Y2026 + 6*Y2126 + 5*Y2226 +
2*Y2326 + 48*Y2426 + 9*Y2526 + 4*Y2626 + 2*Y2726 + 2*Y2826 + 8*Y2926 - 4*X26 <=0;

320*Y126 + 7*Y226 + 2*Y326 + 10*Y426 + 7*Y526 + 2*Y626 + 7*Y726 + 20*Y826 + 7*Y926 + 30*Y1026 + 200*Y1126 +
7*Y1226 + 200*Y1326 + 7*Y1426 + 2*Y1526 + 338*Y1626 + 2*Y1726 + 48*Y1826 +
7*Y1926 + 200*Y2026 + 7*Y2126 + 7*Y2226 + 7*Y2326 + 550*Y2426 + 200*Y2526 + 7*Y2626 + 2*Y2726 + 50*Y2826 +
2*Y2926 - 7*X26 <=0;

9*Y126 + 4*Y226 + 2*Y326 + 9*Y426 + 4*Y526 + 3*Y626 + 6*Y726 + 7*Y826 + 4*Y926 + 4*Y1026 + 11*Y1126 + 5*Y1226 +
12*Y1326 + 3*Y1426 + 3*Y1526 + 10*Y1626 + 2*Y1726 + 7*Y1826 + 5*Y1926 +
12*Y2026 + 7*Y2126 + 5*Y2226 + 2*Y2326 + 25*Y2426 + 9*Y2526 + 5*Y2626 + 2*Y2726 + 5*Y2826 + 6*Y2926 - 5*X26
<=0;

820931*Y126 + 147596*Y226 + 86404*Y326 + 584300*Y426 + 238265*Y526 + 147473*Y626 + 420908*Y726 +
239046*Y826 + 171183*Y926 + 86967*Y1026 + 142521*Y1126 + 1372680*Y1226 +
+ 119500*Y1326 + 247573*Y1426 + 93157*Y1526 + 1994765*Y1626 + 29538*Y1726 + 226845*Y1826 + 117310*Y1926 +
+ 955890*Y2026 + 3333230*Y2126 + 2349633*Y2226 + 139434*Y2326 +
+ 2090879*Y2426 + 755723*Y2526 + 374615*Y2626 + 224382*Y2726 + 194903*Y2826 + 173934*Y2926 -374615*X26
<=0;

229*Y126 + 354*Y226 + 115*Y326 + 5827*Y426 + 4776*Y526 + 152*Y626 + 661*Y726 + 1019*Y826 + 278*Y926 +
60*Y1026 + 2155*Y1126 + 908*Y1226 + 2593*Y1326 + 272*Y1426 + 64*Y1526 +
1053*Y1626 + 137*Y1726 + 138*Y1826 + 523*Y1926 + 1222*Y2026 + 1674*Y2126 + 554*Y2226 + 197*Y2326 + 5794*Y2426 +
+ 1505*Y2526 + 1347*Y2626 + 310*Y2726 + 259*Y2826 + 277*Y2926 >= 1347;

3*Y126 + 3*Y226 + 3*Y326 + 3*Y426 + 3*Y526 + 3*Y626 + 3*Y726 + 3*Y826 + 3*Y926 + 3*Y1026 + 3*Y1126 + 3*Y1226 +
+ 3*Y1326 + 3*Y1426 + 3*Y1526 + 3*Y1626 + 3*Y1726 + 3*Y1826 +
+ 3*Y1926 + 3*Y2026 + 3*Y2126 + 3*Y2226 + 3*Y2326 + 3*Y2426 + 3*Y2526 + 3*Y2626 + 3*Y2726 + 3*Y2826 + 3*Y2926
>= 3;

4*Y126 + 3*Y226 + 1*Y326 + 4*Y426 + 3*Y526 + 1*Y626 + 3*Y726 + 4*Y826 + 2*Y926 + 1*Y1026 + 4*Y1126 + 2*Y1226 +
+ 4*Y1326 + 3*Y1426 + 2*Y1526 + 4*Y1626 + 1*Y1726 + 2*Y1826 +
+ 3*Y1926 + 4*Y2026 + 3*Y2126 + 3*Y2226 + 2*Y2326 + 4*Y2426 + 3*Y2526 + 4*Y2626 + 2*Y2726 + 3*Y2826 + 3*Y2926
>= 4;

@Free(X26);
Y126 >=0; Y226 >=0; Y326 >=0; Y426 >=0; Y526 >=0; Y626 >=0; Y726 >=0; Y826 >=0; Y926 >=0; Y1026 >=0; Y1126
>=0; Y1226 >=0; Y1326 >=0; Y1426 >=0; Y1526 >=0; Y1626 >=0; Y1726 >=0; Y1826 >=0; Y1926 >=0; Y2026 >=0; Y2126
>=0; Y2226 >=0; Y2326 >=0; Y2426 >=0; Y2526 >=0; Y2626 >=0;
Y2726 >=0; Y2826 >=0; Y2926 >=0;

```

## Solutions of Dual Problem Formulation

Global optimal solution found.		
Objective value:	0.9322630	
Infeasibilities:	0.000000	
Total solver iterations:	12	
Variable Value Reduced Cost		
X26	0.9322630	-0.5551115E-16
Y126	0.000000	13.81292
Y226	0.4512042	0.5551115E-16
Y326	0.000000	0.2217430
Y426	0.000000	1.601805
Y526	0.1802560	-0.5551115E-15
Y626	0.000000	0.2187874
Y726	0.000000	0.1520888
Y826	0.000000	0.8157201
Y926	0.000000	0.2122374
Y1026	0.000000	1.223740
Y1126	0.000000	11.09929
Y1226	0.000000	0.8683601
Y1326	0.000000	9.651410
Y1426	0.000000	0.6550044E-02
Y1526	0.000000	0.1965013E-01
Y1626	0.000000	14.14873
Y1726	0.000000	0.2199856
Y1826	0.000000	2.296030
Y1926	0.000000	0.5163352

Y2026	0.000000	10.11415
Y2126	0.000000	0.6010065
Y2226	0.000000	0.5138589
Y2326	0.000000	0.2187076
Y2426	0.000000	30.25481
Y2526	0.000000	9.238038
Y2626	0.000000	0.6773704E-01
Y2726	1.052810	0.5551115E-16
Y2826	0.000000	1.810848
Y2926	0.000000	0.8561387

## SUMMARY

Efficiency score of Warehouse 26 (Pune) = 0.932263

Warehouse 26 (Pune) is not an efficient or inefficient warehouse.

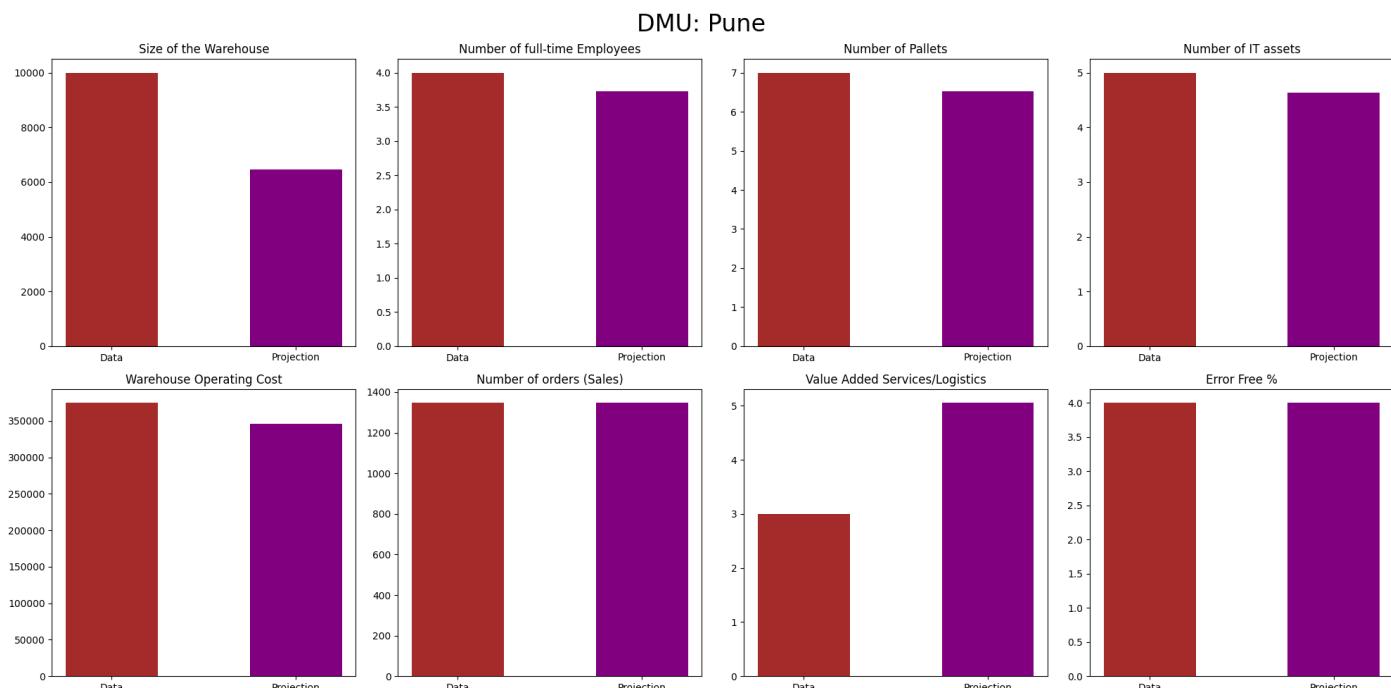
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	10000	6465.57	2857.06
No. of Full-time Employees	4	3.72905	0
No. of Pallets	7	6.52584	0
No. of IT assets	5	4.63146	0.03
Warehouse Operating Cost	374615	345776	3463.51
No. of Orders (Sales)	1347	1347	0
Level of Value-Added Services	3	5.05281	2.053
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 2 (Ahmedabad)	0.4512042
Warehouse 5 (Bhiwandi)	0.180256
Warehouse 27 (Raipur)	1.05281

In order to make warehouse 8 (Chennai) efficient, they need to decrease size of the warehouse by 35.344%, No of full-time employees by 6.774%, number of pallets by 6.774%, IT Assets by 7.371% ,operating cost by 7.698%, whereas value-added logistics needs to be increased by 68.427%.



## WAREHOUSE 27 (RAIPUR)

### Primal Problem Formulation

```

!Objective Function;

MAX = 310*VF27 + 3*VG27 + 2*VH27;

!Subject to;

4000*UA27 + 2*UB27 + 2*UC27 + 224382*UE27 = 1;
(229*VF27 + 3*VG27 + 4*VH27) - (13100*UA27 + 7*UB27 + 320*UC27 + 9*UD27 + 820931*UE27) <=0;
(354*VF27 + 3*VG27 + 3*VH27) - (2000*UA27 + 2*UB27 + 7*UC27 + 4*UD27 + 147596*UE27) <=0;
(115*VF27 + 3*VG27 + 1*VH27) - (550*UA27 + 2*UB27 + 2*UC27 + 2*UD27 + 86404*UE27) <=0;
(5827*VF27 + 3*VG27 + 4*VH27) - (9800*UA27 + 14*UB27 + 10*UC27 + 9*UD27 + 584300*UE27) <=0;
(4776*VF27 + 3*VG27 + 3*VH27) - (7500*UA27 + 4*UB27 + 7*UC27 + 4*UD27 + 238265*UE27) <=0;
(152*VF27 + 3*VG27 + 1*VH27) - (550*UA27 + 2*UB27 + 2*UC27 + 3*UD27 + 147473*UE27) <=0;
(661*VF27 + 3*VG27 + 3*VH27) - (4800*UA27 + 3*UB27 + 7*UC27 + 6*UD27 + 420908*UE27) <=0;
(1019*VF27 + 3*VG27 + 4*VH27) - (10250*UA27 + 5*UB27 + 20*UC27 + 7*UD27 + 239046*UE27) <=0;
(278*VF27 + 3*VG27 + 2*VH27) - (2300*UA27 + 2*UB27 + 7*UC27 + 4*UD27 + 171183*UE27) <=0;
(60*VF27 + 3*VG27 + 1*VH27) - (1000*UA27 + 1*UB27 + 30*UC27 + 4*UD27 + 86967*UE27) <=0;
(2155*VF27 + 3*VG27 + 4*VH27) - (20700*UA27 + 21*UB27 + 200*UC27 + 11*UD27 + 142521*UE27) <=0;
(908*VF27 + 3*VG27 + 2*VH27) - (1200*UA27 + 6*UB27 + 7*UC27 + 5*UD27 + 1372680*UE27) <=0;
(2593*VF27 + 3*VG27 + 4*VH27) - (11000*UA27 + 13*UB27 + 200*UC27 + 12*UD27 + 119500*UE27) <=0;
(272*VF27 + 3*VG27 + 3*VH27) - (4100*UA27 + 2*UB27 + 7*UC27 + 3*UD27 + 247573*UE27) <=0;
(64*VF27 + 3*VG27 + 2*VH27) - (2000*UA27 + 2*UB27 + 2*UC27 + 3*UD27 + 93157*UE27) <=0;
(1053*VF27 + 3*VG27 + 4*VH27) - (21000*UA27 + 5*UB27 + 338*UC27 + 10*UD27 + 1994765*UE27) <=0;
(137*VF27 + 3*VG27 + 1*VH27) - (500*UA27 + 2*UB27 + 2*UC27 + 2*UD27 + 29538*UE27) <=0;
(138*VF27 + 3*VG27 + 2*VH27) - (2152*UA27 + 4*UB27 + 48*UC27 + 7*UD27 + 226845*UE27) <=0;
(523*VF27 + 3*VG27 + 3*VH27) - (9700*UA27 + 5*UB27 + 7*UC27 + 5*UD27 + 117310*UE27) <=0;
(1222*VF27 + 3*VG27 + 4*VH27) - (15000*UA27 + 15*UB27 + 200*UC27 + 12*UD27 + 955890*UE27) <=0;
(1674*VF27 + 3*VG27 + 3*VH27) - (9000*UA27 + 6*UB27 + 7*UC27 + 7*UD27 + 3333230*UE27) <=0;
(554*VF27 + 3*VG27 + 3*VH27) - (4600*UA27 + 5*UB27 + 7*UC27 + 5*UD27 + 2349633*UE27) <=0;
(197*VF27 + 3*VG27 + 2*VH27) - (2000*UA27 + 2*UB27 + 7*UC27 + 2*UD27 + 139434*UE27) <=0;
(5794*VF27 + 3*VG27 + 4*VH27) - (37324*UA27 + 48*UB27 + 550*UC27 + 25*UD27 + 2090879*UE27) <=0;
(1505*VF27 + 3*VG27 + 3*VH27) - (11000*UA27 + 9*UB27 + 200*UC27 + 9*UD27 + 755723*UE27) <=0;
(1347*VF27 + 3*VG27 + 4*VH27) - (10000*UA27 + 4*UB27 + 7*UC27 + 5*UD27 + 374615*UE27) <=0;
(310*VF27 + 3*VG27 + 2*VH27) - (4000*UA27 + 2*UB27 + 2*UC27 + 2*UD27 + 224382*UE27) <=0;
(259*VF27 + 3*VG27 + 3*VH27) - (5500*UA27 + 2*UB27 + 50*UC27 + 5*UD27 + 194903*UE27) <=0;
(277*VF27 + 3*VG27 + 3*VH27) - (2000*UA27 + 8*UB27 + 2*UC27 + 6*UD27 + 173934*UE27) <=0;

UA27 >=0;
UB27 >=0;
UC27 >=0;
UD27 >=0;
UE27 >=0;
VF27 >=0;
VG27 >=0;
VH27 >=0;

```

### Solutions/Weights of Primal Problem

Variable	Value	Reduced Cost
VF27	0.1512402E-03	0.000000
VG27	0.5142166E-01	0.000000
VH27	0.3994253	0.000000
UA27	0.2757823E-04	0.000000
UB27	0.419895	0.000000
UC27	0.2494821E-01	0.000000
UD27	0.000000	0.000000
UE27	0.000000	0.000000

### Dual Problem Formulation

```

!Dual Objective Function;

MIN = X27;

!Subject to;
13100*Y127 + 2000*Y227 + 550*Y327 + 9800*Y427 + 7500*Y527 + 550*Y627 + 4800*Y727 + 10250*Y827 + 2300*Y927 +
1000*Y1027 + 20700*Y1127 + 1200*Y1227 + 11000*Y1327 + 4100*Y1427 + 2000*Y1527 +
21000*Y1627 + 500*Y1727 + 2152*Y1827 + 9700*Y1927 + 15000*Y2027 + 9000*Y2127 + 4600*Y2227 + 2000*Y2327 +
37324*Y2427 + 11000*Y2527 + 10000*Y2627 + 4000*Y2727 + 5500*Y2827 + 2000*Y2927
-4000*X27 <=0;

7*Y127 + 2*Y227 + 2*Y327 + 14*Y427 + 4*Y527 + 2*Y627 + 3*Y727 + 5*Y827 + 2*Y927 + 1*Y1027 + 21*Y1127 +
6*Y1227 + 13*Y1327 + 2*Y1427 + 2*Y1527 + 5*Y1627 + 2*Y1727 + 4*Y1827 + 5*Y1927 + 15*Y2027 + 6*Y2127 + 5*Y2227 +
2*Y2327 + 48*Y2427 + 9*Y2527 + 4*Y2627 + 2*Y2727 + 2*Y2827 + 8*Y2927 -2*X27 <=0;

320*Y127 + 7*Y227 + 2*Y327 + 10*Y427 + 7*Y527 + 2*Y627 + 7*Y727 + 20*Y827 + 7*Y927 + 30*Y1027 + 200*Y1127 +
7*Y1227 + 200*Y1327 + 7*Y1427 + 2*Y1527 + 338*Y1627 + 2*Y1727 + 48*Y1827 +
7*Y1927 + 200*Y2027 + 7*Y2127 + 7*Y2227 + 7*Y2327 + 550*Y2427 + 200*Y2527 + 7*Y2627 + 2*Y2727 + 50*Y2827 +
2*Y2927 - 2*X27 <=0;

9*Y127 + 4*Y227 + 2*Y327 + 9*Y427 + 4*Y527 + 3*Y627 + 6*Y727 + 7*Y827 + 4*Y927 + 4*Y1027 + 11*Y1127 + 5*Y1227 +
12*Y1327 + 3*Y1427 + 3*Y1527 + 10*Y1627 + 2*Y1727 + 7*Y1827 + 5*Y1927 +
12*Y2027 + 7*Y2127 + 5*Y2227 + 2*Y2327 + 25*Y2427 + 9*Y2527 + 5*Y2627 + 2*Y2727 + 5*Y2827 + 6*Y2927 - 2*X27
<=0;

820931*Y127 + 147596*Y227 + 86404*Y327 + 584300*Y427 + 238265*Y527 + 147473*Y627 + 420908*Y727 +
239046*Y827 + 171183*Y927 + 86967*Y1027 + 142521*Y1127 + 1372680*Y1227 +
119500*Y1327 + 247573*Y1427 + 93157*Y1527 + 1994765*Y1627 + 29538*Y1727 + 226845*Y1827 + 117310*Y1927 +
95890*Y2027 + 3333230*Y2127 + 2349633*Y2227 + 139434*Y2327 +
2090879*Y2427 + 755723*Y2527 + 374615*Y2627 + 224382*Y2727 + 194903*Y2827 + 173934*Y2927 - 224382*X27
<=0;

229*Y127 + 354*Y227 + 115*Y327 + 5827*Y427 + 4776*Y527 + 152*Y627 + 661*Y727 + 1019*Y827 + 278*Y927 +
60*Y1027 + 2155*Y1127 + 908*Y1227 + 2593*Y1327 + 272*Y1427 + 64*Y1527 +
1053*Y1627 + 137*Y1727 + 138*Y1827 + 523*Y1927 + 1222*Y2027 + 1674*Y2127 + 554*Y2227 + 197*Y2327 + 5794*Y2427 +
1505*Y2527 + 1347*Y2627 + 310*Y2727 + 259*Y2827 + 277*Y2927 >= 310;

3*Y127 + 3*Y227 + 3*Y327 + 3*Y427 + 3*Y527 + 3*Y627 + 3*Y727 + 3*Y827 + 3*Y927 + 3*Y1027 + 3*Y1127 + 3*Y1227 +
3*Y1327 + 3*Y1427 + 3*Y1527 + 3*Y1627 + 3*Y1727 + 3*Y1827 +
3*Y1927 + 3*Y2027 + 3*Y2127 + 3*Y2227 + 3*Y2327 + 3*Y2427 + 3*Y2527 + 3*Y2627 + 3*Y2727 + 3*Y2827 + 3*Y2927
>= 3;

4*Y127 + 3*Y227 + 1*Y327 + 4*Y427 + 3*Y527 + 1*Y627 + 3*Y727 + 4*Y827 + 2*Y927 + 1*Y1027 + 4*Y1127 + 2*Y1227 +
4*Y1327 + 3*Y1427 + 2*Y1527 + 4*Y1627 + 1*Y1727 + 2*Y1827 +
3*Y1927 + 4*Y2027 + 3*Y2127 + 3*Y2227 + 2*Y2327 + 4*Y2427 + 3*Y2527 + 4*Y2627 + 2*Y2727 + 3*Y2827 + 3*Y2927
>= 2;

@Free(X27);
Y127 >=0; Y227 >=0; Y327 >=0; Y427 >=0; Y527 >=0; Y627 >=0; Y727 >=0; Y827 >=0; Y927 >=0; Y1027 >=0; Y1127
>=0; Y1227 >=0; Y1327 >=0; Y1427 >=0; Y1527 >=0; Y1627 >=0; Y1727 >=0; Y1827 >=0; Y1927 >=0; Y2027 >=0; Y2127
>=0; Y2227 >=0; Y2327 >=0; Y2427 >=0; Y2527 >=0; Y2627 >=0; Y2727 >=0; Y2827 >=0; Y2927 >=0;

```

## Solutions of Dual Problem

Global optimal solution found.			
Objective value:	1.000000	Infeasibilities:	0.4547474E-12
Total solver iterations:	6		
Variable	Value	Reduced Cost	
X27	1.000000	0.000000	
Y127	0.000000	3.500000	
Y227	0.000000	1.000000	
Y327	0.000000	0.1085388E-15	
Y427	0.000000	3.500000	
Y527	0.000000	1.000000	
Y627	0.000000	0.500000	
Y727	0.000000	2.000000	
Y827	0.000000	2.500000	
Y927	0.000000	1.000000	
Y1027	0.000000	1.000000	
Y1127	0.000000	4.500000	
Y1227	0.000000	1.500000	

Y1327	0.000000	5.000000
Y1427	0.000000	0.500000
Y1527	0.000000	0.500000
Y1627	0.000000	4.000000
Y1727	0.000000	0.000000
Y1827	0.000000	2.500000
Y1927	0.000000	1.500000
Y2027	0.000000	5.000000
Y2127	0.000000	2.500000
Y2227	0.000000	1.500000
Y2327	0.000000	0.2124867E-16
Y2427	0.000000	11.50000
Y2527	0.000000	3.500000
Y2627	0.000000	1.500000
Y2727	1.000000	0.2220446E-15
Y2827	0.000000	1.500000
Y2927	0.000000	2.000000

## SUMMARY

Efficiency score of Warehouse 27 (Raipur) = 1

Warehouse 27 (Raipur) is an efficient warehouse.

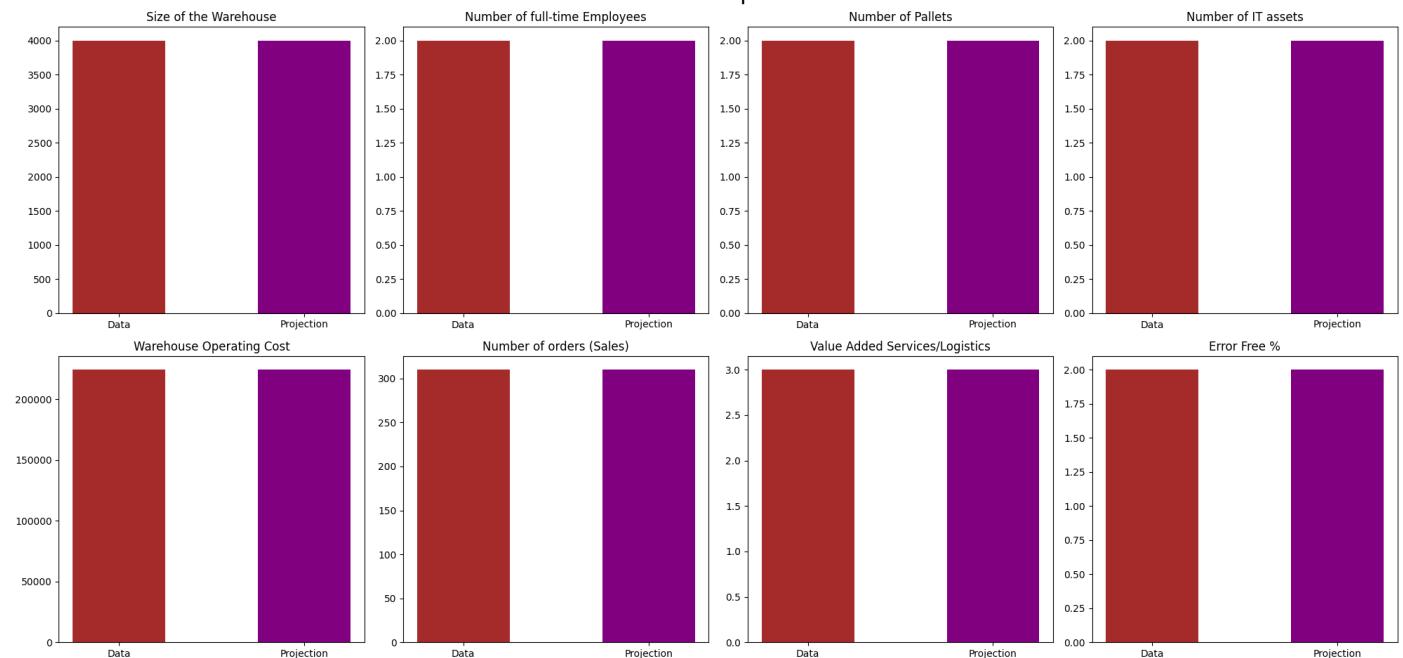
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	4000	4000	0
No. of Full-time Employees	2	2	0
No. of Pallets	2	2	0
No. of IT assets	2	2	0
Warehouse Operating Cost	224382	224382	0
No. of Orders (Sales)	310	310	0
Level of Value-Added Services	3	3	0
Error Free (%)	2	2	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 27 (Raipur)	1

DMU: Raipur



## WAREHOUSE 28 (RANCHI)

### Primal Problem Formulation

```

!Objective Function;

MAX = 259*VF28 + 3*VG28 + 3*VH28;

!Subject to;

5500*UA28 + 2*UB28 + 50*UC28 + 5*UD28 + 194903*UE28 = 1;
(229*VF28 + 3*VG28 + 4*VH28) - (13100*UA28 + 7*UB28 + 320*UC28 + 9*UD28 + 820931*UE28) <=0;
(354*VF28 + 3*VG28 + 3*VH28) - (2000*UA28 + 2*UB28 + 7*UC28 + 4*UD28 + 147596*UE28) <=0;
(115*VF28 + 3*VG28 + 1*VH28) - (550*UA28 + 2*UB28 + 2*UC28 + 2*UD28 + 86404*UE28) <=0;
(5827*VF28 + 3*VG28 + 4*VH28) - (9800*UA28 + 14*UB28 + 10*UC28 + 9*UD28 + 584300*UE28) <=0;
(4776*VF28 + 3*VG28 + 3*VH28) - (7500*UA28 + 4*UB28 + 7*UC28 + 4*UD28 + 238265*UE28) <=0;
(152*VF28 + 3*VG28 + 1*VH28) - (550*UA28 + 2*UB28 + 2*UC28 + 3*UD28 + 147473*UE28) <=0;
(661*VF28 + 3*VG28 + 3*VH28) - (4800*UA28 + 3*UB28 + 7*UC28 + 6*UD28 + 420908*UE28) <=0;
(1019*VF28 + 3*VG28 + 4*VH28) - (10250*UA28 + 5*UB28 + 20*UC28 + 7*UD28 + 239046*UE28) <=0;
(278*VF28 + 3*VG28 + 2*VH28) - (2300*UA28 + 2*UB28 + 7*UC28 + 4*UD28 + 171183*UE28) <=0;
(60*VF28 + 3*VG28 + 1*VH28) - (1000*UA28 + 1*UB28 + 30*UC28 + 4*UD28 + 86967*UE28) <=0;
(2155*VF28 + 3*VG28 + 4*VH28) - (20700*UA28 + 21*UB28 + 200*UC28 + 11*UD28 + 142521*UE28) <=0;
(908*VF28 + 3*VG28 + 2*VH28) - (1200*UA28 + 6*UB28 + 7*UC28 + 5*UD28 + 1372680*UE28) <=0;
(2593*VF28 + 3*VG28 + 4*VH28) - (11000*UA28 + 13*UB28 + 200*UC28 + 12*UD28 + 119500*UE28) <=0;
(272*VF28 + 3*VG28 + 3*VH28) - (4100*UA28 + 2*UB28 + 7*UC28 + 3*UD28 + 247573*UE28) <=0;
(64*VF28 + 3*VG28 + 2*VH28) - (2000*UA28 + 2*UB28 + 2*UC28 + 3*UD28 + 93157*UE28) <=0;
(1053*VF28 + 3*VG28 + 4*VH28) - (21000*UA28 + 5*UB28 + 338*UC28 + 10*UD28 + 1994765*UE28) <=0;
(137*VF28 + 3*VG28 + 1*VH28) - (500*UA28 + 2*UB28 + 2*UC28 + 2*UD28 + 29538*UE28) <=0;
(138*VF28 + 3*VG28 + 2*VH28) - (2152*UA28 + 4*UB28 + 48*UC28 + 7*UD28 + 226845*UE28) <=0;
(523*VF28 + 3*VG28 + 3*VH28) - (9700*UA28 + 5*UB28 + 7*UC28 + 5*UD28 + 11730*UE28) <=0;
(1222*VF28 + 3*VG28 + 4*VH28) - (15000*UA28 + 15*UB28 + 200*UC28 + 12*UD28 + 955890*UE28) <=0;
(1674*VF28 + 3*VG28 + 3*VH28) - (9000*UA28 + 6*UB28 + 7*UC28 + 7*UD28 + 3333230*UE28) <=0;
(554*VF28 + 3*VG28 + 3*VH28) - (4600*UA28 + 5*UB28 + 7*UC28 + 5*UD28 + 2349633*UE28) <=0;
(197*VF28 + 3*VG28 + 2*VH28) - (2000*UA28 + 2*UB28 + 7*UC28 + 2*UD28 + 139434*UE28) <=0;
(5794*VF28 + 3*VG28 + 4*VH28) - (37324*UA28 + 48*UB28 + 550*UC28 + 25*UD28 + 2090879*UE28) <=0;
(1505*VF28 + 3*VG28 + 3*VH28) - (11000*UA28 + 9*UB28 + 200*UC28 + 9*UD28 + 755723*UE28) <=0;
(1347*VF28 + 3*VG28 + 4*VH28) - (10000*UA28 + 4*UB28 + 7*UC28 + 5*UD28 + 374615*UE28) <=0;
(310*VF28 + 3*VG28 + 2*VH28) - (4000*UA28 + 2*UB28 + 2*UC28 + 2*UD28 + 224382*UE28) <=0;
(259*VF28 + 3*VG28 + 3*VH28) - (5500*UA28 + 2*UB28 + 50*UC28 + 5*UD28 + 194903*UE28) <=0;
(277*VF28 + 3*VG28 + 3*VH28) - (2000*UA28 + 8*UB28 + 2*UC28 + 6*UD28 + 173934*UE28) <=0;

UA28 >=0;
UB28 >=0;
UC28 >=0;
UD28 >=0;
UE28 >=0;
VF28 >=0;
VG28 >=0;
VH28 >=0;

```

### Solutions/Weights of Primal Problem

Variable	Value	Reduced Cost
VF28	0.000000	95.000000
VG28	0.8333333E-01	0.000000
VH28	0.2500000	0.000000
UA28	0.000000	3500.000
UB28	0.5000000	0.000000
UC28	0.000000	43.000000
UD28	0.000000	1.000000
UE28	0.000000	47307.00

### Dual Problem Formulation

```

!Dual Objective Function;

MIN = X28;

!Subject to;
13100*Y128 + 2000*Y228 + 550*Y328 + 9800*Y428 + 7500*Y528 + 550*Y628 + 4800*Y728 + 10250*Y828 + 2300*Y928 +
1000*Y1028 + 20700*Y1128 + 1200*Y1228 + 11000*Y1328 + 4100*Y1428 + 2000*Y1528 +
21000*Y1628 + 500*Y1728 + 2152*Y1828 + 9700*Y1928 + 15000*Y2028 + 9000*Y2128 + 4600*Y2228 + 2000*Y2328 +
37324*Y2428 + 11000*Y2528 + 10000*Y2628 + 4000*Y2728 + 5500*Y2828 + 2000*Y2928
-5500*X28 <=0;

7*Y128 + 2*Y228 + 2*Y328 + 14*Y428 + 4*Y528 + 2*Y628 + 3*Y728 + 5*Y828 + 2*Y928 + 1*Y1028 + 21*Y1128 +
6*Y1228 + 13*Y1328 + 2*Y1428 + 2*Y1528 + 5*Y1628 + 2*Y1728 + 4*Y1828 + 5*Y1928 + 15*Y2028 + 6*Y2128 + 5*Y2228
+ 2*Y2328 + 48*Y2428 + 9*Y2528 + 4*Y2628 + 2*Y2728 + 2*Y2828 + 8*Y2928 - 2*X28 <=0;

320*Y128 + 7*Y228 + 2*Y328 + 10*Y428 + 7*Y528 + 2*Y628 + 7*Y728 + 20*Y828 + 7*Y928 + 30*Y1028 + 200*Y1128 +
7*Y1228 + 200*Y1328 + 7*Y1428 + 2*Y1528 + 338*Y1628 + 2*Y1728 + 48*Y1828 +
7*Y1928 + 200*Y2028 + 7*Y2128 + 7*Y2228 + 7*Y2328 + 550*Y2428 + 200*Y2528 + 7*Y2628 + 2*Y2728 + 50*Y2828 +
2*Y2928 - 50*X28 <=0;

9*Y128 + 4*Y228 + 2*Y328 + 9*Y428 + 4*Y528 + 3*Y628 + 6*Y728 + 7*Y828 + 4*Y928 + 4*Y1028 + 11*Y1128 + 5*Y1228
+ 12*Y1328 + 3*Y1428 + 3*Y1528 + 10*Y1628 + 2*Y1728 + 7*Y1828 + 5*Y1928 +
12*Y2028 + 7*Y2128 + 5*Y2228 + 2*Y2328 + 25*Y2428 + 9*Y2528 + 5*Y2628 + 2*Y2728 + 5*Y2828 + 6*Y2928 - 5*X28
<=0;

820931*Y128 + 147596*Y228 + 86404*Y328 + 584300*Y428 + 238265*Y528 + 147473*Y628 + 420908*Y728 +
239046*Y828 + 171183*Y928 + 86967*Y1028 + 142521*Y1128 + 1372680*Y1228
+ 119500*Y1328 + 247573*Y1428 + 93157*Y1528 + 1994765*Y1628 + 29538*Y1728 + 226845*Y1828 + 117310*Y1928
+ 955890*Y2028 + 3333230*Y2128 + 2349633*Y2228 + 139434*Y2328
+ 2090879*Y2428 + 755723*Y2528 + 374615*Y2628 + 224382*Y2728 + 194903*Y2828 + 173934*Y2928 - 194903*X28
<=0;

229*Y128 + 354*Y228 + 115*Y328 + 5827*Y428 + 4776*Y528 + 152*Y628 + 661*Y728 + 1019*Y828 + 278*Y928 +
60*Y1028 + 2155*Y1128 + 908*Y1228 + 2593*Y1328 + 272*Y1428 + 64*Y1528 +
1053*Y1628 + 137*Y1728 + 138*Y1828 + 523*Y1928 + 1222*Y2028 + 1674*Y2128 + 554*Y2228 + 197*Y2328 + 5794*Y2428
+ 1505*Y2528 + 1347*Y2628 + 310*Y2728 + 259*Y2828 + 277*Y2928 >= 259;

3*Y128 + 3*Y228 + 3*Y328 + 3*Y428 + 3*Y528 + 3*Y628 + 3*Y728 + 3*Y828 + 3*Y928 + 3*Y1028 + 3*Y1128 + 3*Y1228
+ 3*Y1328 + 3*Y1428 + 3*Y1528 + 3*Y1628 + 3*Y1728 + 3*Y1828
+ 3*Y1928 + 3*Y2028 + 3*Y2128 + 3*Y2228 + 3*Y2328 + 3*Y2428 + 3*Y2528 + 3*Y2628 + 3*Y2728 + 3*Y2828 + 3*Y2928
>= 3;

4*Y128 + 3*Y228 + 1*Y328 + 4*Y428 + 3*Y528 + 1*Y628 + 3*Y728 + 4*Y828 + 2*Y928 + 1*Y1028 + 4*Y1128 + 2*Y1228
+ 4*Y1328 + 3*Y1428 + 2*Y1528 + 4*Y1628 + 1*Y1728 + 2*Y1828
+ 3*Y1928 + 4*Y2028 + 3*Y2128 + 3*Y2228 + 2*Y2328 + 4*Y2428 + 3*Y2528 + 4*Y2628 + 2*Y2728 + 3*Y2828 + 3*Y2928
>= 3;

@Free(X28);
Y128 >=0; Y228 >=0; Y328 >=0; Y428 >=0; Y528 >=0; Y628 >=0; Y728 >=0; Y828 >=0; Y928 >=0; Y1028 >=0; Y1128
>=0; Y1228 >=0; Y1328 >=0; Y1428 >=0; Y1528 >=0; Y1628 >=0; Y1728 >=0; Y1828 >=0; Y1928 >=0; Y2028 >=0; Y2128
>=0; Y2228 >=0; Y2328 >=0; Y2428 >=0; Y2528 >=0; Y2628 >=0; Y2728 >=0; Y2828 >=0; Y2928 >=0;

```

## Solutions/Weights of Dual Problem

Variable	Value	Reduced Cost
X28	1.000000	0.000000
Y128	0.000000	2.166667
Y228	0.000000	0.000000
Y328	0.000000	0.6666667
Y428	0.000000	5.666667
Y528	0.000000	1.000000
Y628	0.000000	0.6666667
Y728	0.000000	0.5000000
Y828	0.000000	1.166667
Y928	0.000000	0.3333333
Y1028	0.000000	0.1666667
Y1128	0.000000	9.166667
Y1228	0.000000	2.333333

Y1328	0.000000	5.166667
Y1428	0.000000	0.000000
Y1528	0.000000	0.3333333
Y1628	0.000000	1.166667
Y1728	0.000000	0.6666667
Y1828	0.000000	1.333333
Y1928	0.000000	1.500000
Y2028	0.000000	6.166667
Y2128	0.000000	2.000000
Y2228	0.000000	1.500000
Y2328	0.000000	0.3333333
Y2428	0.000000	22.66667
Y2528	0.000000	3.500000
Y2628	0.000000	0.6666667
Y2728	0.000000	0.3333333
Y2828	1.000000	0.000000
Y2928	0.000000	3.000000

## SUMMARY

Efficiency score of Warehouse 28 (Ranchi) = 1

Warehouse 28 (Ranchi) is an efficient warehouse.

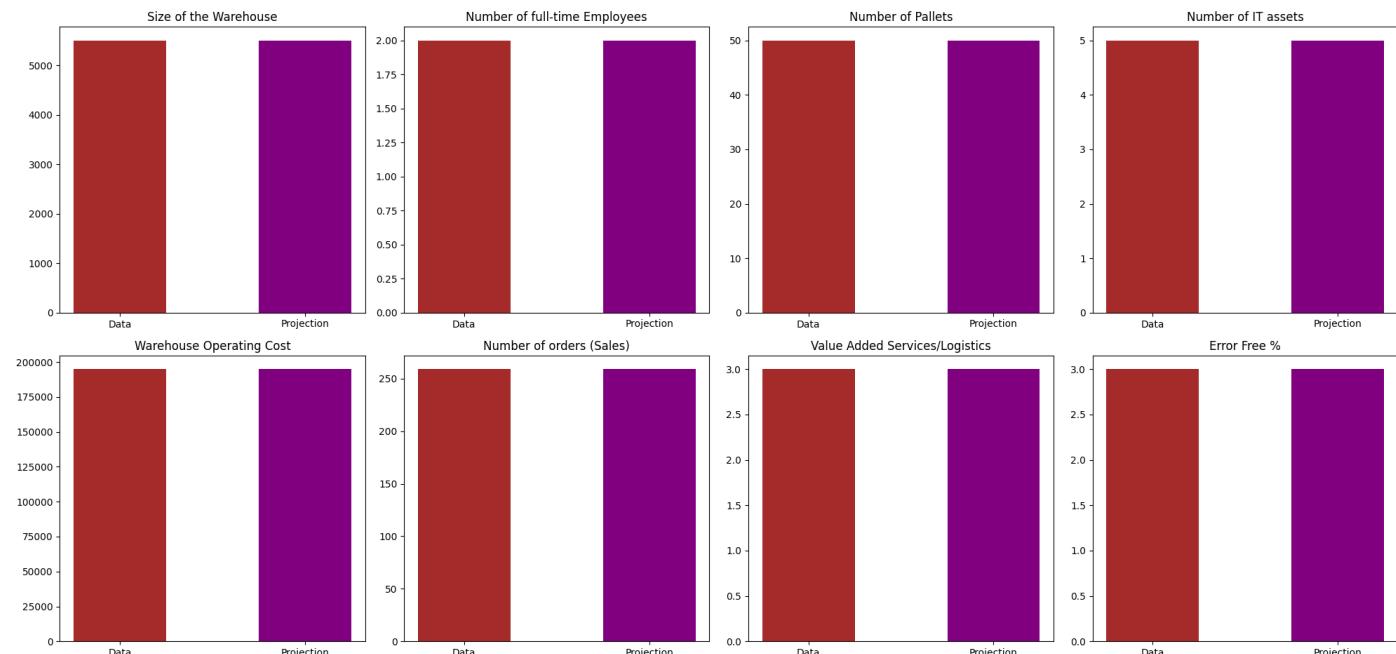
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	5500	5500	0
No. of Full-time Employees	2	2	0
No. of Pallets	50	50	0
No. of IT assets	5	5	0
Warehouse Operating Cost	194903	194903	0
No. of Orders (Sales)	259	259	0
Level of Value-Added Services	3	3	0
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 28 (Ranchi)	1

DMU: Ranchi



## WAREHOUSE 29 (VARANASI)

### Primal Problem Formulation

```

!Objective Function;

MAX = 277*VF29 + 3*VG29 + 3*VH29;

!Subject to;

2000*UA29 + 8*UB29 + 2*UC29 + 6*UD29 + 173934*UE29 = 1;
(229*VF29 + 3*VG29 + 4*VH29) - (13100*UA29 + 7*UB29 + 320*UC29 + 9*UD29 + 820931*UE29) <=0;
(354*VF29 + 3*VG29 + 3*VH29) - (2000*UA29 + 2*UB29 + 7*UC29 + 4*UD29 + 147596*UE29) <=0;
(115*VF29 + 3*VG29 + 1*VH29) - (550*UA29 + 2*UB29 + 2*UC29 + 2*UD29 + 86404*UE29) <=0;
(5827*VF29 + 3*VG29 + 4*VH29) - (9800*UA29 + 14*UB29 + 10*UC29 + 9*UD29 + 584300*UE29) <=0;
(4776*VF29 + 3*VG29 + 3*VH29) - (7500*UA29 + 4*UB29 + 7*UC29 + 4*UD29 + 238265*UE29) <=0;
(152*VF29 + 3*VG29 + 1*VH29) - (550*UA29 + 2*UB29 + 2*UC29 + 3*UD29 + 147473*UE29) <=0;
(661*VF29 + 3*VG29 + 3*VH29) - (4800*UA29 + 3*UB29 + 7*UC29 + 6*UD29 + 420908*UE29) <=0;
(1019*VF29 + 3*VG29 + 4*VH29) - (10250*UA29 + 5*UB29 + 20*UC29 + 7*UD29 + 239046*UE29) <=0;
(278*VF29 + 3*VG29 + 2*VH29) - (2300*UA29 + 2*UB29 + 7*UC29 + 4*UD29 + 171183*UE29) <=0;
(60*VF29 + 3*VG29 + 1*VH29) - (1000*UA29 + 1*UB29 + 30*UC29 + 4*UD29 + 86967*UE29) <=0;
(2155*VF29 + 3*VG29 + 4*VH29) - (20700*UA29 + 21*UB29 + 200*UC29 + 11*UD29 + 142521*UE29) <=0;
(908*VF29 + 3*VG29 + 2*VH29) - (1200*UA29 + 6*UB29 + 7*UC29 + 5*UD29 + 1372680*UE29) <=0;
(2593*VF29 + 3*VG29 + 4*VH29) - (11000*UA29 + 13*UB29 + 200*UC29 + 12*UD29 + 119500*UE29) <=0;
(272*VF29 + 3*VG29 + 3*VH29) - (4100*UA29 + 2*UB29 + 7*UC29 + 3*UD29 + 247573*UE29) <=0;
(64*VF29 + 3*VG29 + 2*VH29) - (2000*UA29 + 2*UB29 + 2*UC29 + 3*UD29 + 93157*UE29) <=0;
(1053*VF29 + 3*VG29 + 4*VH29) - (21000*UA29 + 5*UB29 + 338*UC29 + 10*UD29 + 1994765*UE29) <=0;
(137*VF29 + 3*VG29 + 1*VH29) - (500*UA29 + 2*UB29 + 2*UC29 + 2*UD29 + 29538*UE29) <=0;
(138*VF29 + 3*VG29 + 2*VH29) - (2152*UA29 + 4*UB29 + 48*UC29 + 7*UD29 + 226845*UE29) <=0;
(523*VF29 + 3*VG29 + 3*VH29) - (9700*UA29 + 5*UB29 + 7*UC29 + 5*UD29 + 117310*UE29) <=0;
(1222*VF29 + 3*VG29 + 4*VH29) - (15000*UA29 + 15*UB29 + 200*UC29 + 12*UD29 + 955890*UE29) <=0;
(1674*VF29 + 3*VG29 + 3*VH29) - (9000*UA29 + 6*UB29 + 7*UC29 + 7*UD29 + 3333230*UE29) <=0;
(554*VF29 + 3*VG29 + 3*VH29) - (4600*UA29 + 5*UB29 + 7*UC29 + 5*UD29 + 2349633*UE29) <=0;
(197*VF29 + 3*VG29 + 2*VH29) - (2000*UA29 + 2*UB29 + 7*UC29 + 2*UD29 + 139434*UE29) <=0;
(5794*VF29 + 3*VG29 + 4*VH29) - (37324*UA29 + 48*UB29 + 550*UC29 + 25*UD29 + 2090879*UE29) <=0;
(1505*VF29 + 3*VG29 + 3*VH29) - (11000*UA29 + 9*UB29 + 200*UC29 + 9*UD29 + 755723*UE29) <=0;
(1347*VF29 + 3*VG29 + 4*VH29) - (10000*UA29 + 4*UB29 + 7*UC29 + 5*UD29 + 374615*UE29) <=0;
(310*VF29 + 3*VG29 + 2*VH29) - (4000*UA29 + 2*UB29 + 2*UC29 + 2*UD29 + 224382*UE29) <=0;
(259*VF29 + 3*VG29 + 3*VH29) - (5500*UA29 + 2*UB29 + 50*UC29 + 5*UD29 + 194903*UE29) <=0;
(277*VF29 + 3*VG29 + 3*VH29) - (2000*UA29 + 8*UB29 + 2*UC29 + 6*UD29 + 173934*UE29) <=0;

UA29 >=0;
UB29 >=0;
UC29 >=0;
UD29 >=0;
UE29 >=0;
VF29 >=0;
VG29 >=0;
VH29 >=0;

```

### Solutions/Weights of Primal Problem

Variable	Value	Reduced Cost
VF29	0.000000	0.000000
VG29	0.000000	0.000000
VH29	0.333333	0.000000
UA29	0.2424242E-03	0.000000
UB29	0.000000	0.000000
UC29	0.3030303E-01	0.000000
UD29	0.7575758E-01	0.000000
UE29	0.000000	0.000000

### Dual Problem Formulation

```

!Dual Objective Function;

MIN = X29;

!Subject to;
13100*Y129 + 2000*Y229 + 550*Y329 + 9800*Y429 + 7500*Y529 + 550*Y629 + 4800*Y729 + 10250*Y829 + 2300*Y929 +
1000*Y1029 + 20700*Y1129 + 1200*Y1229 + 11000*Y1329 + 4100*Y1429 + 2000*Y1529 +
21000*Y1629 + 500*Y1729 + 2152*Y1829 + 9700*Y1929 + 15000*Y2029 + 9000*Y2129 + 4600*Y2229 + 2000*Y2329 +
37324*Y2429 + 11000*Y2529 + 10000*Y2629 + 4000*Y2729 + 5500*Y2829 + 2000*Y2929
-2000*X29 <= 0;

7*Y129 + 2*Y229 + 2*Y329 + 14*Y429 + 4*Y529 + 2*Y629 + 3*Y729 + 5*Y829 + 2*Y929 + 1*Y1029 + 21*Y1129 +
6*Y1229 + 13*Y1329 + 2*Y1429 + 2*Y1529 + 5*Y1629 + 2*Y1729 + 4*Y1829 + 5*Y1929 + 15*Y2029 + 6*Y2129 + 5*Y2229 +
2*Y2329 + 48*Y2429 + 9*Y2529 + 4*Y2629 + 2*Y2729 + 2*Y2829 + 8*Y2929 - 8*X29 <= 0;

320*Y129 + 7*Y229 + 2*Y329 + 10*Y429 + 7*Y529 + 2*Y629 + 7*Y729 + 20*Y829 + 7*Y929 + 30*Y1029 + 200*Y1129 +
7*Y1229 + 200*Y1329 + 7*Y1429 + 2*Y1529 + 338*Y1629 + 2*Y1729 + 48*Y1829 +
7*Y1929 + 200*Y2029 + 7*Y2129 + 7*Y2229 + 7*Y2329 + 550*Y2429 + 200*Y2529 + 7*Y2629 + 2*Y2729 + 50*Y2829 +
2*Y2929 - 2*X29 <= 0;

9*Y129 + 4*Y229 + 2*Y329 + 9*Y429 + 4*Y529 + 3*Y629 + 6*Y729 + 7*Y829 + 4*Y929 + 4*Y1029 + 11*Y1129 + 5*Y1229 +
12*Y1329 + 3*Y1429 + 3*Y1529 + 10*Y1629 + 2*Y1729 + 7*Y1829 + 5*Y1929 +
12*Y2029 + 7*Y2129 + 5*Y2229 + 2*Y2329 + 25*Y2429 + 9*Y2529 + 5*Y2629 + 2*Y2729 + 5*Y2829 + 6*Y2929 - 6*X29
<= 0;

820931*Y129 + 147596*Y229 + 86404*Y329 + 584300*Y429 + 238265*Y529 + 147473*Y629 + 420908*Y729 +
239046*Y829 + 171183*Y929 + 86967*Y1029 + 142521*Y1129 + 1372680*Y1229 +
119500*Y1329 + 247573*Y1429 + 93157*Y1529 + 1994765*Y1629 + 29538*Y1729 + 226845*Y1829 + 117310*Y1929 +
955890*Y2029 + 3333230*Y2129 + 2349633*Y2229 + 139434*Y2329 +
2090879*Y2429 + 755723*Y2529 + 374615*Y2629 + 224382*Y2729 + 194903*Y2829 + 173934*Y2929 - 173934*X29
<= 0;

229*Y129 + 354*Y229 + 115*Y329 + 5827*Y429 + 4776*Y529 + 152*Y629 + 661*Y729 + 1019*Y829 + 278*Y929 +
60*Y1029 + 2155*Y1129 + 908*Y1229 + 2593*Y1329 + 272*Y1429 + 64*Y1529 +
1053*Y1629 + 137*Y1729 + 138*Y1829 + 523*Y1929 + 1222*Y2029 + 1674*Y2129 + 554*Y2229 + 197*Y2329 + 5794*Y2429 +
1505*Y2529 + 1347*Y2629 + 310*Y2729 + 259*Y2829 + 277*Y2929 >= 277;

3*Y129 + 3*Y229 + 3*Y329 + 3*Y429 + 3*Y529 + 3*Y629 + 3*Y729 + 3*Y829 + 3*Y929 + 3*Y1029 + 3*Y1129 + 3*Y1229 +
3*Y1329 + 3*Y1429 + 3*Y1529 + 3*Y1629 + 3*Y1729 + 3*Y1829 +
3*Y1929 + 3*Y2029 + 3*Y2129 + 3*Y2229 + 3*Y2329 + 3*Y2429 + 3*Y2529 + 3*Y2629 + 3*Y2729 + 3*Y2829 + 3*Y2929
>= 3;

@Free(X29);
Y129 >=0; Y229 >=0; Y329 >=0; Y429 >=0; Y529 >=0; Y629 >=0; Y729 >=0; Y829 >=0; Y929 >=0; Y1029 >=0; Y1129
>=0; Y1229 >=0; Y1329 >=0; Y1429 >=0; Y1529 >=0; Y1629 >=0; Y1729 >=0; Y1829 >=0;
Y1929 >=0; Y2029 >=0; Y2129 >=0; Y2229 >=0; Y2329 >=0; Y2429 >=0; Y2529 >=0; Y2629 >=0;
Y2729 >=0; Y2829 >=0; Y2929 >=0;

```

## Solutions of Dual Problem

Global optimal solution found.		
Objective value:	1.000000	
Infeasibilities:	0.000000	
Total solver iterations:	6	
Variable	Value	Reduced Cost
X29	1.000000	0.5551115E-16
Y129	0.000000	14.19096
Y229	0.000000	0.2775558E-16
Y329	0.000000	0.6808460E-01
Y429	0.000000	1.614447
Y529	0.000000	0.7669722
Y629	0.000000	0.2164282
Y729	0.000000	0.8016622
Y829	0.000000	1.513559
Y929	0.000000	0.3954962
Y1029	0.000000	1.363290
Y1129	0.000000	9.924595
Y1229	0.000000	1.653828

Y1329	0.000000	8.802955
Y1429	0.000000	0.2823658
Y1529	0.000000	-0.5551115E-16
Y1629	0.000000	17.20437
Y1729	0.000000	0.000000
Y1829	0.000000	2.259665
Y1929	0.000000	0.9840630
Y2029	0.000000	10.20091
Y2129	0.000000	4.569412
Y2229	0.000000	2.798845
Y2329	0.000000	0.1609342
Y2429	0.000000	28.66846
Y2529	0.000000	9.584826
Y2629	0.000000	0.9677562
Y2729	0.000000	0.3042937
Y2829	0.000000	2.211580
Y2929	1.000000	0.2775558E-16

## SUMMARY

Efficiency score of Warehouse 29 (Varanasi) = 1

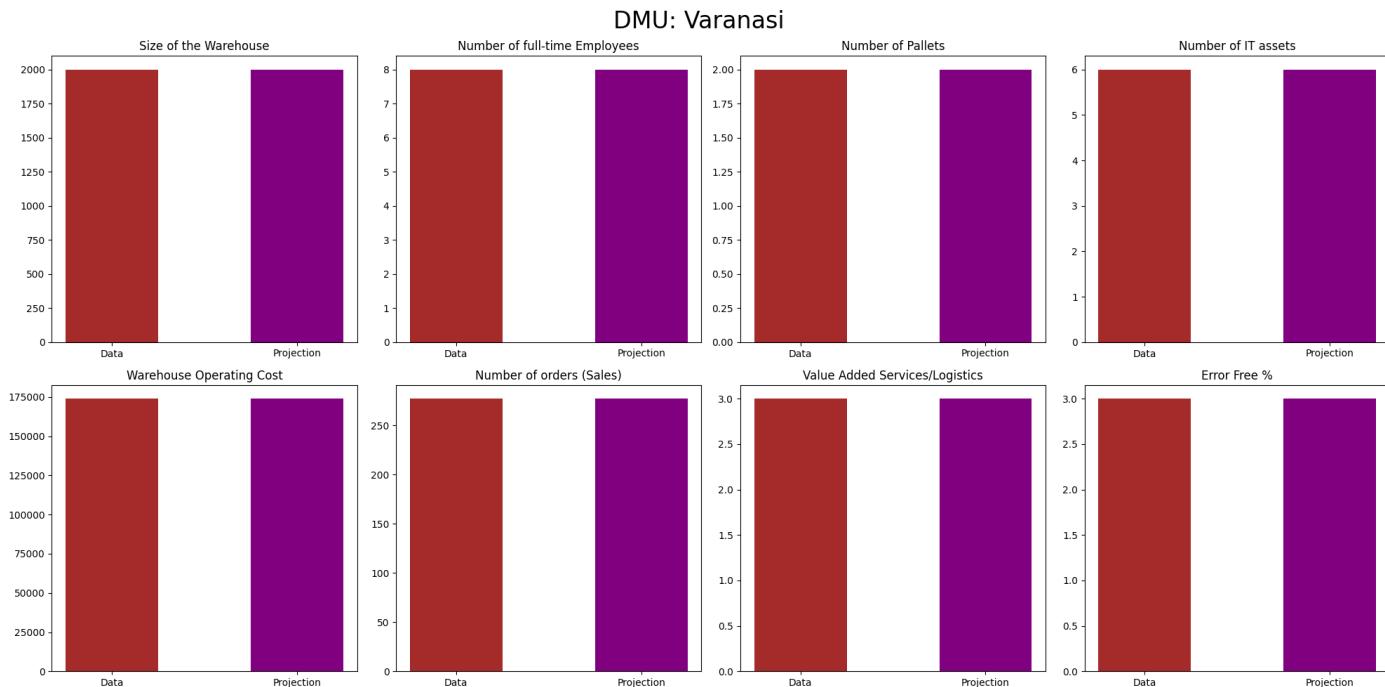
Warehouse 29 (Varanasi) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	2000	2000	0
No. of Full-time Employees	8	8	0
No. of Pallets	2	2	0
No. of IT assets	6	6	0
Warehouse Operating Cost	173934	173934	0
No. of Orders (Sales)	277	277	0
Level of Value-Added Services	3	3	0
Error Free (%)	3	3	0

## LISTING OF PEERS

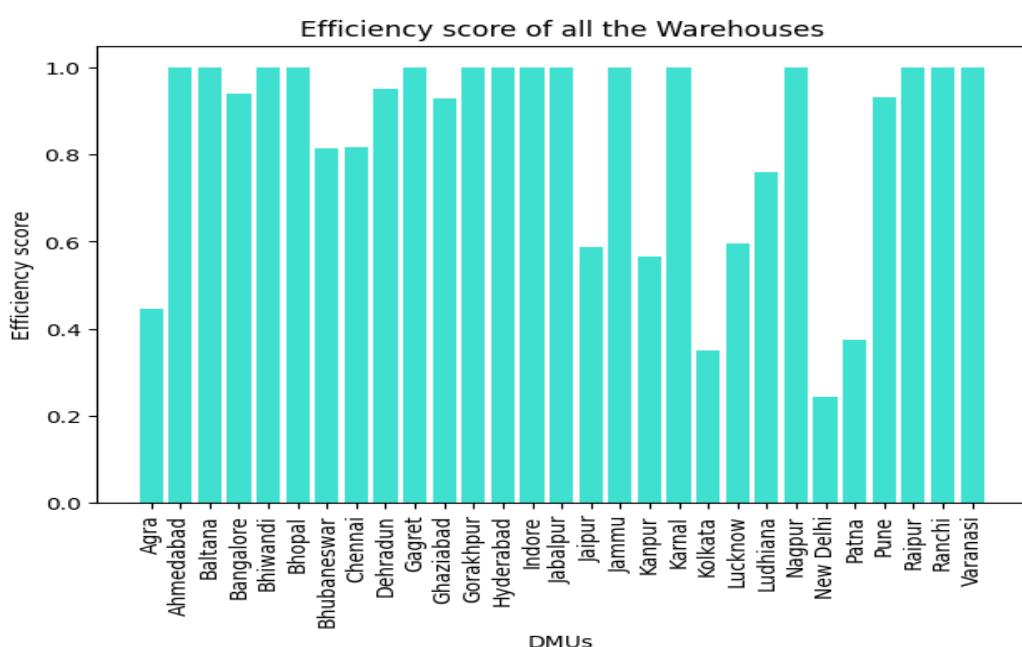
Peers	Lambda Weight
Warehouse 29 (Varanasi)	1



## SUMMARY OF CCR MODEL

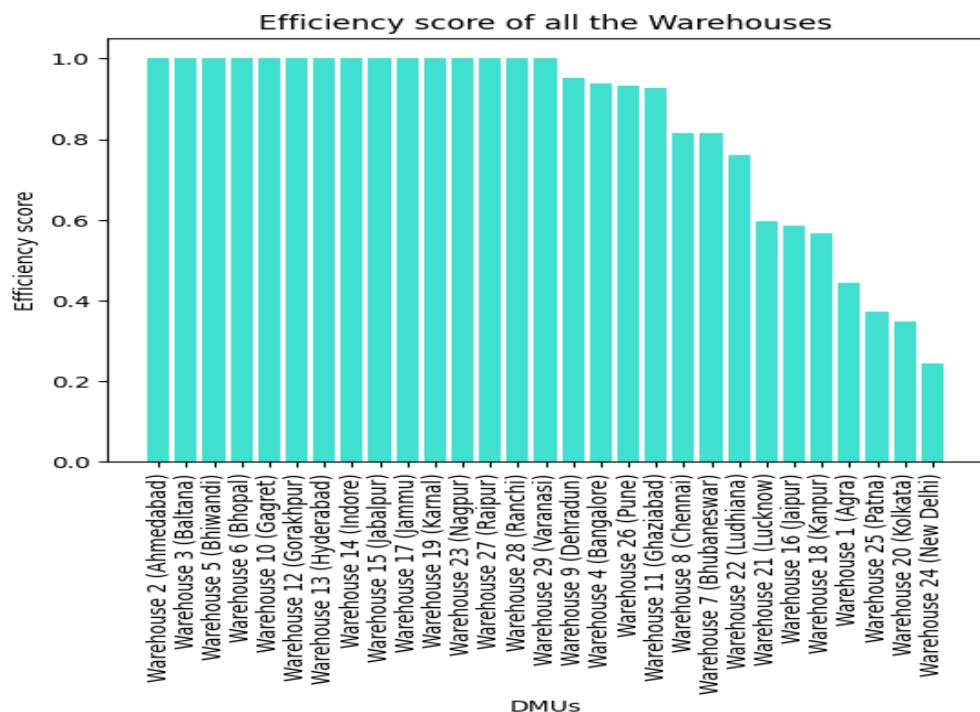
Following is the table of efficiency score of all the DMUs (Warehouses). It can be clearly seen that there are 15 efficient DMUs and 14 inefficient DMUs.

DMU	Efficiency Score
Warehouse 1 (Agra)	0.4444
Warehouse 2 (Ahmedabad)	1
Warehouse 3 (Baltana)	1
Warehouse 4 (Bangalore)	0.9389
Warehouse 5 (Bhiwandi)	1
Warehouse 6 (Bhopal)	1
Warehouse 7 (Bhubaneswar)	0.8153
Warehouse 8 (Chennai)	0.8164
Warehouse 9 (Dehradun)	0.9515
Warehouse 10 (Gagret)	1
Warehouse 11 (Ghaziabad)	0.9279
Warehouse 12 (Gorakhpur)	1
Warehouse 13 (Hyderabad)	1
Warehouse 14 (Indore)	1
Warehouse 15 (Jabalpur)	1
Warehouse 16 (Jaipur)	0.5859
Warehouse 17 (Jammu)	1
Warehouse 18 (Kanpur)	0.5656
Warehouse 19 (Karnal)	1
Warehouse 20 (Kolkata)	0.3483
Warehouse 21 (Lucknow)	0.5967
Warehouse 22 (Ludhiana)	0.7601
Warehouse 23 (Nagpur)	1
Warehouse 24 (New Delhi)	0.2438
Warehouse 25 (Patna)	0.3739
Warehouse 26 (Pune)	0.9323
Warehouse 27 (Raipur)	1
Warehouse 28 (Ranchi)	1
Warehouse 29 (Varanasi)	1



Hence, the ranking of all the DMUs (Warehouses) using the CCR model,

No.	DMU	Score	Rank
2	Ahmedabad	1	1
3	Baltana	1	1
5	Bhiwandi	1	1
6	Bhopal	1	1
10	Gagret	1	1
12	Gorakhpur	1	1
13	Hyderabad	1	1
14	Indore	1	1
15	Jabalpur	1	1
17	Jammu	1	1
19	Karnal	1	1
23	Nagpur	1	1
27	Raipur	1	1
28	Ranchi	1	1
29	Varanasi	1	1
9	Dehradun	0.9515	16
4	Bangalore	0.9389	17
26	Pune	0.9323	18
11	Ghaziabad	0.9279	19
8	Chennai	0.8164	20
7	Bhubaneswar	0.8153	21
22	Ludhiana	0.7601	22
21	Lucknow	0.5967	23
16	Jaipur	0.5859	24
18	Kanpur	0.5656	25
1	Agra	0.4444	26
25	Patna	0.3739	27
20	Kolkata	0.3483	28
24	New Delhi	0.2438	29



Now, we will move to the BCC models of all the twenty-nine warehouses and check the efficiency score in case variable returns to scale.

## WAREHOUSE 1 (AGRA)

### BCC Model

```

!Dual Objective Function;

MIN = X1;

!Subject to;
13100*Y11 + 2000*Y21 + 550*Y31 + 9800*Y41 + 7500*Y51 + 550*Y61 + 4800*Y71 + 10250*Y81 + 2300*Y91 + 1000*Y101
+ 20700*Y111 + 1200*Y121 + 11000*Y131 + 4100*Y141+ 2000*Y151 +
21000*Y161 + 500*Y171 + 2152*Y181 + 9700*Y191 + 15000*Y201+ 9000*Y211 + 4600*Y221 + 2000*Y231 + 37324*Y241 +
11000*Y251 + 10000*Y261 + 4000*Y271 + 5500*Y281 + 2000*Y291 -13100*X1 <=0;

7*Y11 + 2*Y21 + 2*Y31 + 14*Y41 + 4*Y51 + 2*Y61 + 3*Y71 + 5*Y81 + 2*Y91 + 1*Y101 + 21*Y111 + 6*Y121 + 13*Y131
+ 2*Y141 + 2*Y151 + 5*Y161 + 2*Y171 + 4*Y181 + 5*Y191 + 15*Y201 + 6*Y211 + 5*Y221 + 2*Y231 + 48*Y241 + 9*Y251
+ 4*Y261 + 2*Y271 + 2*Y281 + 8*Y291 -7*X1 <=0;

320*Y11 + 7*Y21 + 2*Y31 + 10*Y41 + 7*Y51 + 2*Y61 + 7*Y71 + 20*Y81 + 7*Y91 + 30*Y101 + 200*Y111 + 7*Y121 +
200*Y131 + 7*Y141 + 2*Y151 + 338*Y161 + 2*Y171 + 48*Y181 + 7*Y191 +
200*Y201 + 7*Y211 + 7*Y221 + 7*Y231 + 550*Y241 + 200*Y251 + 7*Y261 + 2*Y271 + 50*Y281 + 2*Y291 - 320*X1 <=0;

9*Y11 + 4*Y21 + 2*Y31 + 9*Y41 + 4*Y51 + 3*Y61 + 6*Y71 + 7*Y81 + 4*Y91 + 4*Y101 + 11*Y111 + 5*Y121 + 12*Y131 +
3*Y141 + 3*Y151 + 10*Y161 + 2*Y171 + 7*Y181 + 5*Y191 + 12*Y201 + 7*Y211 + 5*Y221 + 2*Y231 + 25*Y241 + 9*Y251
+ 5*Y261 + 2*Y271 + 5*Y281 + 6*Y291 - 9*X1 <=0;

820931*Y11 + 147596*Y21 + 86404*Y31 + 584300*Y41 + 238265*Y51 + 147473*Y61 + 420908*Y71 + 239046*Y81 +
171183*Y91 + 86967*Y101 + 142521*Y111 + 1372680*Y121 + 119500*Y131 + 247573*Y141 + 93157*Y151 +
1994765*Y161 + 29538*Y171 + 226845*Y181 + 117310*Y191 + 955890*Y201 + 3333230*Y211 + 2349633*Y221 +
139434*Y231 + 2090879*Y241 + 755723*Y251 + 374615*Y261 + 224382*Y271 + 194903*Y281 + 173934*Y291 -
820931*X1 <=0;

229*Y11 + 354*Y21 + 115*Y31 + 5827*Y41 + 4776*Y51 + 152*Y61 + 661*Y71 + 1019*Y81 + 278*Y91 + 60*Y101 +
2155*Y111 + 908*Y121 + 2593*Y131 + 272*Y141 + 64*Y151 + 1053*Y161 + 137*Y171 + 138*Y181 + 523*Y191 +
1222*Y201 + 1674*Y211 + 554*Y221 + 197*Y231 + 5794*Y241 + 1505*Y251 + 1347*Y261 + 310*Y271 + 259*Y281 +
277*Y291 >= 229;

3*Y11 + 3*Y21 + 3*Y31 + 3*Y41 + 3*Y51 + 3*Y61 + 3*Y71 + 3*Y81 + 3*Y91 + 3*Y101 + 3*Y111 + 3*Y121 + 3*Y131 +
3*Y141 + 3*Y151 + 3*Y161 + 3*Y171 + 3*Y181 + 3*Y191 + 3*Y201 + 3*Y211 + 3*Y221 + 3*Y231 + 3*Y241 + 3*Y251 +
3*Y261 + 3*Y271 + 3*Y281 + 3*Y291 >= 3;

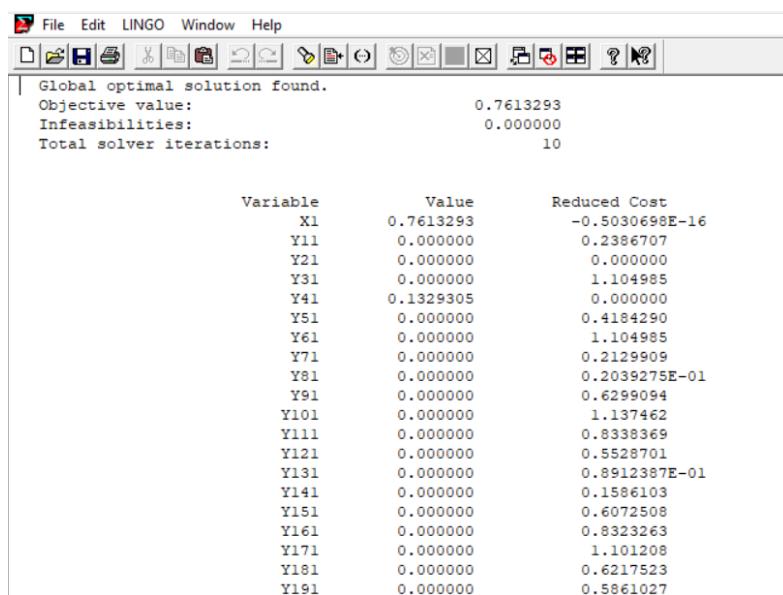
4*Y11 + 3*Y21 + 1*Y31 + 4*Y41 + 3*Y51 + 1*Y61 + 3*Y71 + 4*Y81 + 2*Y91 + 1*Y101 + 4*Y111 + 2*Y121 + 4*Y131 +
3*Y141 + 2*Y151 + 4*Y161 + 1*Y171 + 2*Y181 + 3*Y191 + 4*Y201 + 3*Y211 + 3*Y221 + 2*Y231 + 4*Y241 + 3*Y251 +
4*Y261 + 2*Y271 + 3*Y281 + 3*Y291 >= 4;

Y11 + Y21 + Y31 + Y41 + Y51 + Y61 + Y71 + Y81 + Y91 + Y101 + Y111 + Y121 + Y131 + Y141 + Y151 + Y161 + Y171 +
Y181 + Y191 + Y201 + Y211 + Y221 + Y231 + Y241 +
Y251 + Y261 + Y271 + Y281 + Y291 = 1;

@Free(X1);
Y11>=0; Y21>=0; Y31>=0; Y41>=0; Y51>=0; Y61>=0; Y71>=0; Y81>=0; Y91>=0; Y101>=0; Y111>=0; Y121>=0; Y131>=0;
Y141>=0; Y151>=0; Y161>=0; Y171>=0; Y181>=0; Y191>=0; Y201>=0; Y211>=0; Y221>=0; Y231>=0; Y241>=0; Y251>=0;
Y261>=0; Y271>=0; Y281>=0; Y291>=0;

```

### SOLUTION OF BCC MODEL



The screenshot shows the LINGO software interface with the following output:

```

Global optimal solution found.
Objective value: 0.7613293
Infeasibilities: 0.000000
Total solver iterations: 10

Variable      Value      Reduced Cost
X1          0.7613293   -0.5030698E-16
Y11         0.000000    0.2386707
Y21         0.000000    0.000000
Y31         0.000000    1.104985
Y41         0.1329305   0.000000
Y51         0.000000    0.4184290
Y61         0.000000    1.104985
Y71         0.000000    0.2129909
Y81         0.000000    0.2039275E-01
Y91         0.000000    0.6299094
Y101        0.000000    1.137462
Y111        0.000000    0.8338369
Y121        0.000000    0.5528701
Y131        0.000000    0.8912387E-01
Y141        0.000000    0.1586103
Y151        0.000000    0.6072508
Y161        0.000000    0.8323263
Y171        0.000000    1.101208
Y181        0.000000    0.6217523
Y191        0.000000    0.5861027

```

Y201	0.000000	0.3942598
Y211	0.000000	0.5347432
Y221	0.000000	0.2009063
Y231	0.000000	0.6072508
Y241	0.000000	2.130211
Y251	0.000000	0.6903323
Y261	0.8670695	-0.5030698E-16
Y271	0.000000	0.7583082
Y281	0.000000	0.2643505
Y291	0.000000	0.9063444E-02

## SUMMARY

Efficiency of Warehouse 1 (Agra) = 0.7613293

Warehouse 1 (Agra) is an inefficient warehouse.

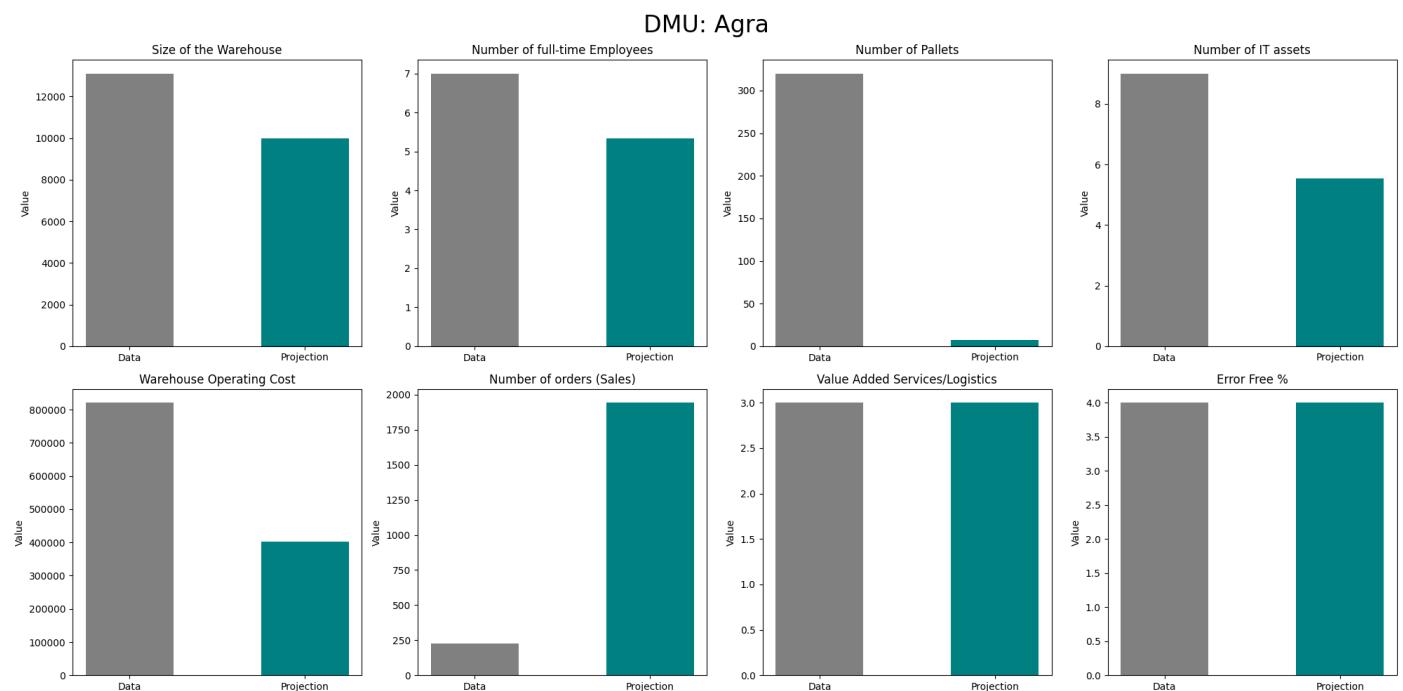
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	13100	9973.2	0
No. of Full-time Employees	7	5.32919	0
No. of Pallets	320	7.39884	236.221
No. of IT assets	9	5.5317	1.32
Warehouse Operating Cost	820931	402482	222504
No. of Orders (Sales)	229	1942.47	1713.47
Level of Value-Added Services	3	3.00003	0
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 4 (Bangalore)	0.1329305
Warehouse 26 (Pune)	0.8670695

In order to make warehouse 1 (Agra) efficient, they need to decrease size of the warehouse by 23.869%, No of full-time employees by 23.869%, number of pallets by 97.688%, IT Assets by 38.537% , operating cost by 50.973%, whereas No. of orders needs to be increased by 748.239%.



## WAREHOUSE 2 (Ahmedabad)

### BCC MODEL

```

!Dual Objective Function;

MIN = X2;

!Subject to;
13100*Y12 + 2000*Y22 + 550*Y32 + 9800*Y42 + 7500*Y52 + 550*Y62 + 4800*Y72 + 10250*Y82 + 2300*Y92 + 1000*Y102
+ 20700*Y112 + 1200*Y122 + 11000*Y132 + 4100*Y142 + 2000*Y152 +
21000*Y162 + 500*Y172 + 2152*Y182 + 9700*Y192 + 15000*Y202 + 9000*Y212 + 4600*Y222 + 2000*Y232 + 37324*Y242
+ 11000*Y252 + 10000*Y262 + 4000*Y272 + 5500*Y282 + 2000*Y292 - 2000*X2 <=0;

7*Y12 + 2*Y22 + 2*Y32 + 14*Y42 + 4*Y52 + 2*Y62 + 3*Y72 + 5*Y82 + 2*Y92 + 1*Y102 + 21*Y112 + 6*Y122 + 13*Y132
+ 2*Y142 + 2*Y152 + 5*Y162 + 2*Y172 + 4*Y182 + 5*Y192 + 15*Y202 + 6*Y212 + 5*Y222 + 2*Y232 + 48*Y242 + 9*Y252
+ 4*Y262 + 2*Y272 + 2*Y282 + 8*Y292 - 2*X2 <=0;

320*Y12 + 7*Y22 + 2*Y32 + 10*Y42 + 7*Y52 + 2*Y62 + 7*Y72 + 20*Y82 + 7*Y92 + 30*Y102 + 200*Y112 + 7*Y122 +
200*Y132 + 7*Y142 + 2*Y152 + 338*Y162 + 2*Y172 + 48*Y182 + 7*Y192 + 200*Y202 + 7*Y212 + 7*Y222 + 7*Y232 +
550*Y242 + 200*Y252 + 7*Y262 + 2*Y272 + 50*Y282 + 2*Y292 - 7*X2 <=0;

9*Y12 + 4*Y22 + 2*Y32 + 9*Y42 + 4*Y52 + 3*Y62 + 6*Y72 + 7*Y82 + 4*Y92 + 4*Y102 + 11*Y112 + 5*Y122 + 12*Y132 +
3*Y142 + 3*Y152 + 10*Y162 + 2*Y172 + 7*Y182 + 5*Y192 + 12*Y202 + 7*Y212 + 5*Y222 + 2*Y232 + 25*Y242 + 9*Y252
+ 5*Y262 + 2*Y272 + 5*Y282 + 6*Y292 - 4*X2 <=0;

820931*Y12 + 147596*Y22 + 86404*Y32 + 584300*Y42 + 238265*Y52 + 147473*Y62 + 420908*Y72 + 239046*Y82 +
171183*Y92 + 86967*Y102 + 142521*Y112 + 1372680*Y122 + 119500*Y132 + 247573*Y142 + 93157*Y152 +
1994765*Y162 + 29538*Y172 + 226845*Y182 + 117310*Y192 + 955890*Y202 + 3333230*Y212 + 2349633*Y222 +
139434*Y232 + 2090879*Y242 + 755723*Y252 + 374615*Y262 + 224382*Y272 + 194903*Y282 + 173934*Y292 -
147596*X2 <=0;

229*Y12 + 354*Y22 + 115*Y32 + 5827*Y42 + 4776*Y52 + 152*Y62 + 661*Y72 + 1019*Y82 + 278*Y92 + 60*Y102 +
2155*Y112 + 908*Y122 + 2593*Y132 + 272*Y142 + 64*Y152 + 1053*Y162 + 137*Y172 + 138*Y182 + 523*Y192 +
1222*Y202 + 1674*Y212 + 554*Y222 + 197*Y232 + 5794*Y242 + 1505*Y252 + 1347*Y262 + 310*Y272 + 259*Y282 +
277*Y292 >= 354;

3*Y12 + 3*Y22 + 3*Y32 + 3*Y42 + 3*Y52 + 3*Y62 + 3*Y72 + 3*Y82 + 3*Y92 + 3*Y102 + 3*Y112 + 3*Y122 + 3*Y132 +
3*Y142 + 3*Y152 + 3*Y162 + 3*Y172 + 3*Y182 + 3*Y192 + 3*Y202 + 3*Y212 + 3*Y222 + 3*Y232 + 3*Y242 + 3*Y252 +
3*Y262 + 3*Y272 + 3*Y282 + 3*Y292 >= 3;

4*Y12 + 3*Y22 + 1*Y32 + 4*Y42 + 3*Y52 + 1*Y62 + 3*Y72 + 4*Y82 + 2*Y92 + 1*Y102 + 4*Y112 + 2*Y122 + 4*Y132 +
3*Y142 + 2*Y152 + 4*Y162 + 1*Y172 + 2*Y182 + 3*Y192 + 4*Y202 + 3*Y212 + 3*Y222 + 2*Y232 + 4*Y242 + 3*Y252 +
4*Y262 + 2*Y272 + 3*Y282 + 3*Y292 >= 3;

Y12 + Y22 + Y32 + Y42 + Y52 + Y62 + Y72 + Y82 + Y92 + Y102 + Y112 + Y122 + Y132 + Y142 + Y152 + Y162 + Y172 +
Y182 + Y192 + Y202 + Y212 + Y222 + Y232 + Y242 + Y252 + Y262 + Y272 + Y282 + Y292 = 1;

@Free(X2);
Y12 >=0; Y22 >=0; Y32 >=0; Y42 >=0; Y52 >=0; Y62 >=0; Y72 >=0; Y82 >=0; Y92 >=0; Y102 >=0; Y112 >=0;
Y122 >=0; Y132 >=0; Y142 >=0; Y152 >=0; Y162 >=0; Y172 >=0; Y182 >=0; Y192 >=0; Y202 >=0; Y212 >=0; Y222
>=0; Y232 >=0; Y242 >=0; Y252 >=0; Y262 >=0; Y272 >=0; Y282 >=0; Y292 >=0;

```

### SOLUTION OF BCC MODEL

Variable	Value	Reduced Cost
X2	1.000000	0.000000
Y12	0.000000	3.885285
Y22	1.000000	0.000000
Y32	0.000000	0.3211190
Y42	0.000000	3.131913
Y52	0.000000	0.6785365
Y62	0.000000	0.6659721
Y72	0.000000	1.6266644
Y82	0.000000	0.4328804
Y92	0.000000	0.4665278
Y102	0.000000	0.2410312
Y112	0.000000	1.220081
Y122	0.000000	7.584379

Y132	0.000000	0.4239470
Y142	0.000000	0.5645643
Y152	0.000000	0.2591946E-01
Y162	0.000000	10.34732
Y172	0.000000	-0.2775558E-16
Y182	0.000000	0.9473818
Y192	0.000000	0.7877766E-01
Y202	0.000000	5.313527
Y212	0.000000	18.32216
Y222	0.000000	12.68458
Y232	0.000000	0.2872430
Y242	0.000000	14.47055
Y252	0.000000	4.016927
Y262	0.000000	1.115164
Y272	0.000000	0.7669394
Y282	0.000000	0.2671399
Y292	0.000000	0.6483310

## SUMMARY

Efficiency of Warehouse 2 (Ahmedabad) = 1

Warehouse 2 (Ahmedabad) is an efficient warehouse.

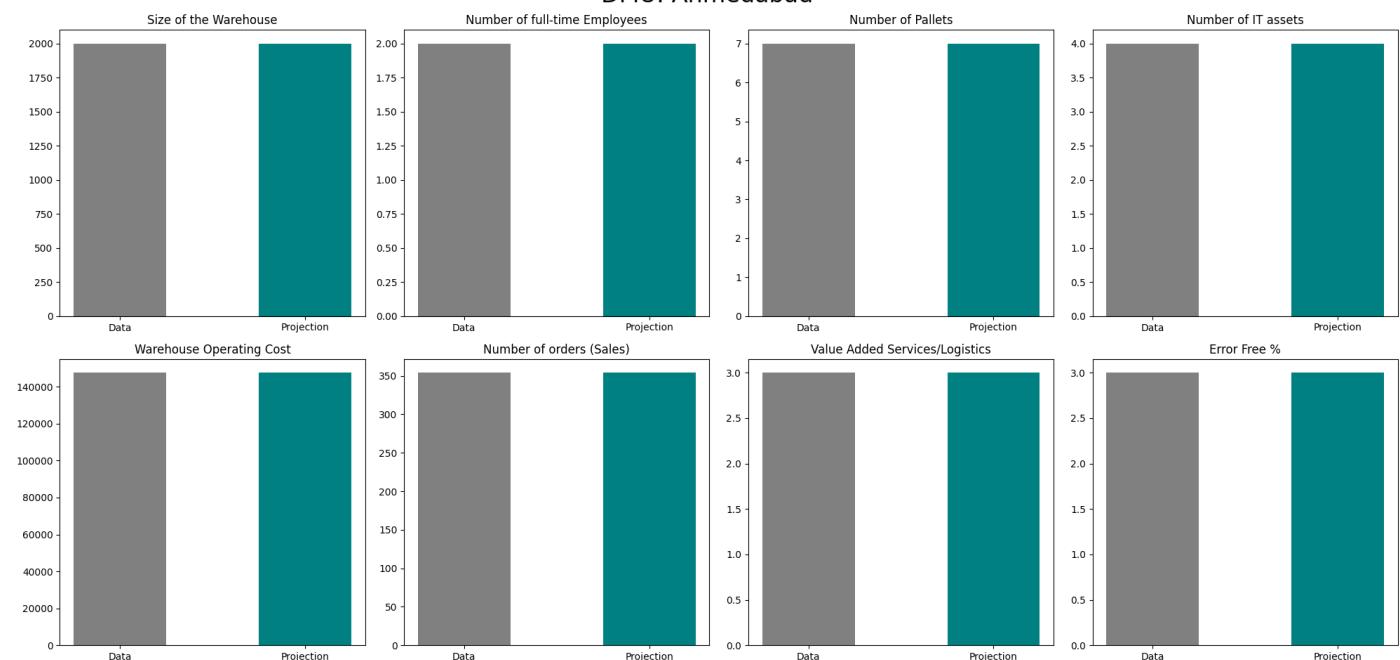
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	2000	2000	0
No. of Full-time Employees	2	2	0
No. of Pallets	7	7	0
No. of IT assets	4	4	0
Warehouse Operating Cost	147596	147596	0
No. of Orders (Sales)	354	354	0
Level of Value-Added Services	3	3	0
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 2 (Ahmedabad)	1

DMU: Ahmedabad



## WAREHOUSE 3 (Baltana)

### BCC MODEL

```

!Dual Objective Function;

MIN = X3;

!Subject to;
13100*Y13 + 2000*Y23 + 550*Y33 + 9800*Y43 + 7500*Y53 + 550*Y63 + 4800*Y73 + 10250*Y83 + 2300*Y93 + 1000*Y103
+ 20700*Y113 + 1200*Y123 + 11000*Y133 + 4100*Y143 + 2000*Y153 +
21000*Y163 + 500*Y173 + 2152*Y183 + 9700*Y193 + 15000*Y203 + 9000*Y213 + 4600*Y223 + 2000*Y233 + 37324*Y243
+ 11000*Y253 + 10000*Y263 + 4000*Y273 + 5500*Y283 + 2000*Y293 - 550*X3 <=0;

7*Y13 + 2*Y23 + 2*Y33 + 14*Y43 + 4*Y53 + 2*Y63 + 3*Y73 + 5*Y83 + 2*Y93 + 1*Y103 + 21*Y113 + 6*Y123 + 13*Y133
+ 2*Y143 + 2*Y153 + 5*Y163 + 2*Y173 + 4*Y183 + 5*Y193 + 15*Y203 + 6*Y213 + 5*Y223 + 2*Y233 + 48*Y243 + 9*Y253
+ 4*Y263 + 2*Y273 + 2*Y283 + 8*Y293 - 2*X3 <=0;

320*Y13 + 7*Y23 + 2*Y33 + 10*Y43 + 7*Y53 + 2*Y63 + 7*Y73 + 20*Y83 + 7*Y93 + 30*Y103 + 200*Y113 + 7*Y123 +
200*Y133 + 7*Y143 + 2*Y153 + 338*Y163 + 2*Y173 + 48*Y183 + 7*Y193 +
200*Y203 + 7*Y213 + 7*Y223 + 7*Y233 + 550*Y243 + 200*Y253 + 7*Y263 + 2*Y273 + 50*Y283 + 2*Y293 - 2*X3 <= 0;

9*Y13 + 4*Y23 + 2*Y33 + 9*Y43 + 4*Y53 + 3*Y63 + 6*Y73 + 7*Y83 + 4*Y93 + 4*Y103 + 11*Y113 + 5*Y123 + 12*Y133 +
3*Y143 + 3*Y153 + 10*Y163 + 2*Y173 + 7*Y183 + 5*Y193 +
12*Y203 + 7*Y213 + 5*Y223 + 2*Y233 + 25*Y243 + 9*Y253 + 5*Y263 + 2*Y273 + 5*Y283 + 6*Y293 - 2*X3 <= 0;

820931*Y13 + 147596*Y23 + 86404*Y33 + 584300*Y43 + 238265*Y53 + 147473*Y63 + 420908*Y73 + 239046*Y83 +
171183*Y93 + 86967*Y103 + 142521*Y113 + 1372680*Y123 + 119500*Y133 + 247573*Y143 + 93157*Y153 +
1994765*Y163 + 29538*Y173 + 226845*Y183 + 117310*Y193 + 955890*Y203 + 3333230*Y213 + 2349633*Y223 +
139434*Y233 + 2090879*Y243 + 755723*Y253 + 374615*Y263 + 224382*Y273 + 194903*Y283 + 173934*Y293 - 86404*X3
<= 0;

229*Y13 + 354*Y23 + 115*Y33 + 5827*Y43 + 4776*Y53 + 152*Y63 + 661*Y73 + 1019*Y83 + 278*Y93 + 60*Y103 +
2155*Y113 + 908*Y123 + 2593*Y133 + 272*Y143 + 64*Y153 + 1053*Y163 + 137*Y173 + 138*Y183 + 523*Y193 +
1222*Y203 + 1674*Y213 + 554*Y223 + 197*Y233 + 5794*Y243 + 1505*Y253 + 1347*Y263 + 310*Y273 + 259*Y283 +
277*Y293 >= 115;

3*Y13 + 3*Y23 + 3*Y33 + 3*Y43 + 3*Y53 + 3*Y63 + 3*Y73 + 3*Y83 + 3*Y93 + 3*Y103 + 3*Y113 + 3*Y123 + 3*Y133 +
3*Y143 + 3*Y153 + 3*Y163 + 3*Y173 + 3*Y183 + 3*Y193 + 3*Y203 + 3*Y213 + 3*Y223 + 3*Y233 + 3*Y243 + 3*Y253 +
3*Y263 + 3*Y273 + 3*Y283 + 3*Y293 >= 3;

4*Y13 + 3*Y23 + 1*Y33 + 4*Y43 + 3*Y53 + 1*Y63 + 3*Y73 + 4*Y83 + 2*Y93 + 1*Y103 + 4*Y113 + 2*Y123 + 4*Y133 +
3*Y143 + 2*Y153 + 4*Y163 + 1*Y173 + 2*Y183 + 3*Y193 + 4*Y203 + 3*Y213 + 3*Y223 + 2*Y233 + 4*Y243 + 3*Y253 +
4*Y263 + 2*Y273 + 3*Y283 + 3*Y293 >= 1;

Y13 + Y23 + Y33 + Y43 + Y53 + Y63 + Y73 + Y83 + Y93 + Y103 + Y113 + Y123 + Y133 + Y143 + Y153 + Y163 + Y173 +
Y183 + Y193 + Y203 + Y213 + Y223 + Y233 + Y243 +
Y253 + Y263 + Y273 + Y283 + Y293 = 1;

@Free(X3);
Y13 >=0; Y23 >=0; Y33 >=0; Y43 >=0; Y53 >=0; Y63 >=0; Y73 >=0; Y83 >=0; Y93 >=0; Y103 >=0; Y113 >=0; Y123
>=0; Y133 >=0; Y143 >=0; Y153 >=0; Y163 >=0; Y173 >=0; Y183 >=0; Y193 >=0; Y203 >=0; Y213 >=0; Y223 >=0; Y233
>=0; Y243 >=0; Y253 >=0; Y263 >=0; Y273 >=0; Y283 >=0; Y293 >=0;

```

### SOLUTION OF BCC MODEL

Variable	Value	Reduced Cost
X3	1.000000	0.000000
Y13	0.000000	2.833333
Y23	0.000000	0.333333
Y33	1.000000	0.000000
Y43	0.000000	5.166667
Y53	0.000000	1.000000
Y63	0.000000	0.1666667
Y73	0.000000	1.000000
Y83	0.000000	1.833333
Y93	0.000000	0.333333
Y103	0.000000	0.5551115E-16
Y113	0.000000	7.833333
Y123	0.000000	1.833333

Y133	0.000000	5.333333
Y143	0.000000	0.1666667
Y153	0.000000	0.1666667
Y163	0.000000	2.333333
Y173	0.000000	0.000000
Y183	0.000000	1.500000
Y193	0.000000	1.500000
Y203	0.000000	6.000000
Y213	0.000000	2.166667
Y223	0.000000	1.500000
Y233	0.000000	0.000000
Y243	0.000000	19.16667
Y253	0.000000	3.500000
Y263	0.000000	1.166667
Y273	0.000000	0.000000
Y283	0.000000	0.5000000
Y293	0.000000	2.666667

## SUMMARY

Efficiency of Warehouse 3 (Baltana) = 1

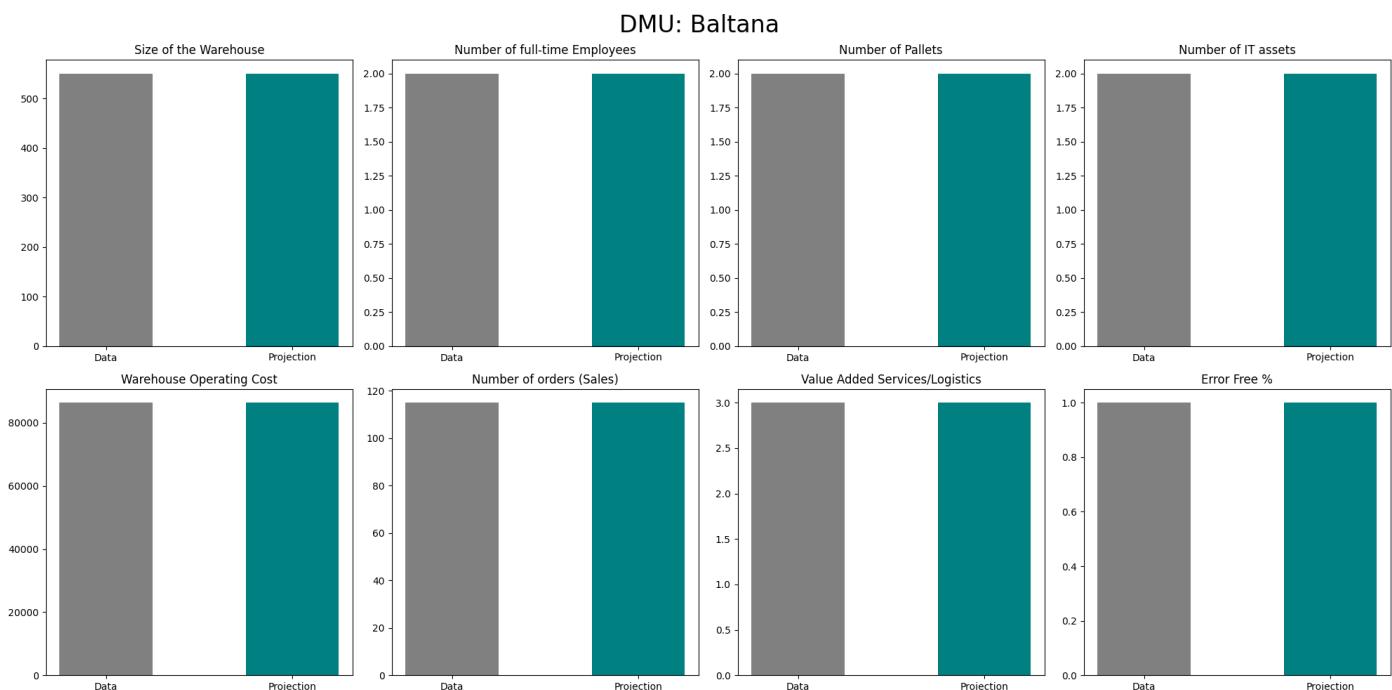
Warehouse 3 (Baltana) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	550	550	0
No. of Full-time Employees	2	2	0
No. of Pallets	2	2	0
No. of IT assets	2	2	0
Warehouse Operating Cost	86404	86404	0
No. of Orders (Sales)	115	115	0
Level of Value-Added Services	3	3	0
Error Free (%)	1	1	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 3 (Baltana)	1



## WAREHOUSE 4 (Bangalore)

### BCC MODEL

```

!Dual Objective Function;

MIN = X4;

!Subject to;
13100*Y14 + 2000*Y24 + 550*Y34 + 9800*Y44 + 7500*Y54 + 550*Y64 + 4800*Y74 + 10250*Y84 + 2300*Y94 + 1000*Y104
+ 20700*Y114 + 1200*Y124 + 11000*Y134 + 4100*Y144 + 2000*Y154 +
21000*Y164 + 500*Y174 + 2152*Y184 + 9700*Y194 + 15000*Y204 + 9000*Y214 + 4600*Y224 + 2000*Y234 + 37324*Y244
+ 11000*Y254 + 10000*Y264 + 4000*Y274 + 5500*Y284 + 2000*Y294 - 9800*X4 <=0;

7*Y14 + 2*Y24 + 2*Y34 + 14*Y44 + 4*Y54 + 2*Y64 + 3*Y74 + 5*Y84 + 2*Y94 + 1*Y104 + 21*Y114 + 6*Y124 + 13*Y134
+ 2*Y144 + 2*Y154 + 5*Y164 + 2*Y174 + 4*Y184 + 5*Y194 + 15*Y204 + 6*Y214 + 5*Y224 + 2*Y234 + 48*Y244 +
9*Y254 + 4*Y264 + 2*Y274 + 2*Y284 + 8*Y294 - 14*X4 <=0;

320*Y14 + 7*Y24 + 2*Y34 + 10*Y44 + 7*Y54 + 2*Y64 + 7*Y74 + 20*Y84 + 7*Y94 + 30*Y104 + 200*Y114 + 7*Y124 +
200*Y134 + 7*Y144 + 2*Y154 + 338*Y164 + 2*Y174 + 48*Y184 + 7*Y194 + 200*Y204 + 7*Y214 + 7*Y224 + 7*Y234 +
550*Y244 + 200*Y254 + 7*Y264 + 2*Y274 + 50*Y284 + 2*Y294 - 10*X4 <=0;

9*Y14 + 4*Y24 + 2*Y34 + 9*Y44 + 4*Y54 + 3*Y64 + 6*Y74 + 7*Y84 + 4*Y94 + 4*Y104 + 11*Y114 + 5*Y124 + 12*Y134 +
3*Y144 + 3*Y154 + 10*Y164 + 2*Y174 + 7*Y184 + 5*Y194 + 12*Y204 + 7*Y214 + 5*Y224 + 2*Y234 + 25*Y244 + 9*Y254
+ 5*Y264 + 2*Y274 + 5*Y284 + 6*Y294 - 9*X4 <=0;

820931*Y14 + 147596*Y24 + 86404*Y34 + 584300*Y44 + 238265*Y54 + 147473*Y64 + 420908*Y74 + 239046*Y84 +
171183*Y94 + 86967*Y104 + 142521*Y114 + 1372680*Y124 + 119500*Y134 + 247573*Y144 + 93157*Y154 +
1994765*Y164 + 29538*Y174 + 226845*Y184 + 117310*Y194 + 955890*Y204 + 3333230*Y214 + 2349633*Y224 +
139434*Y234 + 2090879*Y244 + 755723*Y254 + 374615*Y264 + 224382*Y274 + 194903*Y284 + 173934*Y294 - 584300*X4
<= 0;

229*Y14 + 354*Y24 + 115*Y34 + 5827*Y44 + 4776*Y54 + 152*Y64 + 661*Y74 + 1019*Y84 + 278*Y94 + 60*Y104 +
2155*Y114 + 908*Y124 + 2593*Y134 + 272*Y144 + 64*Y154 + 1053*Y164 + 137*Y174 + 138*Y184 + 523*Y194 +
1222*Y204 + 1674*Y214 + 554*Y224 + 197*Y234 + 5794*Y244 + 1505*Y254 + 1347*Y264 + 310*Y274 + 259*Y284 +
277*Y294 >= 5827;

3*Y14 + 3*Y24 + 3*Y34 + 3*Y44 + 3*Y54 + 3*Y64 + 3*Y74 + 3*Y84 + 3*Y94 + 3*Y104 + 3*Y114 + 3*Y124 + 3*Y134 +
3*Y144 + 3*Y154 + 3*Y164 + 3*Y174 + 3*Y184 + 3*Y194 + 3*Y204 + 3*Y214 + 3*Y224 + 3*Y234 + 3*Y244 + 3*Y254 +
3*Y264 + 3*Y274 + 3*Y284 + 3*Y294 >= 3;

4*Y14 + 3*Y24 + 1*Y34 + 4*Y44 + 3*Y54 + 1*Y64 + 3*Y74 + 4*Y84 + 2*Y94 + 1*Y104 + 4*Y114 + 2*Y124 + 4*Y134 +
3*Y144 + 2*Y154 + 4*Y164 + 1*Y174 + 2*Y184 + 3*Y194 + 4*Y204 + 3*Y214 + 3*Y224 + 2*Y234 + 4*Y244 + 3*Y254 +
4*Y264 + 2*Y274 + 3*Y284 + 3*Y294 >= 4;

Y14 + Y24 + Y34 + Y44 + Y54 + Y64 + Y74 + Y84 + Y94 + Y104 + Y114 + Y124 + Y134 + Y144 + Y154 + Y164 + Y174 +
Y184 + Y194 + Y204 + Y214 + Y224 + Y234 + Y244 + Y254 + Y264 + Y274 + Y284 + Y294 = 1;

@Free(X4);
Y14 >=0; Y24 >=0; Y34 >=0; Y44 >=0; Y54 >=0; Y64 >=0; Y74 >=0; Y84 >=0; Y94 >=0; Y104 >=0; Y114 >=0; Y124
>=0; Y134 >=0; Y144 >=0; Y154 >=0; Y164 >=0; Y174 >=0; Y184 >=0; Y194 >=0; Y204 >=0; Y214 >=0; Y224 >=0; Y234
>=0; Y244 >=0; Y254 >=0; Y264 >=0; Y274 >=0; Y284 >=0; Y294 >=0;

```

### SOLUTION OF BCC MODEL

File		Edit	LINGO	Window	Help
Global optimal solution found.					
Objective value:		1.000000			
Infeasibilities:		0.000000			
Total solver iterations:		6			
Variable	Value	Reduced Cost			
X4	1.000000	0.000000			
Y14	0.000000	1.147845			
Y24	0.000000	0.7949186E-01			
Y34	0.000000	0.1309850			
Y44	1.000000	0.1110223E-15			
Y54	0.000000	0.000000			
Y64	0.000000	0.1256239			
Y74	0.000000	0.3207240			
Y84	0.000000	0.7425634			
Y94	0.000000	0.2035274			
Y104	0.000000	0.1848725			
Y114	0.000000	1.644292			
Y124	0.000000	0.000000			

Y134	0.000000	0.5910326
Y144	0.000000	0.3056588
Y154	0.000000	0.2039223
Y164	0.000000	1.834576
Y174	0.000000	0.1226953
Y184	0.000000	0.2087104
Y194	0.000000	0.8407192
Y204	0.000000	1.197844
Y214	0.000000	0.6025190
Y224	0.000000	0.3158194
Y234	0.000000	0.1846515
Y244	0.000000	2.813353
Y254	0.000000	0.8310875
Y264	0.000000	0.6695283
Y274	0.000000	0.3723602
Y284	0.000000	0.4503995
Y294	0.000000	0.9064861E-01

## SUMMARY

Efficiency of Warehouse 4 (Bangalore) = 1

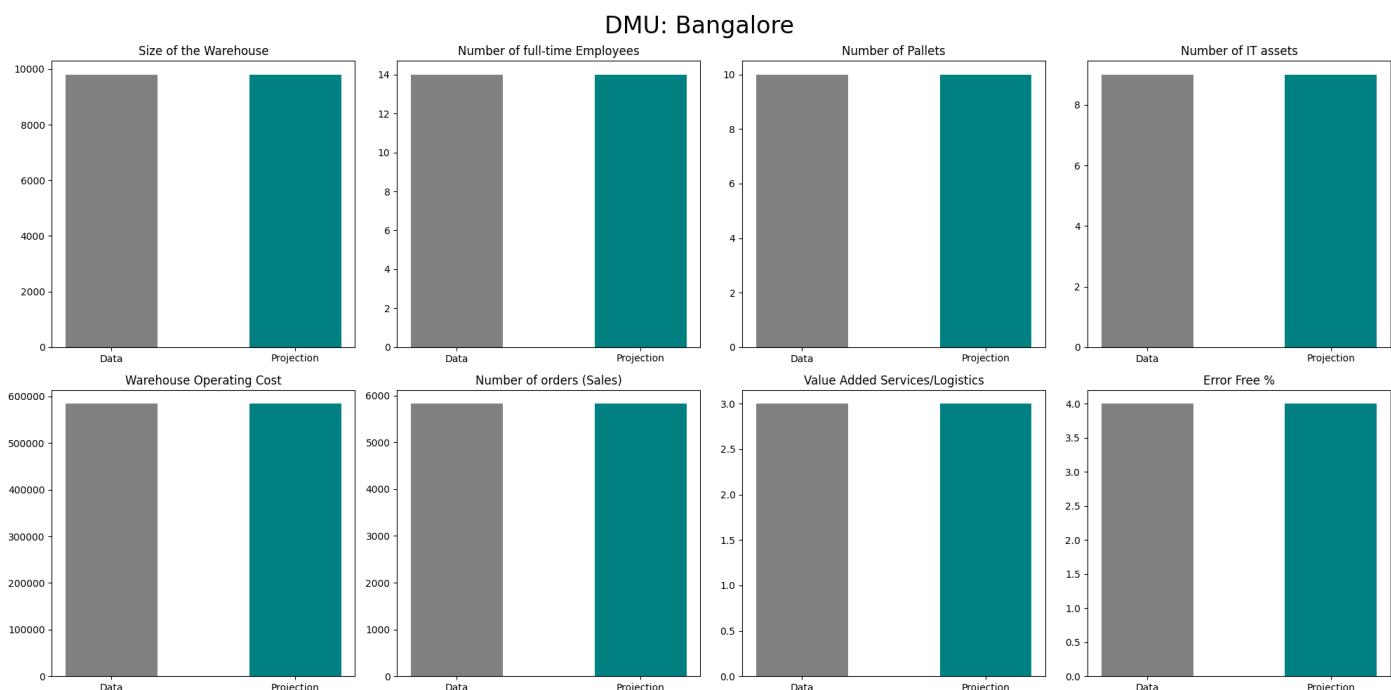
Warehouse 4 (Bangalore) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	9800	9800	0
No. of Full-time Employees	14	14	0
No. of Pallets	10	10	0
No. of IT assets	9	9	0
Warehouse Operating Cost	584300	584300	0
No. of Orders (Sales)	5827	5827	0
Level of Value-Added Services	3	3	0
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 4 (Bangalore)	1



## WAREHOUSE 5 (Bhiwandi)

### BCC MODEL

```

!Dual Objective Function;
MIN = X5;

!Subject to;
13100*Y15 + 2000*Y25 + 550*Y35 + 9800*Y45 + 7500*Y55 + 550*Y65 + 4800*Y75 + 10250*Y85 + 2300*Y95 + 1000*Y105
+ 20700*Y115 + 1200*Y125 + 11000*Y135 + 4100*Y145 + 2000*Y155 +
21000*Y165 + 500*Y175 + 2152*Y185 + 9700*Y195 + 15000*Y205 + 9000*Y215 + 4600*Y225 + 2000*Y235 + 37324*Y245
+ 11000*Y255 + 10000*Y265 + 4000*Y275 + 5500*Y285 + 2000*Y295 - 7500*X5 <= 0;

7*Y15 + 2*Y25 + 2*Y35 + 14*Y45 + 4*Y55 + 2*Y65 + 3*Y75 + 5*Y85 + 2*Y95 + 1*Y105 + 21*Y115 + 6*Y125 + 13*Y135
+ 2*Y145 + 2*Y155 + 5*Y165 + 2*Y175 + 4*Y185 + 5*Y195 + 15*Y205 + 6*Y215 + 5*Y225 + 2*Y235 + 48*Y245 + 9*Y255
+ 4*Y265 + 2*Y275 + 2*Y285 + 8*Y295 - 4*X5 <= 0;

320*Y15 + 7*Y25 + 2*Y35 + 10*Y45 + 7*Y55 + 2*Y65 + 7*Y75 + 20*Y85 + 7*Y95 + 30*Y105 + 200*Y115 + 7*Y125 +
200*Y135 + 7*Y145 + 2*Y155 + 338*Y165 + 2*Y175 + 48*Y185 + 7*Y195 + 200*Y205 + 7*Y215 + 7*Y225 + 7*Y235 +
550*Y245 + 200*Y255 + 7*Y265 + 2*Y275 + 50*Y285 + 2*Y295 - 7*X5 <= 0;

9*Y15 + 4*Y25 + 2*Y35 + 9*Y45 + 4*Y55 + 3*Y65 + 6*Y75 + 7*Y85 + 4*Y95 + 4*Y105 + 11*Y115 + 5*Y125 + 12*Y135 +
3*Y145 + 3*Y155 + 10*Y165 + 2*Y175 + 7*Y185 + 5*Y195 + 12*Y205 + 7*Y215 + 5*Y225 + 2*Y235 + 25*Y245 + 9*Y255
+ 5*Y265 + 2*Y275 + 5*Y285 + 6*Y295 - 4*X5 <= 0;

820931*Y15 + 147596*Y25 + 86404*Y35 + 584300*Y45 + 238265*Y55 + 147473*Y65 + 420908*Y75 + 239046*Y85 +
171183*Y95 + 86967*Y105 + 142521*Y115 + 1372680*Y125 + 119500*Y135 + 247573*Y145 + 93157*Y155 +
1994765*Y165 + 29538*Y175 + 226845*Y185 + 117310*Y195 + 955890*Y205 + 3333230*Y215 + 2349633*Y225 +
139434*Y235 + 2090879*Y245 + 755723*Y255 + 374615*Y265 + 224382*Y275 + 194903*Y285 + 173934*Y295 -
238265*X5 <= 0;

229*Y15 + 354*Y25 + 115*Y35 + 5827*Y45 + 4776*Y55 + 152*Y65 + 661*Y75 + 1019*Y85 + 278*Y95 + 60*Y105 +
2155*Y115 + 908*Y125 + 2593*Y135 + 272*Y145 + 64*Y155 + 1053*Y165 + 137*Y175 + 138*Y185 + 523*Y195 +
1222*Y205 + 1674*Y215 + 554*Y225 + 197*Y235 + 5794*Y245 + 1505*Y255 + 1347*Y265 + 310*Y275 + 259*Y285 +
277*Y295 >= 4776;

3*Y15 + 3*Y25 + 3*Y35 + 3*Y45 + 3*Y55 + 3*Y65 + 3*Y75 + 3*Y85 + 3*Y95 + 3*Y105 + 3*Y115 + 3*Y125 + 3*Y135 +
3*Y145 + 3*Y155 + 3*Y165 + 3*Y175 + 3*Y185 + 3*Y195 + 3*Y205 + 3*Y215 + 3*Y225 + 3*Y235 + 3*Y245 + 3*Y255 +
3*Y265 + 3*Y275 + 3*Y285 + 3*Y295 >= 3;

4*Y15 + 3*Y25 + 1*Y35 + 4*Y45 + 3*Y55 + 1*Y65 + 3*Y75 + 4*Y85 + 2*Y95 + 1*Y105 + 4*Y115 + 2*Y125 + 4*Y135 +
3*Y145 + 2*Y155 + 4*Y165 + 1*Y175 + 2*Y185 + 3*Y195 + 4*Y205 + 3*Y215 + 3*Y225 + 2*Y235 + 4*Y245 + 3*Y255 +
4*Y265 + 2*Y275 + 3*Y285 + 3*Y295 >= 3;

Y15 + Y25 + Y35 + Y45 + Y55 + Y65 + Y75 + Y85 + Y95 + Y105 + Y115 + Y125 + Y135 + Y145 + Y155 + Y165 + Y175 +
Y185 + Y195 + Y205 + Y215 + Y225 + Y235 + Y245 + Y255 + Y265 + Y275 + Y285 + Y295 = 1;

@Free(X5);
Y15 >=0; Y25 >=0; Y35 >=0; Y45 >=0; Y55 >=0; Y65 >=0; Y75 >=0; Y85 >=0; Y95 >=0; Y105 >=0; Y115 >=0; Y125
>=0; Y135 >=0; Y145 >=0; Y155 >=0; Y165 >=0; Y175 >=0; Y185 >=0; Y195 >=0; Y205 >=0; Y215 >=0;
Y225 >=0; Y235 >=0; Y245 >=0; Y255 >=0; Y265 >=0; Y275 >=0; Y285 >=0; Y295 >=0;

```

### SOLUTION OF BCC MODEL

File Edit LINGO Window Help		
Global optimal solution found.		
Objective value:	1.000000	
Infeasibilities:	0.000000	
Total solver iterations:	2	
Variable	Value	Reduced Cost
X5	1.000000	-0.1110223E-15
Y15	0.000000	3.459818
Y25	0.000000	0.5459019
Y35	0.000000	0.3384461
Y45	0.000000	1.230744
Y55	1.000000	0.1110223E-15
Y65	0.000000	0.5866282
Y75	0.000000	1.627024
Y85	0.000000	0.7926524
Y95	0.000000	0.6606637
Y105	0.000000	0.3582182
Y115	0.000000	0.1881854
Y125	0.000000	5.564012

Y135	0.000000	0.000000
Y145	0.000000	0.9820567
Y155	0.000000	0.3774251
Y165	0.000000	8.210407
Y175	0.000000	0.9552456E-01
Y185	0.000000	0.9318809
Y195	0.000000	0.3835935
Y205	0.000000	3.792221
Y215	0.000000	13.61994
Y225	0.000000	9.732367
Y235	0.000000	0.5445691
Y245	0.000000	7.665179
Y255	0.000000	2.894102
Y265	0.000000	1.289383
Y275	0.000000	0.8758580
Y285	0.000000	0.7731040
Y295	0.000000	0.6713490

## SUMMARY

Efficiency of Warehouse 5 (Bhiwandi) = 1

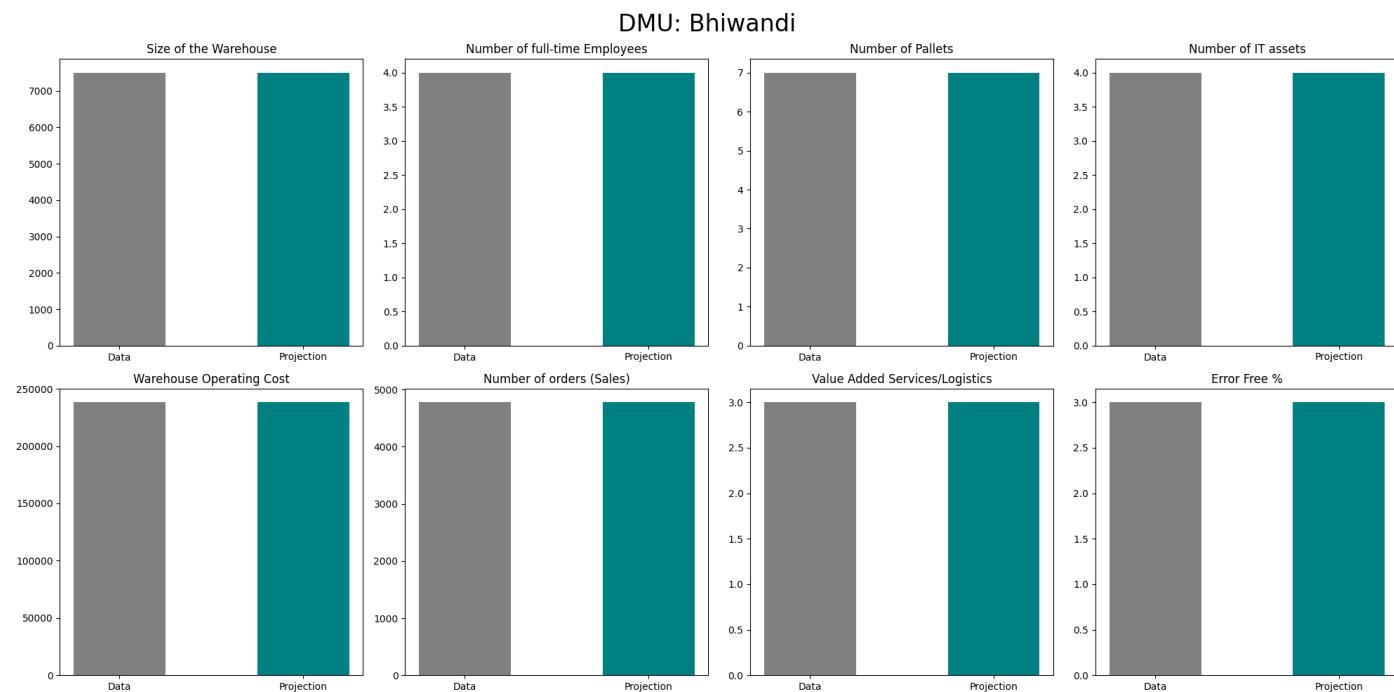
Warehouse 5 (Bhiwandi) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	7500	7500	0
No. of Full-time Employees	4	4	0
No. of Pallets	7	7	0
No. of IT assets	4	4	0
Warehouse Operating Cost	238265	238265	0
No. of Orders (Sales)	4776	4776	0
Level of Value-Added Services	3	3	0
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 5 (Bhiwandi)	1



## WAREHOUSE 6 (Bhopal)

### BCC MODEL

```

!Dual Objective Function;
MIN = X6;

!Subject to;
13100*Y16 + 2000*Y26 + 550*Y36 + 9800*Y46 + 7500*Y56 + 550*Y66 + 4800*Y76 + 10250*Y86 + 2300*Y96 + 1000*Y106
+ 20700*Y116 + 1200*Y126 + 11000*Y136 + 4100*Y146 + 2000*Y156 +
21000*Y166 + 500*Y176 + 2152*Y186 + 9700*Y196 + 15000*Y206 + 9000*Y216 + 4600*Y226 + 2000*Y236 + 37324*Y246
+ 11000*Y256 + 10000*Y266 + 4000*Y276 + 5500*Y286 + 2000*Y296 - 550*X6 <=0;

7*Y16 + 2*Y26 + 2*Y36 + 14*Y46 + 4*Y56 + 2*Y66 + 3*Y76 + 5*Y86 + 2*Y96 + 1*Y106 + 21*Y116 + 6*Y126 + 13*Y136
+ 2*Y146 + 2*Y156 + 5*Y166 + 2*Y176 + 4*Y186 + 5*Y196 + 15*Y206 + 6*Y216 + 5*Y226 + 2*Y236 + 48*Y246 + 9*Y256
+ 4*Y266 + 2*Y276 + 2*Y286 + 8*Y296 - 2*X6 <=0;

320*Y16 + 7*Y26 + 2*Y36 + 10*Y46 + 7*Y56 + 2*Y66 + 7*Y76 + 20*Y86 + 7*Y96 + 30*Y106 + 200*Y116 + 7*Y126 +
200*Y136 + 7*Y146 + 2*Y156 + 338*Y166 + 2*Y176 + 48*Y186 + 7*Y196 +
200*Y206 + 7*Y216 + 7*Y226 + 7*Y236 + 550*Y246 + 200*Y256 + 7*Y266 + 2*Y276 + 50*Y286 + 2*Y296 - 2*X6 <= 0;

9*Y16 + 4*Y26 + 2*Y36 + 9*Y46 + 4*Y56 + 3*Y66 + 6*Y76 + 7*Y86 + 4*Y96 + 4*Y106 + 11*Y116 + 5*Y126 + 12*Y136 +
3*Y146 + 3*Y156 + 10*Y166 + 2*Y176 + 7*Y186 + 5*Y196 + 12*Y206 + 7*Y216 + 5*Y226 + 2*Y236 + 25*Y246 + 9*Y256
+ 5*Y266 + 2*Y276 + 5*Y286 + 6*Y296 - 3*X6 <= 0;

820931*Y16 + 147596*Y26 + 86404*Y36 + 584300*Y46 + 238265*Y56 + 147473*Y66 + 420908*Y76 + 239046*Y86 +
171183*Y96 + 86967*Y106 + 142521*Y116 + 1372680*Y126 + 119500*Y136 + 247573*Y146 + 93157*Y156 +
1994765*Y166 + 29538*Y176 + 226845*Y186 + 117310*Y196 + 955890*Y206 + 3333230*Y216 + 2349633*Y226 +
139434*Y236 + 2090879*Y246 + 755723*Y256 + 374615*Y266 + 224382*Y276 + 194903*Y286 + 173934*Y296 -
147473*X6 <= 0;

229*Y16 + 354*Y26 + 115*Y36 + 5827*Y46 + 4776*Y56 + 152*Y66 + 661*Y76 + 1019*Y86 + 278*Y96 + 60*Y106 +
2155*Y116 + 908*Y126 + 2593*Y136 + 272*Y146 + 64*Y156 + 1053*Y166 + 137*Y176 + 138*Y186 + 523*Y196 +
1222*Y206 + 1674*Y216 + 554*Y226 + 197*Y236 + 5794*Y246 + 1505*Y256 + 1347*Y266 + 310*Y276 + 259*Y286 +
277*Y296 >= 152;

3*Y16 + 3*Y26 + 3*Y36 + 3*Y46 + 3*Y56 + 3*Y66 + 3*Y76 + 3*Y86 + 3*Y96 + 3*Y106 + 3*Y116 + 3*Y126 + 3*Y136 +
3*Y146 + 3*Y156 + 3*Y166 + 3*Y176 + 3*Y186 + 3*Y196 + 3*Y206 + 3*Y216 + 3*Y226 + 3*Y236 + 3*Y246 + 3*Y256 +
3*Y266 + 3*Y276 + 3*Y286 + 3*Y296 >= 3;

4*Y16 + 3*Y26 + 1*Y36 + 4*Y46 + 3*Y56 + 1*Y66 + 3*Y76 + 4*Y86 + 2*Y96 + 1*Y106 + 4*Y116 + 2*Y126 + 4*Y136 +
3*Y146 + 2*Y156 + 4*Y166 + 1*Y176 + 2*Y186 + 3*Y196 + 4*Y206 + 3*Y216 + 3*Y226 + 2*Y236 + 4*Y246 + 3*Y256 +
4*Y266 + 2*Y276 + 3*Y286 + 3*Y296 >= 1;

Y16 + Y26 + Y36 + Y46 + Y56 + Y66 + Y76 + Y86 + Y96 + Y106 + Y116 + Y126 + Y136 + Y146 + Y156 + Y166 + Y176 +
Y186 + Y196 + Y206 + Y216 + Y226 + Y236 + Y246 + Y256 + Y266 + Y276 + Y286 + Y296 = 1;

@Free(X6);
Y16 >=0; Y26 >=0; Y36 >=0; Y46 >=0; Y56 >=0; Y66 >=0; Y76 >=0; Y86 >=0; Y96 >=0; Y106 >=0; Y116 >=0;
Y126 >=0; Y136 >=0; Y146 >=0; Y156 >=0; Y166 >=0; Y176 >=0; Y186 >=0; Y196 >=0; Y206 >=0; Y216 >=0;
Y226 >=0; Y236 >=0; Y246 >=0; Y256 >=0; Y266 >=0; Y276 >=0; Y286 >=0; Y296 >=0;

```

### SOLUTION OF BCC MODEL

File		Edit	LINGO	Window	Help
Global optimal solution found.					
Objective value:		1.000000			
Infeasibilities:		0.000000			
Total solver iterations:		4			
Variable	Value	Reduced Cost			
X6	1.000000	0.1389219E-16			
Y16	0.000000	7.896552			
Y26	0.000000	0.8620690E-01			
Y36	0.000000	0.3330669E-15			
Y46	0.000000	5.931034			
Y56	0.000000	1.051724			
Y66	1.000000	0.1110223E-15			
Y76	0.000000	0.5689655			
Y86	0.000000	1.758621			
Y96	0.000000	0.8620690E-01			
Y106	0.000000	0.1110223E-15			
Y116	0.000000	12.58621			
Y126	0.000000	2.017241			

Y136	0.000000	8.724138
Y146	0.000000	0.8620690E-01
Y156	0.000000	0.2541599E-15
Y166	0.000000	7.241379
Y176	0.000000	0.3330669E-15
Y186	0.000000	1.758621
Y196	0.000000	1.534483
Y206	0.000000	9.689655
Y216	0.000000	2.017241
Y226	0.000000	1.534483
Y236	0.000000	0.8620690E-01
Y246	0.000000	31.65517
Y256	0.000000	6.793103
Y266	0.000000	1.051724
Y276	0.000000	0.1526557E-15
Y286	0.000000	0.8275862
Y296	0.000000	2.896552

## SUMMARY

Efficiency of Warehouse 6 (Bhopal) = 1

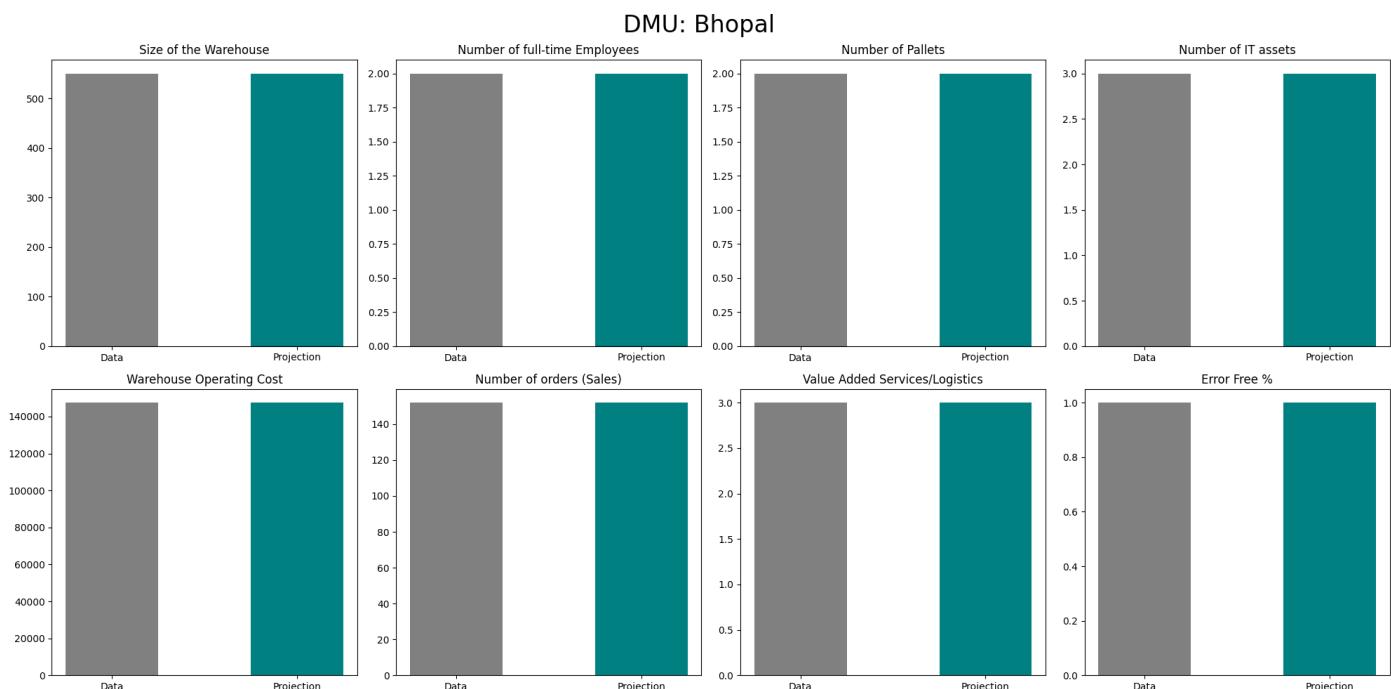
Warehouse 6 (Bhopal) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	550	550	0
No. of Full-time Employees	2	2	0
No. of Pallets	2	2	0
No. of IT assets	3	3	0
Warehouse Operating Cost	147473	147473	0
No. of Orders (Sales)	152	152	0
Level of Value-Added Services	3	3	0
Error Free (%)	1	1	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 6 (Bhopal)	1



## WAREHOUSE 7 (Bhubneshwar)

### BCC MODEL

```

!Dual Objective Function;

MIN = X7;

!Subject to;
13100*Y17 + 2000*Y27 + 550*Y37 + 9800*Y47 + 7500*Y57 + 550*Y67 + 4800*Y77 + 10250*Y87 + 2300*Y97 + 1000*Y107
+ 20700*Y117 + 1200*Y127 + 11000*Y137 + 4100*Y147 + 2000*Y157 +
21000*Y167 + 500*Y177 + 2152*Y187 + 9700*Y197 + 15000*Y207 + 9000*Y217 + 4600*Y227 + 2000*Y237 + 37324*Y247
+ 11000*Y257 + 10000*Y267 + 4000*Y277 + 5500*Y287 + 2000*Y297 - 4800*X7 <= 0;

7*Y17 + 2*Y27 + 2*Y37 + 14*Y47 + 4*Y57 + 2*Y67 + 3*Y77 + 5*Y87 + 2*Y97 + 1*Y107 + 21*Y117 + 6*Y127 + 13*Y137
+ 2*Y147 + 2*Y157 + 5*Y167 + 2*Y177 + 4*Y187 + 5*Y197 + 15*Y207 + 6*Y217 + 5*Y227 + 2*Y237 + 48*Y247 + 9*Y257
+ 4*Y267 + 2*Y277 + 2*Y287 + 8*Y297 - 3*X7 <= 0;

320*Y17 + 7*Y27 + 2*Y37 + 10*Y47 + 7*Y57 + 2*Y67 + 7*Y77 + 20*Y87 + 7*Y97 + 30*Y107 + 200*Y117 + 7*Y127 +
200*Y137 + 7*Y147 + 2*Y157 + 338*Y167 + 2*Y177 + 48*Y187 + 7*Y197 + 200*Y207 + 7*Y217 + 7*Y227 + 7*Y237 +
550*Y247 + 200*Y257 + 7*Y267 + 2*Y277 + 50*Y287 + 2*Y297 - 7*X7 <= 0;

9*Y17 + 4*Y27 + 2*Y37 + 9*Y47 + 4*Y57 + 3*Y67 + 6*Y77 + 7*Y87 + 4*Y97 + 4*Y107 + 11*Y117 + 5*Y127 + 12*Y137 +
3*Y147 + 3*Y157 + 10*Y167 + 2*Y177 + 7*Y187 + 5*Y197 + 12*Y207 + 7*Y217 + 5*Y227 + 2*Y237 + 25*Y247 + 9*Y257
+ 5*Y267 + 2*Y277 + 5*Y287 + 6*Y297 - 6*X7 <= 0;

820931*Y17 + 147596*Y27 + 86404*Y37 + 584300*Y47 + 238265*Y57 + 147473*Y67 + 420908*Y77 + 239046*Y87 +
171183*Y97 + 86967*Y107 + 142521*Y117 + 1372680*Y127 + 119500*Y137 + 247573*Y147 + 93157*Y157 +
1994765*Y167 + 29538*Y177 + 226845*Y187 + 117310*Y197 + 955890*Y207 + 3333230*Y217 + 2349633*Y227 +
139434*Y237 + 2090879*Y247 + 755723*Y257 + 374615*Y267 + 224382*Y277 + 194903*Y287 + 173934*Y297 -
420908*X7 <= 0;

229*Y17 + 354*Y27 + 115*Y37 + 5827*Y47 + 4776*Y57 + 152*Y67 + 661*Y77 + 1019*Y87 + 278*Y97 + 60*Y107 +
2155*Y117 + 908*Y127 + 2593*Y137 + 272*Y147 + 64*Y157 + 1053*Y167 + 137*Y177 + 138*Y187 + 523*Y197 +
1222*Y207 + 1674*Y217 + 554*Y227 + 197*Y237 + 5794*Y247 + 1505*Y257 + 1347*Y267 + 310*Y277 + 259*Y287 +
277*Y297 >= 661;

3*Y17 + 3*Y27 + 3*Y37 + 3*Y47 + 3*Y57 + 3*Y67 + 3*Y77 + 3*Y87 + 3*Y97 + 3*Y107 + 3*Y117 + 3*Y127 + 3*Y137 +
3*Y147 + 3*Y157 + 3*Y167 + 3*Y177 + 3*Y187 + 3*Y197 + 3*Y207 + 3*Y217 + 3*Y227 + 3*Y237 + 3*Y247 + 3*Y257 +
3*Y267 + 3*Y277 + 3*Y287 + 3*Y297 >= 3;

4*Y17 + 3*Y27 + 1*Y37 + 4*Y47 + 3*Y57 + 1*Y67 + 3*Y77 + 4*Y87 + 2*Y97 + 1*Y107 + 4*Y117 + 2*Y127 + 4*Y137 +
3*Y147 + 2*Y157 + 4*Y167 + 1*Y177 + 2*Y187 + 3*Y197 + 4*Y207 + 3*Y217 + 3*Y227 + 2*Y237 + 4*Y247 + 3*Y257 +
4*Y267 + 2*Y277 + 3*Y287 + 3*Y297 >= 3;

Y17 + Y27 + Y37 + Y47 + Y57 + Y67 + Y77 + Y87 + Y97 + Y107 + Y117 + Y127 + Y137 + Y147 + Y157 + Y167 + Y177 +
Y187 + Y197 + Y207 + Y217 + Y227 + Y237 + Y247 + Y257 + Y267 + Y277 + Y287 + Y297 = 1;

@Free(X7);
Y17 >=0; Y27 >=0; Y37 >=0; Y47 >=0; Y57 >=0; Y67 >=0; Y77 >=0; Y87 >=0; Y97 >=0; Y107 >=0; Y117 >=0;
Y127 >=0; Y137 >=0; Y147 >=0; Y157 >=0; Y167 >=0; Y177 >=0; Y187 >=0; Y197 >=0; Y207 >=0; Y217 >=0;
Y227 >=0; Y237 >=0; Y247 >=0; Y257 >=0; Y267 >=0; Y277 >=0; Y287 >=0; Y297 >=0;

```

### SOLUTION OF BCC MODEL

File Edit LINGO Window Help		
Global optimal solution found.		
Objective value:	0.8387481	
Infeasibilities:	0.1373901E-14	
Total solver iterations:	14	
Variable	Value	Reduced Cost
X7	0.8387481	-0.5551115E-16
Y17	0.000000	21.87928
Y27	0.5161252	-0.1110223E-15
Y37	0.000000	0.2960682
Y47	0.000000	1.404622
Y57	0.3236942E-01	-0.2553513E-14
Y67	0.000000	0.2929447
Y77	0.000000	0.1612519
Y87	0.000000	1.072148
Y97	0.000000	0.3249604
Y107	0.000000	2.050790
Y117	0.000000	15.85106
Y127	0.000000	0.8927337
Y137	0.000000	14.44861
Y147	0.000000	0.2872760E-01
Y157	0.2047840	-0.5551115E-16
Y167	0.000000	22.79924
Y177	0.000000	0.2936918
Y187	0.000000	3.438701

Y197	0.000000	0.5399700
Y207	0.000000	14.92207
Y217	0.000000	0.5936306
Y227	0.000000	0.4843974
Y237	0.000000	0.3286833
Y247	0.000000	43.77880
Y257	0.000000	14.22351
Y267	0.2257527	-0.2636780E-15
Y277	0.2096870E-01	0.3469447E-17
Y287	0.000000	2.967596
Y297	0.000000	0.6151573

## SUMMARY

Efficiency of Warehouse 7 (Bhubaneshwar) = 0.8387481

Warehouse 7 (Bhubaneshwar) is an inefficient warehouse.

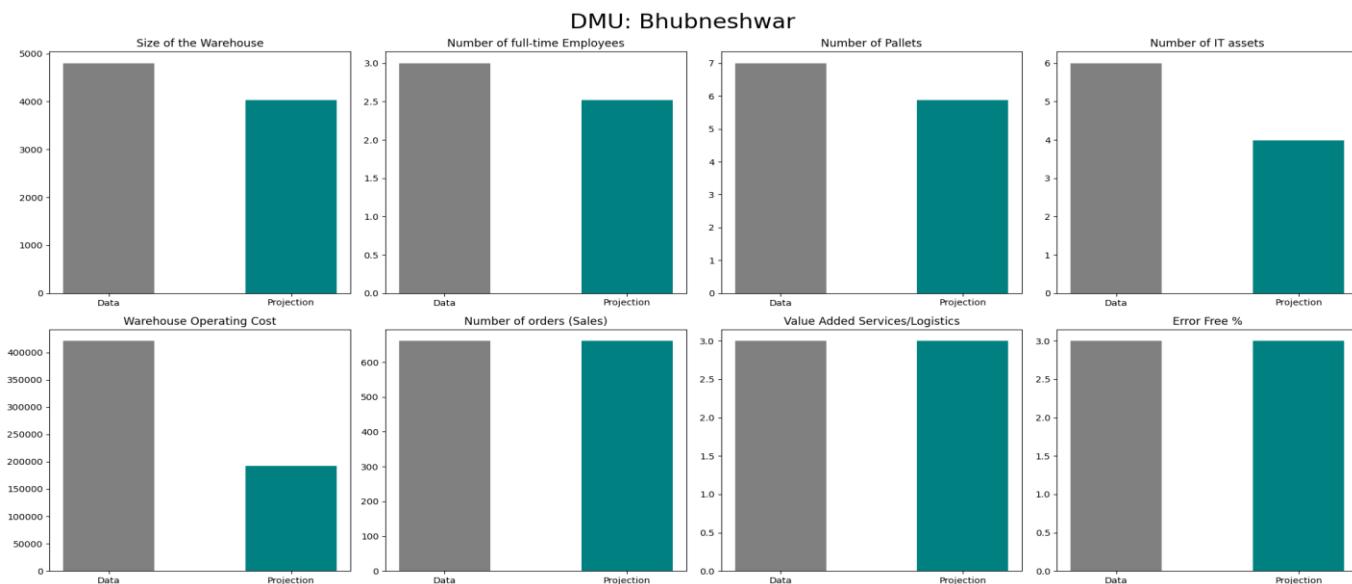
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	4800	4025.98	0
No. of Full-time Employees	3	2.51624	0
No. of Pallets	7	5.87123	0
No. of IT assets	6	3.979	1.053
Warehouse Operating Cost	420908	192245	160790
No. of Orders (Sales)	661	661	0
Level of Value-Added Services	3	3.00003	0
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 2 (Ahmedabad)	0.5161252
Warehouse 5 (Bhiwandi)	0.03236942
Warehouse 15 (Jabalpur)	0.204784
Warehouse 26 (Pune)	0.2257527
Warehouse 27 (Raipur)	0.0209687

In order to make warehouse 8 (Chennai) efficient, they need to decrease size of the warehouse by 16.125%, No of full-time employees by 16.125%, number of pallets by 16.125%, IT Assets by 33.683% , operating cost by 54.326%, whereas value-added logistics needs to be increased by 0.001%.



## WAREHOUSE 8 (Chennai)

### BCC MODEL

```

!Dual Objective Function;
MIN = X8;

!Subject to;
13100*Y18 + 2000*Y28 + 550*Y38 + 9800*Y48 + 7500*Y58 + 550*Y68 + 4800*Y78 + 10250*Y88 + 2300*Y98 + 1000*Y108
+ 20700*Y118 + 1200*Y128 + 11000*Y138 + 4100*Y148 + 2000*Y158 +
21000*Y168 + 500*Y178 + 2152*Y188 + 9700*Y198 + 15000*Y208 + 9000*Y218 + 4600*Y228 + 2000*Y238 + 37324*Y248
+ 11000*Y258 + 10000*Y268 + 4000*Y278 + 5500*Y288 + 2000*Y298 -10250*X8 <=0;

7*Y18 + 2*Y28 + 2*Y38 + 14*Y48 + 4*Y58 + 2*Y68 + 3*Y78 + 5*Y88 + 2*Y98 + 1*Y108 + 21*Y118 + 6*Y128 + 13*Y138
+ 2*Y148 + 2*Y158 + 5*Y168 + 2*Y178 + 4*Y188 + 5*Y198 + 15*Y208 + 6*Y218 + 5*Y228 + 2*Y238 + 48*Y248 + 9*Y258
+ 4*Y268 + 2*Y278 + 2*Y288 + 8*Y298 -5*X8 <= 0;

320*Y18 + 7*Y28 + 2*Y38 + 10*Y48 + 7*Y58 + 2*Y68 + 7*Y78 + 20*Y88 + 7*Y98 + 30*Y108 + 200*Y118 + 7*Y128 +
200*Y138 + 7*Y148 + 2*Y158 + 338*Y168 + 2*Y178 + 48*Y188 + 7*Y198 + 200*Y208 + 7*Y218 + 7*Y228 + 7*Y238 +
550*Y248 + 200*Y258 + 7*Y268 + 2*Y278 + 50*Y288 + 2*Y298 -20*X8 <= 0;

9*Y18 + 4*Y28 + 2*Y38 + 9*Y48 + 4*Y58 + 3*Y68 + 6*Y78 + 7*Y88 + 4*Y98 + 4*Y108 + 11*Y118 + 5*Y128 + 12*Y138 +
3*Y148 + 3*Y158 + 10*Y168 + 2*Y178 + 7*Y188 + 5*Y198 + 12*Y208 + 7*Y218 + 5*Y228 + 2*Y238 + 25*Y248 + 9*Y258
+ 5*Y268 + 2*Y278 + 5*Y288 + 6*Y298 - 7*X8 <= 0;

820931*Y18 + 147596*Y28 + 86404*Y38 + 584300*Y48 + 238265*Y58 + 147473*Y68 + 420908*Y78 + 239046*Y88 +
171183*Y98 + 86967*Y108 + 142521*Y118 + 1372680*Y128 + 119500*Y138 + 247573*Y148 + 93157*Y158 +
1994765*Y168 + 29538*Y178 + 226845*Y188 + 117310*Y198 + 955890*Y208 + 3333230*Y218 + 2349633*Y228 +
139434*Y238 + 2090879*Y248 + 755723*Y258 + 374615*Y268 + 224382*Y278 + 194903*Y288 + 173934*Y298 - 239046*X8
<=0;

229*Y18 + 354*Y28 + 115*Y38 + 5827*Y48 + 4776*Y58 + 152*Y68 + 661*Y78 + 1019*Y88 + 278*Y98 + 60*Y108 +
2155*Y118 + 908*Y128 + 2593*Y138 + 272*Y148 + 64*Y158 + 1053*Y168 + 137*Y178 + 138*Y188 + 523*Y198 +
1222*Y208 + 1674*Y218 + 554*Y228 + 197*Y238 + 5794*Y248 + 1505*Y258 + 1347*Y268 + 310*Y278 + 259*Y288 +
277*Y298 >= 1019;

3*Y18 + 3*Y28 + 3*Y38 + 3*Y48 + 3*Y58 + 3*Y68 + 3*Y78 + 3*Y88 + 3*Y98 + 3*Y108 + 3*Y118 + 3*Y128 + 3*Y138 +
3*Y148 + 3*Y158 + 3*Y168 + 3*Y178 + 3*Y188 + 3*Y198 + 3*Y208 + 3*Y218 + 3*Y228 + 3*Y238 + 3*Y248 + 3*Y258 +
3*Y268 + 3*Y278 + 3*Y288 + 3*Y298 >=3 ;

4*Y18 + 3*Y28 + 1*Y38 + 4*Y48 + 3*Y58 + 1*Y68 + 3*Y78 + 4*Y88 + 2*Y98 + 1*Y108 + 4*Y118 + 2*Y128 + 4*Y138 +
3*Y148 + 2*Y158 + 4*Y168 + 1*Y178 + 2*Y188 + 3*Y198 + 4*Y208 + 3*Y218 + 3*Y228 + 2*Y238 + 4*Y248 + 3*Y258 +
4*Y268 + 2*Y278 + 3*Y288 + 3*Y298 >=4;

Y18 + Y28 + Y38 + Y48 + Y58 + Y68 + Y78 + Y88 + Y98 + Y108 + Y118 + Y128 + Y138 + Y148 + Y158 + Y168 + Y178 +
Y188 + Y198 + Y208 + Y218 + Y228 + Y238 + Y248 + Y258 + Y268 + Y278 + Y288 + Y298 = 1;

@Free(X8);
Y18 >=0; Y28 >=0; Y38 >=0; Y48 >=0; Y58 >=0; Y68 >=0; Y78 >=0; Y88 >=0; Y98 >=0; Y108 >=0; Y118 >=0;
Y128 >=0; Y138 >=0; Y148 >=0; Y158 >=0; Y168 >=0; Y178 >=0; Y188 >=0; Y198 >=0; Y208 >=0; Y218 >=0;
Y228 >=0; Y238 >=0; Y248 >=0; Y258 >=0; Y268 >=0; Y278 >=0; Y288 >=0; Y298 >=0;

```

### SOLUTION OF BCC MODEL

File Edit LINGO Window Help		
Global optimal solution found.		
Objective value:	1.000000	
Infeasibilities:	0.000000	
Total solver iterations:	6	
Variable	Value	Reduced Cost
X8	1.000000	-0.2220446E-15
Y18	0.000000	2.425655
Y28	0.000000	0.000000
Y38	0.000000	0.5613249
Y48	0.000000	1.057241
Y58	0.000000	-0.3330669E-15
Y68	0.000000	0.7588910
Y78	0.000000	0.9101839
Y88	1.000000	0.2775558E-15
Y98	0.000000	0.4581384
Y108	0.000000	0.5644851
Y118	0.000000	0.4162001
Y128	0.000000	4.505175

Y138	0.000000	-0.4440892E-15
Y148	0.000000	0.3354920
Y158	0.000000	0.2136313
Y168	0.000000	6.159986
Y178	0.000000	0.3725833
Y188	0.000000	0.7794417
Y198	0.000000	0.8326673E-16
Y208	0.000000	2.940458
Y218	0.000000	10.50927
Y228	0.000000	7.333576
Y238	0.000000	0.3606480
Y248	0.000000	7.968394
Y258	0.000000	2.405275
Y268	0.000000	0.3637938
Y278	0.000000	0.6240851
Y288	0.000000	0.2166340
Y298	0.000000	0.3145236

## SUMMARY

Efficiency of Warehouse 8 (Chennai) = 1

Warehouse 8 (Chennai) is an efficient warehouse.

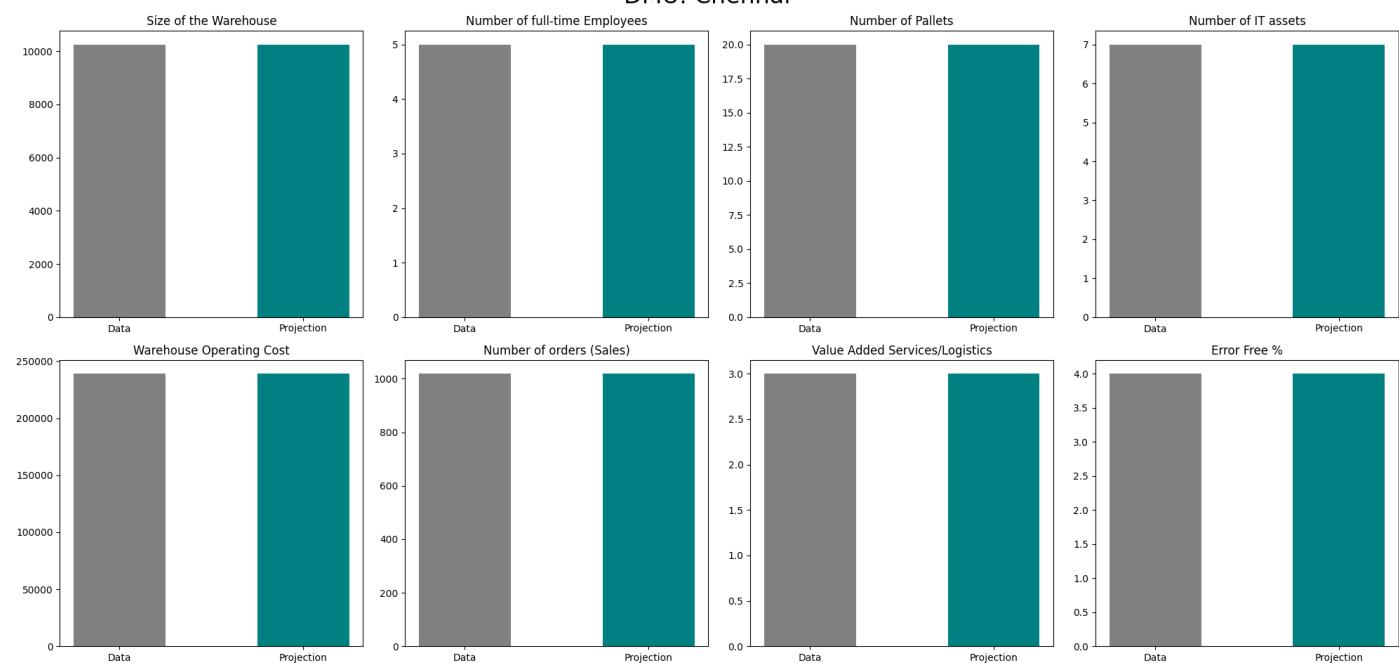
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	10250	10250	0
No. of Full-time Employees	5	5	0
No. of Pallets	20	20	0
No. of IT assets	7	7	0
Warehouse Operating Cost	239046	239046	0
No. of Orders (Sales)	1019	1019	0
Level of Value-Added Services	3	3	0
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 8 (Chennai)	1

DMU: Chennai



## WAREHOUSE 9 (Dehradun)

### BCC MODEL

```

!Dual Objective Function;

MIN = X9;

!Subject to;
13100*Y19 + 2000*Y29 + 550*Y39 + 9800*Y49 + 7500*Y59 + 550*Y69 + 4800*Y79 + 10250*Y89 + 2300*Y99 + 1000*Y109
+ 20700*Y119 + 1200*Y129 + 11000*Y139 + 4100*Y149 + 2000*Y159 +
21000*Y169 + 500*Y179 + 2152*Y189 + 9700*Y199 + 15000*Y209 + 9000*Y219 + 4600*Y229 + 2000*Y239 + 37324*Y249
+ 11000*Y259 + 10000*Y269 + 4000*Y279 + 5500*Y289 + 2000*Y299 - 2300*X9 <=0;

7*Y19 + 2*Y29 + 2*Y39 + 14*Y49 + 4*Y59 + 2*Y69 + 3*Y79 + 5*Y89 + 2*Y99 + 1*Y109 + 21*Y119 + 6*Y129 + 13*Y139
+ 2*Y149 + 2*Y159 + 5*Y169 + 2*Y179 + 4*Y189 + 5*Y199 + 15*Y209 + 6*Y219 + 5*Y229 + 2*Y239 + 48*Y249 + 9*Y259
+ 4*Y269 + 2*Y279 + 2*Y289 + 8*Y299 - 2*X9 <=0;

320*Y19 + 7*Y29 + 2*Y39 + 10*Y49 + 7*Y59 + 2*Y69 + 7*Y79 + 20*Y89 + 7*Y99 + 30*Y109 + 200*Y119 + 7*Y129 +
200*Y139 + 7*Y149 + 2*Y159 + 338*Y169 + 2*Y179 + 48*Y189 + 7*Y199 + 200*Y209 + 7*Y219 + 7*Y229 + 7*Y239 +
550*Y249 + 200*Y259 + 7*Y269 + 2*Y279 + 50*Y289 + 2*Y299 - 7*X9 <= 0;

9*Y19 + 4*Y29 + 2*Y39 + 9*Y49 + 4*Y59 + 3*Y69 + 6*Y79 + 7*Y89 + 4*Y99 + 4*Y109 + 11*Y119 + 5*Y129 + 12*Y139 +
3*Y149 + 3*Y159 + 10*Y169 + 2*Y179 + 7*Y189 + 5*Y199 + 12*Y209 + 7*Y219 + 5*Y229 + 2*Y239 + 25*Y249 + 9*Y259
+ 5*Y269 + 2*Y279 + 5*Y289 + 6*Y299 - 4*X9 <= 0;

820931*Y19 + 147596*Y29 + 86404*Y39 + 584300*Y49 + 238265*Y59 + 147473*Y69 + 420908*Y79 + 239046*Y89 +
171183*Y99 + 86967*Y109 + 142521*Y119 + 1372680*Y129 + 119500*Y139 + 247573*Y149 + 93157*Y159 +
1994765*Y169 + 29538*Y179 + 226845*Y189 + 117310*Y199 + 955890*Y209 + 3333230*Y219 + 2349633*Y229 +
139434*Y239 + 2090879*Y249 + 755723*Y259 + 374615*Y269 + 224382*Y279 + 194903*Y289 + 173934*Y299 - 171183*X9
<= 0;

229*Y19 + 354*Y29 + 115*Y39 + 5827*Y49 + 4776*Y59 + 152*Y69 + 661*Y79 + 1019*Y89 + 278*Y99 + 60*Y109 +
2155*Y119 + 908*Y129 + 2593*Y139 + 272*Y149 + 64*Y159 + 1053*Y169 + 137*Y179 + 138*Y189 + 523*Y199 +
1222*Y209 + 1674*Y219 + 554*Y229 + 197*Y239 + 5794*Y249 + 1505*Y259 + 1347*Y269 + 310*Y279 + 259*Y289 +
277*Y299 >=278;

3*Y19 + 3*Y29 + 3*Y39 + 3*Y49 + 3*Y59 + 3*Y69 + 3*Y79 + 3*Y89 + 3*Y99 + 3*Y109 + 3*Y119 + 3*Y129 + 3*Y139 +
3*Y149 + 3*Y159 + 3*Y169 + 3*Y179 + 3*Y189 + 3*Y199 + 3*Y209 + 3*Y219 + 3*Y229 + 3*Y239 + 3*Y249 + 3*Y259 +
3*Y269 + 3*Y279 + 3*Y289 + 3*Y299 >=3;

4*Y19 + 3*Y29 + 1*Y39 + 4*Y49 + 3*Y59 + 1*Y69 + 3*Y79 + 4*Y89 + 2*Y99 + 1*Y109 + 4*Y119 + 2*Y129 + 4*Y139 +
3*Y149 + 2*Y159 + 4*Y169 + 1*Y179 + 2*Y189 + 3*Y199 + 4*Y209 + 3*Y219 + 3*Y229 + 2*Y239 + 4*Y249 + 3*Y259 +
4*Y269 + 2*Y279 + 3*Y289 + 3*Y299 >= 2;

Y19 + Y29 + Y39 + Y49 + Y59 + Y69 + Y79 + Y89 + Y99 + Y109 + Y119 + Y129 + Y139 + Y149 + Y159 + Y169 + Y179 +
Y189 + Y199 + Y209 + Y219 + Y229 + Y239 + Y249 + Y259 + Y269 + Y279 + Y289 + Y299 = 1;

@Free(X9);
Y19 >=0; Y29 >=0; Y39 >=0; Y49 >=0; Y59 >=0; Y69 >=0; Y79 >=0; Y89 >=0; Y99 >=0; Y109 >=0; Y119 >=0; Y129
>=0; Y139 >=0; Y149 >=0; Y159 >=0; Y169 >=0; Y179 >=0; Y189 >=0; Y199 >=0; Y209 >=0; Y219 >=0;
Y229 >=0; Y239 >=0; Y249 >=0; Y259 >=0; Y269 >=0; Y279 >=0; Y289 >=0; Y299 >=0;

```

### SOLUTION OF BCC MODEL

Global optimal solution found.		
Variable	Value	Reduced Cost
X9	0.9514737	-0.5637851E-16
Y19	0.000000	6.839852
Y29	0.3409041	-0.7771561E-15
Y39	0.000000	0.6740573E-02
Y49	0.000000	4.119869
Y59	0.3906967E-02	0.1110223E-13
Y69	0.2185827	0.2220446E-15
Y79	0.000000	0.4156234
Y89	0.000000	1.444895
Y99	0.000000	0.4852626E-01
Y109	0.1048665	-0.2220446E-15
Y119	0.000000	10.81507
Y129	0.000000	1.631560
Y139	0.000000	7.127533
Y149	0.000000	0.5561262E-01
Y159	0.000000	0.1612942E-01
Y169	0.000000	6.222935
Y179	0.2136193E-01	0.9020562E-16
Y189	0.000000	1.522665
Y199	0.000000	1.379766
Y209	0.000000	8.364865

Y219	0.000000	1.612960
Y229	0.000000	1.330792
Y239	0.000000	0.6020299E-01
Y249	0.000000	26.94562
Y259	0.000000	5.687911
Y269	0.000000	0.7576825
Y279	0.3103778	0.1526557E-15
Y289	0.000000	0.6987296
Y299	0.000000	2.515381

## SUMMARY

Efficiency of Warehouse 9 (Dehradun) = 0.9514737

Warehouse 9 (Dehradun) is an inefficient warehouse.

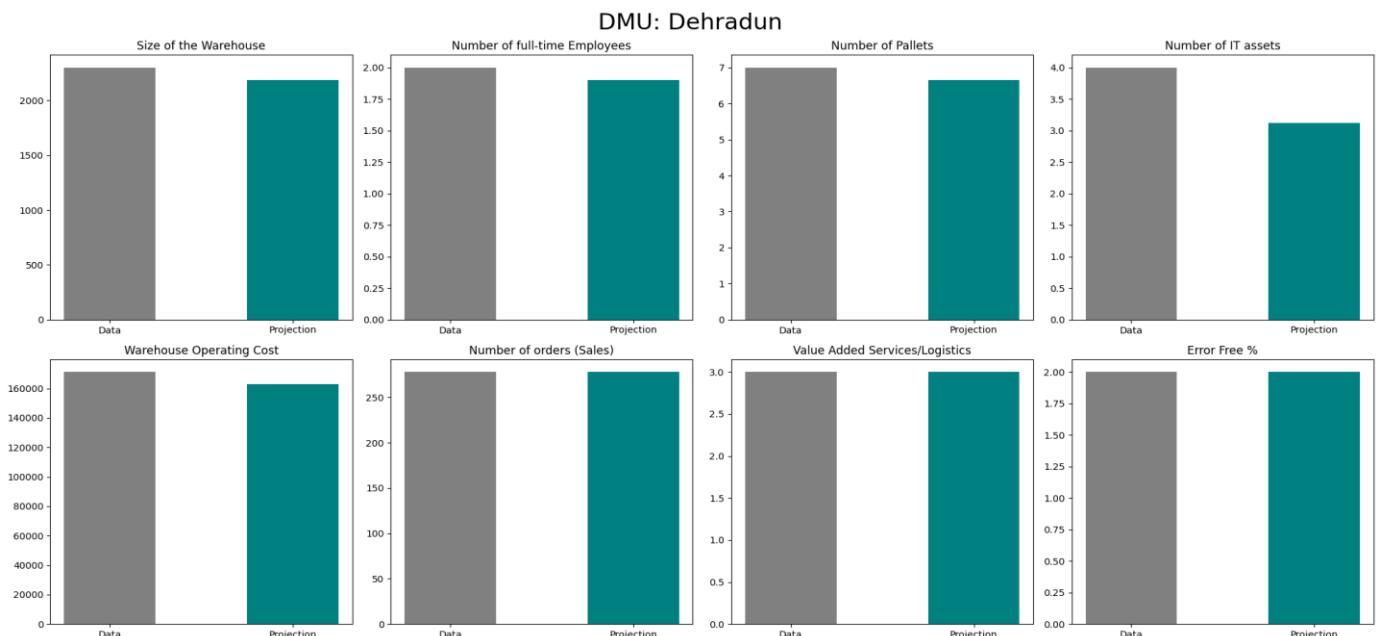
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	2300	2188.39	0
No. of Full-time Employees	2	1.90295	0
No. of Pallets	7	6.66032	0
No. of IT assets	4	3.11794	0.688
Warehouse Operating Cost	171183	162876	0
No. of Orders (Sales)	278	278	0
Level of Value-Added Services	3	3	0
Error Free (%)	2	2	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 2 (Dehradun)	0.3409041
Warehouse 5 (Bhiwandi)	0.003906967
Warehouse 6 (Bhopal)	0.2185827
Warehouse 10 (Gagret)	0.1048665
Warehouse 17 (Jammu)	0.02136193
Warehouse 27 (Raipur)	0.3103778

In order to make warehouse 9 (Dehradun) efficient, they need to decrease size of the warehouse by 4.853%, No of full-time employees by 4.853%, number of pallets by 4.853%, IT Assets by 22.052% , operating cost by 4.853%,



## WAREHOUSE 10 (Gagret)

### BCC MODEL

```

!Dual Objective Function;
MIN = X10;

!Subject to;
13100*Y110 + 2000*Y210 + 550*Y310 + 9800*Y410 + 7500*Y510 + 550*Y610 + 4800*Y710 + 10250*Y810 + 2300*Y910 +
1000*Y1010 + 20700*Y1110 + 1200*Y1210 + 11000*Y1310 + 4100*Y1410 + 2000*Y1510 + 21000*Y1610 + 500*Y1710 +
2152*Y1810 + 9700*Y1910 + 15000*Y2010 + 9000*Y2110 + 4600*Y2210 + 2000*Y2310 + 37324*Y2410 + 11000*Y2510 +
10000*Y2610 + 4000*Y2710 + 5500*Y2810 + 2000*Y2910 - 1000*X10 <= 0;

7*Y110 + 2*Y210 + 2*Y310 + 14*Y410 + 4*Y510 + 2*Y610 + 3*Y710 + 5*Y810 + 2*Y910 + 1*Y1010 + 21*Y1110 +
6*Y1210 + 13*Y1310 + 2*Y1410 + 2*Y1510 + 5*Y1610 + 2*Y1710 + 4*Y1810 + 5*Y1910 + 15*Y2010 + 6*Y2110 +
5*Y2210 + 2*Y2310 + 48*Y2410 + 9*Y2510 + 4*Y2610 + 2*Y2710 + 2*Y2810 + 8*Y2910 - 1*X10 <= 0;

320*Y110 + 7*Y210 + 2*Y310 + 10*Y410 + 7*Y510 + 2*Y610 + 7*Y710 + 20*Y810 + 7*Y910 + 30*Y1010 + 200*Y1110 +
7*Y1210 + 200*Y1310 + 7*Y1410 + 2*Y1510 + 338*Y1610 + 2*Y1710 + 48*Y1810 + 7*Y1910 + 200*Y2010 + 7*Y2110 +
7*Y2210 + 7*Y2310 + 550*Y2410 + 200*Y2510 + 7*Y2610 + 2*Y2710 + 50*Y2810 + 2*Y2910 - 30*X10 <= 0;

9*Y110 + 4*Y210 + 2*Y310 + 9*Y410 + 4*Y510 + 3*Y610 + 6*Y710 + 7*Y810 + 4*Y910 + 4*Y1010 + 11*Y1110 + 5*Y1210 +
12*Y1310 + 3*Y1410 + 3*Y1510 + 10*Y1610 + 2*Y1710 + 7*Y1810 + 5*Y1910 + 12*Y2010 + 7*Y2110 + 5*Y2210 +
2*Y2310 + 25*Y2410 + 9*Y2510 + 5*Y2610 + 2*Y2710 + 5*Y2810 + 6*Y2910 - 4*X10 <= 0;

820931*Y110 + 147596*Y210 + 86404*Y310 + 584300*Y410 + 238265*Y510 + 147473*Y610 + 420908*Y710 + 239046*Y810 +
171183*Y910 + 86967*Y1010 + 142521*Y1110 + 1372680*Y1210 + 119500*Y1310 + 247573*Y1410 + 93157*Y1510 +
1994765*Y1610 + 29538*Y1710 + 226845*Y1810 + 117310*Y1910 + 955890*Y2010 + 3333230*Y2110 + 2349633*Y2210 +
139434*Y2310 + 2090879*Y2410 + 755723*Y2510 + 374615*Y2610 + 224382*Y2710 + 194903*Y2810 + 173934*Y2910 -
86967*X10 <= 0;

229*Y110 + 354*Y210 + 115*Y310 + 5827*Y410 + 4776*Y510 + 152*Y610 + 661*Y710 + 1019*Y810 + 278*Y910 +
60*Y1010 + 2155*Y1110 + 908*Y1210 + 2593*Y1310 + 272*Y1410 + 64*Y1510 + 1053*Y1610 + 137*Y1710 + 138*Y1810 +
523*Y1910 + 1222*Y2010 + 1674*Y2110 + 554*Y2210 + 197*Y2310 + 5794*Y2410 + 1505*Y2510 + 1347*Y2610 +
310*Y2710 + 259*Y2810 + 277*Y2910 >= 60;

3*Y110 + 3*Y210 + 3*Y310 + 3*Y410 + 3*Y510 + 3*Y610 + 3*Y710 + 3*Y810 + 3*Y910 + 3*Y1010 + 3*Y1110 + 3*Y1210 +
3*Y1310 + 3*Y1410 + 3*Y1510 + 3*Y1610 + 3*Y1710 + 3*Y1810 + 3*Y1910 + 3*Y2010 + 3*Y2110 + 3*Y2210 + 3*Y2310 +
3*Y2410 + 3*Y2510 + 3*Y2610 + 3*Y2710 + 3*Y2810 + 3*Y2910 >= 3;

4*Y110 + 3*Y210 + 1*Y310 + 4*Y410 + 3*Y510 + 1*Y610 + 3*Y710 + 4*Y810 + 2*Y910 + 1*Y1010 + 4*Y1110 + 2*Y1210 +
4*Y1310 + 3*Y1410 + 2*Y1510 + 4*Y1610 + 1*Y1710 + 2*Y1810 + 3*Y1910 + 4*Y2010 + 3*Y2110 + 3*Y2210 + 2*Y2310 +
4*Y2410 + 3*Y2510 + 4*Y2610 + 2*Y2710 + 3*Y2810 + 3*Y2910 >= 1;

Y110 + Y210 + Y310 + Y410 + Y510 + Y610 + Y710 + Y810 + Y910 + Y1010 + Y1110 + Y1210 + Y1310 + Y1410 + Y1510 +
Y1610 + Y1710 + Y1810 + Y1910 + Y2010 + Y2110 + Y2210 + Y2310 + Y2410 + Y2510 + Y2610 + Y2710 + Y2810 +
Y2910 = 1;

@Free(X10);
Y110 >= 0; Y210 >= 0; Y310 >= 0; Y410 >= 0; Y510 >= 0; Y610 >= 0; Y710 >= 0; Y810 >= 0; Y910 >= 0;
Y1010 >= 0; Y1110 >= 0; Y1210 >= 0; Y1310 >= 0; Y1410 >= 0; Y1510 >= 0; Y1610 >= 0; Y1710 >= 0; Y1810 >= 0; Y1910 >= 0;
Y2010 >= 0; Y2110 >= 0; Y2210 >= 0; Y2310 >= 0; Y2410 >= 0; Y2510 >= 0; Y2610 >= 0; Y2710 >= 0; Y2810 >= 0; Y2910 >= 0;

```

### SOLUTION OF BCC MODEL



```

Global optimal solution found.
Objective value:                      1.000000
Infeasibilities:                      0.000000
Total solver iterations:                2

Variable      Value      Reduced Cost
X10          1.000000   0.000000
Y110         0.000000   7.469307
Y210         0.000000   0.8175988
Y310         0.000000   0.3938198
Y410         0.000000   8.614574
Y510         0.000000   2.240955
Y610         0.000000   0.8167470
Y710         0.000000   3.108112
Y810         0.000000   2.644083
Y910         0.000000   0.9809482
Y1010        1.000000   0.000000
Y1110        0.000000   8.339109
Y1210        0.000000   10.89267

```

Y1310	0.000000	4.997929
Y1410	0.000000	1.509980
Y1510	0.000000	0.4405870
Y1610	0.000000	14.80314
Y1710	0.000000	-0.1110223E-15
Y1810	0.000000	2.161867
Y1910	0.000000	1.801012
Y2010	0.000000	11.58570
Y2110	0.000000	24.47026
Y2210	0.000000	17.26074
Y2310	0.000000	0.7610737
Y2410	0.000000	32.57067
Y2510	0.000000	7.813153
Y2610	0.000000	3.185234
Y2710	0.000000	1.349373
Y2810	0.000000	1.145219
Y2910	0.000000	3.386313

## SUMMARY

Efficiency of Warehouse 10 (Gagret) = 1

Warehouse 10 (Gagret) is an efficient warehouse.

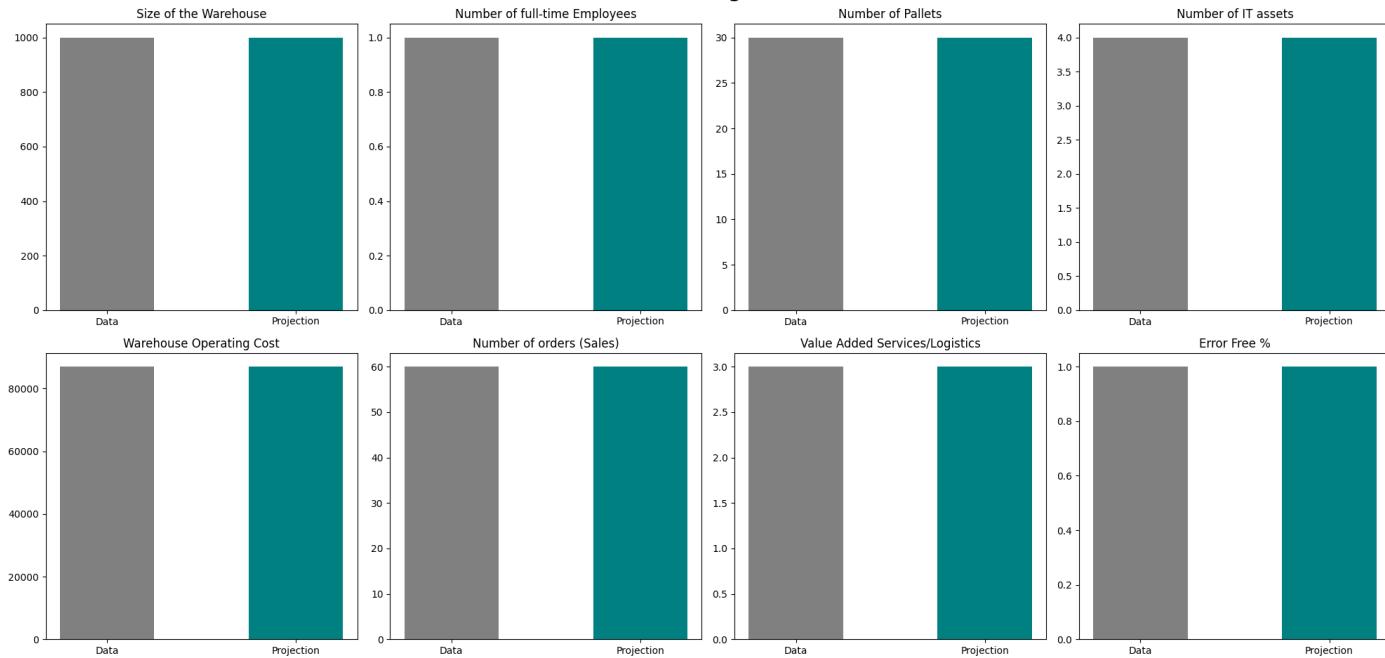
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	1000	1000	0
No. of Full-time Employees	1	1	0
No. of Pallets	30	30	0
No. of IT assets	4	4	0
Warehouse Operating Cost	86967	86967	0
No. of Orders (Sales)	60	60	0
Level of Value-Added Services	3	3	0
Error Free (%)	1	1	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 10 (Gagret)	1

DMU: Gagret



## WAREHOUSE 11 (Ghaziabad)

### BCC MODEL

```

!Dual Objective Function;
MIN = X11;

!Subject to;
13100*Y111 + 2000*Y211 + 550*Y311 + 9800*Y411 + 7500*Y511 + 550*Y611 + 4800*Y711 + 10250*Y811 + 2300*Y911 +
1000*Y1011 + 20700*Y1111 + 1200*Y1211 + 11000*Y1311 + 4100*Y1411 + 2000*Y1511 + 21000*Y1611 + 500*Y1711 +
2152*Y1811 + 9700*Y1911 + 15000*Y2011 + 9000*Y2111 + 4600*Y2211 + 2000*Y2311 + 37324*Y2411 + 11000*Y2511 +
10000*Y2611 + 4000*Y2711 + 5500*Y2811 + 2000*Y2911 - 20700*X11 <=0;

7*Y111 + 2*Y211 + 2*Y311 + 14*Y411 + 4*Y511 + 2*Y611 + 3*Y711 + 5*Y811 + 2*Y911 + 1*Y1011 + 21*Y1111 +
6*Y1211 + 13*Y1311 + 2*Y1411 + 2*Y1511 + 5*Y1611 + 2*Y1711 + 4*Y1811 + 5*Y1911 + 15*Y2011 + 6*Y2111 + 5*Y2211 +
2*Y2311 + 48*Y2411 + 9*Y2511 + 4*Y2611 + 2*Y2711 + 2*Y2811 + 8*Y2911 - 21*X11 <= 0;

320*Y111 + 7*Y211 + 2*Y311 + 10*Y411 + 7*Y511 + 2*Y611 + 7*Y711 + 20*Y811 + 7*Y911 + 30*Y1011 + 200*Y1111 +
7*Y1211 + 200*Y1311 + 7*Y1411 + 2*Y1511 + 338*Y1611 + 2*Y1711 + 48*Y1811 + 7*Y1911 + 200*Y2011 + 7*Y2111 +
7*Y2211 + 7*Y2311 + 550*Y2411 + 200*Y2511 + 7*Y2611 + 2*Y2711 + 50*Y2811 + 2*Y2911 - 200*X11 <= 0;

9*Y111 + 4*Y211 + 2*Y311 + 9*Y411 + 4*Y511 + 3*Y611 + 6*Y711 + 7*Y811 + 4*Y911 + 4*Y1011 + 11*Y1111 + 5*Y1211 +
12*Y1311 + 3*Y1411 + 3*Y1511 + 10*Y1611 + 2*Y1711 + 7*Y1811 + 5*Y1911 + 12*Y2011 + 7*Y2111 + 5*Y2211 +
2*Y2311 + 25*Y2411 + 9*Y2511 + 5*Y2611 + 2*Y2711 + 5*Y2811 + 6*Y2911 - 11*X11 <= 0;

820931*Y111 + 147596*Y211 + 86404*Y311 + 584300*Y411 + 238265*Y511 + 147473*Y611 + 420908*Y711 + 239046*Y811 +
171183*Y911 + 86967*Y1011 + 142521*Y1111 + 1372680*Y1211 +
+ 119500*Y1311 + 247573*Y1411 + 93157*Y1511 + 1994765*Y1611 + 29538*Y1711 + 226845*Y1811 + 117310*Y1911 +
955890*Y2011 + 3333230*Y2111 + 2349633*Y2211 + 139434*Y2311 + 2090879*Y2411 + 755723*Y2511 + 374615*Y2611 +
224382*Y2711 + 194903*Y2811 + 173934*Y2911 - 142521*X11 <= 0;

229*Y111 + 354*Y211 + 115*Y311 + 5827*Y411 + 4776*Y511 + 152*Y611 + 661*Y711 + 1019*Y811 + 278*Y911 +
60*Y1011 + 2155*Y1111 + 908*Y1211 + 2593*Y1311 + 272*Y1411 + 64*Y1511 +
1053*Y1611 + 137*Y1711 + 138*Y1811 + 523*Y1911 + 1222*Y2011 + 1674*Y2111 + 554*Y2211 + 197*Y2311 + 5794*Y2411 +
1505*Y2511 + 1347*Y2611 + 310*Y2711 + 259*Y2811 + 277*Y2911 >= 2155;

3*Y111 + 3*Y211 + 3*Y311 + 3*Y411 + 3*Y511 + 3*Y611 + 3*Y711 + 3*Y811 + 3*Y911 + 3*Y1011 + 3*Y1111 + 3*Y1211 +
3*Y1311 + 3*Y1411 + 3*Y1511 + 3*Y1611 + 3*Y1711 + 3*Y1811 + 3*Y1911 + 3*Y2011 + 3*Y2111 + 3*Y2211 + 3*Y2311 +
3*Y2411 + 3*Y2511 + 3*Y2611 + 3*Y2711 + 3*Y2811 + 3*Y2911 >= 3;

4*Y111 + 3*Y211 + 1*Y311 + 4*Y411 + 3*Y511 + 1*Y611 + 3*Y711 + 4*Y811 + 2*Y911 + 1*Y1011 + 4*Y1111 + 2*Y1211 +
+ 4*Y1311 + 3*Y1411 + 2*Y1511 + 4*Y1611 + 1*Y1711 + 2*Y1811 + 3*Y1911 + 4*Y2011 + 3*Y2111 + 3*Y2211 + 2*Y2311 +
+ 4*Y2411 + 3*Y2511 + 4*Y2611 + 2*Y2711 + 3*Y2811 + 3*Y2911 >= 4;

Y111 + Y211 + Y311 + Y411 + Y511 + Y611 + Y711 + Y811 + Y911 + Y1011 + Y1111 + Y1211 + Y1311 + Y1411 + Y1511 +
+ Y1611 + Y1711 + Y1811 + Y1911 + Y2011 + Y2111 + Y2211 + Y2311 + Y2411 + Y2511 + Y2611 + Y2711 + Y2811 +
Y2911 = 1;

@Free(X11);
Y111 >=0; Y211 >=0; Y311 >=0; Y411 >=0; Y511 >=0; Y611 >=0; Y711 >=0; Y811 >=0; Y911 >=0; Y1011 >=0; Y1111
>=0; Y1211 >=0; Y1311 >=0; Y1411 >=0; Y1511 >=0; Y1611 >=0; Y1711 >=0; Y1811 >=0; Y1911 >=0; Y2011 >=0; Y2111
>=0; Y2211 >=0; Y2311 >=0; Y2411 >=0; Y2511 >=0; Y2611 >=0; Y2711 >=0; Y2811 >=0; Y2911 >=0;

```

### SOLUTION OF BCC MODEL

File Edit LINGO Window Help		
Global optimal solution found.		
Objective value:	1.000000	
Infeasibilities:	0.6163588E-13	
Total solver iterations:	4	
Variable	Value	Reduced Cost
X11	1.000000	0.1110223E-15
Y111	0.000000	1.597890
Y211	0.000000	0.1835746E-01
Y311	0.000000	0.5728461
Y411	0.000000	0.9999621
Y511	0.000000	0.2474631
Y611	0.000000	0.7853277
Y711	0.000000	0.8253123
Y811	0.000000	0.1122167E-01
Y911	0.000000	0.4906836
Y1011	0.000000	0.6906093
Y1111	1.000000	0.000000
Y1211	0.000000	3.584838

Y1311	0.1665335E-15	0.000000
Y1411	0.000000	0.2128126
Y1511	0.000000	0.2353545
Y1611	0.000000	4.622145
Y1711	0.000000	0.4291551
Y1811	0.000000	0.8058431
Y1911	-0.7401487E-16	0.2220446E-15
Y2011	0.000000	2.113420
Y2111	0.000000	8.242440
Y2211	0.000000	5.640712
Y2311	0.000000	0.2941185
Y2411	0.000000	5.737563
Y2511	0.000000	1.845845
Y2611	0.000000	0.2374416
Y2711	0.000000	0.5087681
Y2811	0.000000	0.1960647
Y2911	0.000000	0.2012498

## SUMMARY

Efficiency of Warehouse 11 (Ghaziabad) = 1

Warehouse 11 (Ghaziabad) is an efficient warehouse.

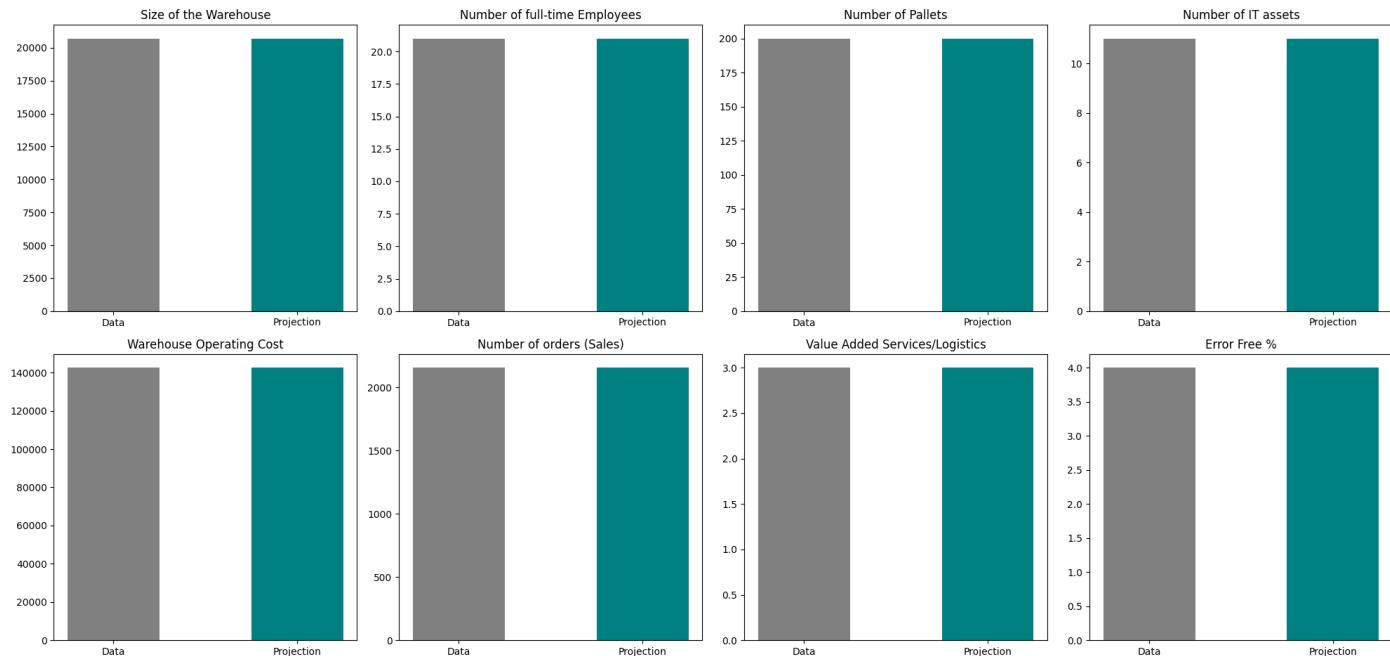
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	20700	20700	0
No. of Full-time Employees	21	21	0
No. of Pallets	200	200	0
No. of IT assets	11	11	0
Warehouse Operating Cost	142521	142521	0
No. of Orders (Sales)	2155	2155	0
Level of Value-Added Services	3	3	0
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 11 (Ghaziabad)	1

DMU: Ghaziabad



## WAREHOUSE 12 (Gorakhpur)

### BCC MODEL

```

!Dual Objective Function;
MIN = X12;

!Subject to;
13100*Y112 + 2000*Y212 + 550*Y312 + 9800*Y412 + 7500*Y512 + 550*Y612 + 4800*Y712 + 10250*Y812 + 2300*Y912 +
1000*Y1012 + 20700*Y1112 + 1200*Y1212 + 11000*Y1312 + 4100*Y1412 + 2000*Y1512 + 21000*Y1612 + 500*Y1712 +
2152*Y1812 + 9700*Y1912 + 15000*Y2012 + 9000*Y2112 + 4600*Y2212 + 2000*Y2312 + 37324*Y2412 + 11000*Y2512 +
10000*Y2612 + 4000*Y2712 + 5500*Y2812 + 2000*Y2912 - 1200*X12 <=0;

7*Y112 + 2*Y212 + 2*Y312 + 14*Y412 + 4*Y512 + 2*Y612 + 3*Y712 + 5*Y812 + 2*Y912 + 1*Y1012 + 21*Y1112 +
6*Y1212 + 13*Y1312 + 2*Y1412 + 2*Y1512 + 5*Y1612 + 2*Y1712 + 4*Y1812 + 5*Y1912 + 15*Y2012 + 6*Y2112 + 5*Y2212 +
2*Y2312 + 48*Y2412 + 9*Y2512 + 4*Y2612 + 2*Y2712 + 2*Y2812 + 8*Y2912 -6*X12 <=0;

320*Y112 + 7*Y212 + 2*Y312 + 10*Y412 + 7*Y512 + 2*Y612 + 7*Y712 + 20*Y812 + 7*Y912 + 30*Y1012 + 200*Y1112 +
7*Y1212 + 200*Y1312 + 7*Y1412 + 2*Y1512 + 338*Y1612 + 2*Y1712 + 48*Y1812 + 7*Y1912 + 200*Y2012 + 7*Y2112 +
7*Y2212 + 7*Y2312 + 550*Y2412 + 200*Y2512 + 7*Y2612 + 2*Y2712 + 50*Y2812 + 2*Y2912 -7*X12 <=0;

9*Y112 + 4*Y212 + 2*Y312 + 9*Y412 + 4*Y512 + 3*Y612 + 6*Y712 + 7*Y812 + 4*Y912 + 4*Y1012 + 11*Y1112 + 5*Y1212 +
12*Y1312 + 3*Y1412 + 3*Y1512 + 10*Y1612 + 2*Y1712 + 7*Y1812 + 5*Y1912 +12*Y2012 + 7*Y2112 + 5*Y2212 +
2*Y2312 + 25*Y2412 + 9*Y2512 + 5*Y2612 + 2*Y2712 + 5*Y2812 + 6*Y2912 - 5*X12 <= 0;

820931*Y112 + 147596*Y212 + 86404*Y312 + 584300*Y412 + 238265*Y512 + 147473*Y612 + 420908*Y712 + 239046*Y812 +
171183*Y912 + 86967*Y1012 + 142521*Y1112 + 1372680*Y1212 +
+ 119500*Y1312 + 247573*Y1412 + 93157*Y1512 + 1994765*Y1612 + 29538*Y1712 +226845*Y1812 + 117310*Y1912 +
955890*Y2012 + 3333230*Y2112 + 2349633*Y2212 +139434*Y2312 + 2090879*Y2412 + 755723*Y2512 + 374615*Y2612 +
224382*Y2712 + 194903*Y2812 + 173934*Y2912-1372680*X12 <=0;

229*Y112 + 354*Y212 + 115*Y312 + 5827*Y412 + 4776*Y512 + 152*Y612 + 661*Y712 + 1019*Y812 + 278*Y912 +
60*Y1012 + 2155*Y1112 + 908*Y1212 + 2593*Y1312 + 272*Y1412 + 64*Y1512 +
1053*Y1612 + 137*Y1712 + 138*Y1812 + 523*Y1912 + 1222*Y2012 + 1674*Y2112 + 554*Y2212 + 197*Y2312 + 5794*Y2412 +
+ 1505*Y2512 + 1347*Y2612 + 310*Y2712 + 259*Y2812 + 277*Y2912 >=908;

3*Y112 + 3*Y212 + 3*Y312 + 3*Y412 + 3*Y512 + 3*Y612 + 3*Y712 + 3*Y812 + 3*Y912 + 3*Y1012 + 3*Y1112 + 3*Y1212 +
+ 3*Y1312 + 3*Y1412 + 3*Y1512 + 3*Y1612 + 3*Y1712 + 3*Y1812 +
+ 3*Y1912 + 3*Y2012 + 3*Y2112 + 3*Y2212 + 3*Y2312 + 3*Y2412 + 3*Y2512 + 3*Y2612 + 3*Y2712 + 3*Y2812 + 3*Y2912
>=3;

4*Y112 + 3*Y212 + 1*Y312 + 4*Y412 + 3*Y512 + 1*Y612 + 3*Y712 + 4*Y812 + 2*Y912 + 1*Y1012 + 4*Y1112 + 2*Y1212 +
+ 4*Y1312 + 3*Y1412 + 2*Y1512 + 4*Y1612 + 1*Y1712 + 2*Y1812 +
+ 3*Y1912 + 4*Y2012 + 3*Y2112 + 3*Y2212 + 2*Y2312 + 4*Y2412 + 3*Y2512 + 4*Y2612 + 2*Y2712 + 3*Y2812 + 3*Y2912
>=2;

Y112 + Y212 + Y312 + Y412 + Y512 + Y612 + Y712 + Y812 + Y912 + Y1012 + Y1112 + Y1212 + Y1312 + Y1412 + Y1512 +
+ Y1612 + Y1712 + Y1812 + Y1912 + Y2012 + Y2112 + Y2212 + Y2312 + Y2412 + Y2512 + Y2612 + Y2712 + Y2812 +
Y2912 = 1;

@Free(X12);
Y1212 >=0; Y212 >=0; Y312 >=0; Y412 >=0; Y512 >=0; Y612 >=0; Y712 >=0; Y812 >=0; Y912 >=0; Y1012 >=0; Y1112
>=0; Y1212 >=0; Y1312 >=0; Y1412 >=0; Y1512 >=0; Y1612 >=0; Y1712 >=0; Y1812 >=0; Y1912 >=0;
Y2012 >=0; Y2112 >=0; Y2212 >=0; Y2312 >=0; Y2412 >=0; Y2512 >=0; Y2612 >=0; Y2712 >=0; Y2812 >=0; Y2912 >=0;

```

### SOLUTION OF BCC MODEL

Global optimal solution found.		
Objective value:	1.000000	
Infeasibilities:	0.000000	
Total solver iterations:	7	
Variable	Value	Reduced Cost
X12	1.000000	-0.1110223E-15
Y112	0.000000	3.659789
Y212	0.000000	-0.1255940E-14
Y312	0.000000	0.2285462E-01
Y412	0.000000	0.6279877
Y512	0.000000	0.1776357E-14
Y612	0.000000	0.1383587
Y712	0.000000	0.9725708
Y812	0.000000	2.269369
Y912	0.000000	0.4273484
Y1012	0.000000	0.4342011
Y1112	0.000000	5.455494
Y1212	1.000000	0.4649059E-15

Y1312	0.000000	2.558083
Y1412	0.000000	0.5214124
Y1512	0.000000	0.2882549
Y1612	0.000000	5.819937
Y1712	0.000000	0.6245005E-16
Y1812	0.000000	0.8223652
Y1912	0.000000	2.341735
Y2012	0.000000	4.243519
Y2112	0.000000	1.970219
Y2212	0.000000	0.8237034
Y2312	0.000000	0.1102864
Y2412	0.000000	10.83684
Y2512	0.000000	2.881354
Y2612	0.000000	1.816796
Y2712	0.000000	0.6596057
Y2812	0.000000	1.197975
Y2912	0.000000	0.2864912

## SUMMARY

Efficiency of Warehouse 12 (Gorakhpur) = 1

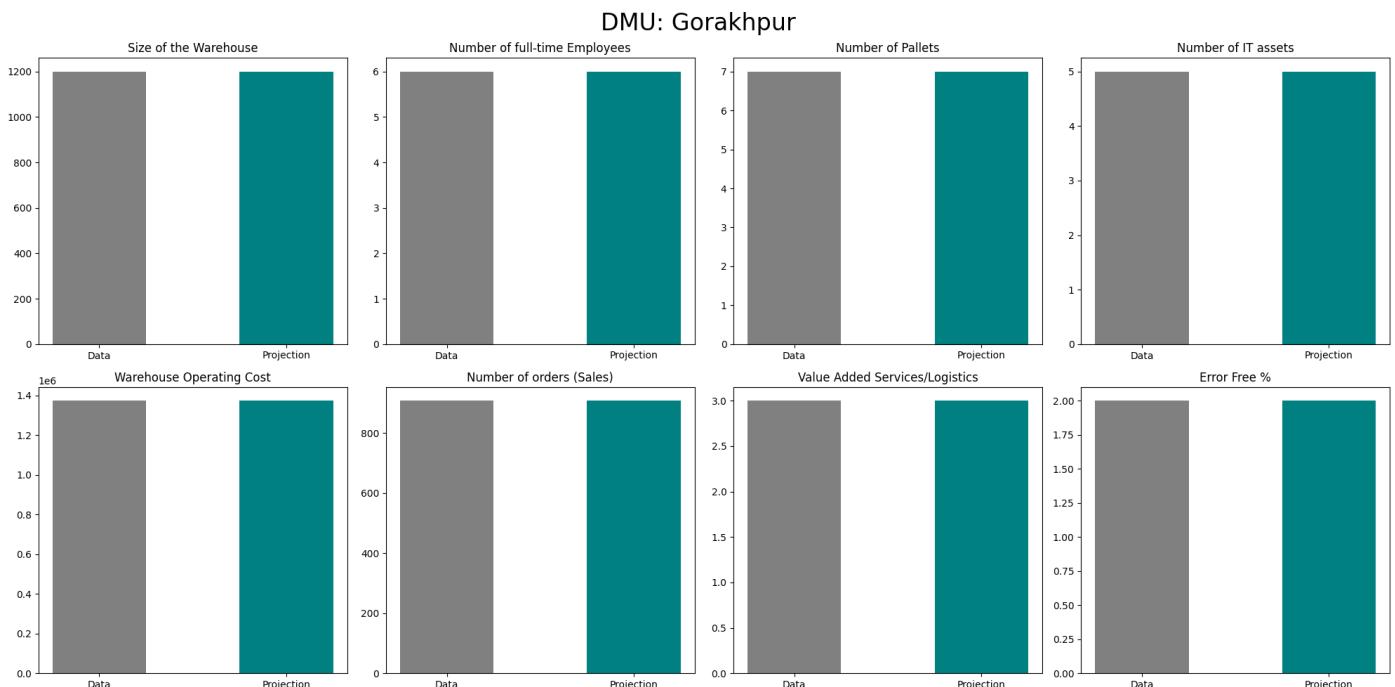
Warehouse 12 (Gorakhpur) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	1200	1200	0
No. of Full-time Employees	6	6	0
No. of Pallets	7	7	0
No. of IT assets	5	5	0
Warehouse Operating Cost	1372680	1372680	0
No. of Orders (Sales)	908	908	0
Level of Value-Added Services	3	3	0
Error Free (%)	2	2	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 12 (Gorakhpur)	1



## WAREHOUSE 13 (Hyderabad)

### BCC MODEL

```

!Dual Objective Function;
MIN = X13;

!Subject to;
13100*Y113 + 2000*Y213 + 550*Y313 + 9800*Y413 + 7500*Y513 + 550*Y613 + 4800*Y713 + 10250*Y813 + 2300*Y913 +
1000*Y1013 + 20700*Y1113 + 1200*Y1213 + 11000*Y1313 + 4100*Y1413 + 2000*Y1513 + 21000*Y1613 + 500*Y1713 +
2152*Y1813 + 9700*Y1913 + 15000*Y2013 + 9000*Y2113 + 4600*Y2213 + 2000*Y2313 + 37324*Y2413 + 11000*Y2513 +
10000*Y2613 + 4000*Y2713 + 5500*Y2813 + 2000*Y2913 - 11000*X13 <=0;

7*Y113 + 2*Y213 + 2*Y313 + 14*Y413 + 4*Y513 + 2*Y613 + 3*Y713 + 5*Y813 + 2*Y913 + 1*Y1013 + 21*Y1113 +
6*Y1213 + 13*Y1313 + 2*Y1413 + 2*Y1513 + 5*Y1613 + 2*Y1713 + 4*Y1813 + 5*Y1913 + 15*Y2013 + 6*Y2113 + 5*Y2213 +
2*Y2313 + 48*Y2413 + 9*Y2513 + 4*Y2613 + 2*Y2713 + 2*Y2813 + 8*Y2913 - 13*X13 <=0;

320*Y113 + 7*Y213 + 2*Y313 + 10*Y413 + 7*Y513 + 2*Y613 + 7*Y713 + 20*Y813 + 7*Y913 + 30*Y1013 + 200*Y1113 +
7*Y1213 + 200*Y1313 + 7*Y1413 + 2*Y1513 + 338*Y1613 + 2*Y1713 + 48*Y1813 + 7*Y1913 + 200*Y2013 + 7*Y2113 +
7*Y2213 + 7*Y2313 + 550*Y2413 + 200*Y2513 + 7*Y2613 + 2*Y2713 + 50*Y2813 + 2*Y2913 - 200*X13 <=0;

9*Y113 + 4*Y213 + 2*Y313 + 9*Y413 + 4*Y513 + 3*Y613 + 6*Y713 + 7*Y813 + 4*Y913 + 4*Y1013 + 11*Y1113 + 5*Y1213 +
12*Y1313 + 3*Y1413 + 3*Y1513 + 10*Y1613 + 2*Y1713 + 7*Y1813 + 5*Y1913 + 12*Y2013 + 7*Y2113 + 5*Y2213 +
2*Y2313 + 25*Y2413 + 9*Y2513 + 5*Y2613 + 2*Y2713 + 5*Y2813 + 6*Y2913 - 12*X13 <=0;

820931*Y113 + 147596*Y213 + 86404*Y313 + 584300*Y413 + 238265*Y513 + 147473*Y613 + 420908*Y713 + 239046*Y813 +
171183*Y913 + 86967*Y1013 + 142521*Y1113 + 1372680*Y1213 +
+ 119500*Y1313 + 247573*Y1413 + 93157*Y1513 + 1994765*Y1613 + 29538*Y1713 + 226845*Y1813 + 117310*Y1913 +
955890*Y2013 + 3333230*Y2113 + 2349633*Y2213 + 139434*Y2313 + 2090879*Y2413 + 755723*Y2513 + 374615*Y2613 +
224382*Y2713 + 194903*Y2813 + 173934*Y2913 - 119500*X13 <=0;

229*Y113 + 354*Y213 + 115*Y313 + 5827*Y413 + 4776*Y513 + 152*Y613 + 661*Y713 + 1019*Y813 + 278*Y913 +
60*Y1013 + 2155*Y1113 + 908*Y1213 + 2593*Y1313 + 272*Y1413 + 64*Y1513 +
1053*Y1613 + 137*Y1713 + 138*Y1813 + 523*Y1913 + 1222*Y2013 + 1674*Y2113 + 554*Y2213 + 197*Y2313 + 5794*Y2413 +
+ 1505*Y2513 + 1347*Y2613 + 310*Y2713 + 259*Y2813 + 277*Y2913 >=2593;

3*Y113 + 3*Y213 + 3*Y313 + 3*Y413 + 3*Y513 + 3*Y613 + 3*Y713 + 3*Y813 + 3*Y913 + 3*Y1013 + 3*Y1113 + 3*Y1213 +
+ 3*Y1313 + 3*Y1413 + 3*Y1513 + 3*Y1613 + 3*Y1713 + 3*Y1813 +
+ 3*Y1913 + 3*Y2013 + 3*Y2113 + 3*Y2213 + 3*Y2313 + 3*Y2413 + 3*Y2513 + 3*Y2613 + 3*Y2713 + 3*Y2813 + 3*Y2913
>=3;

4*Y113 + 3*Y213 + 1*Y313 + 4*Y413 + 3*Y513 + 1*Y613 + 3*Y713 + 4*Y813 + 2*Y913 + 1*Y1013 + 4*Y1113 + 2*Y1213 +
+ 4*Y1313 + 3*Y1413 + 2*Y1513 + 4*Y1613 + 1*Y1713 + 2*Y1813 + 3*Y1913 + 4*Y2013 + 3*Y2113 + 3*Y2213 + 2*Y2313 +
+ 4*Y2413 + 3*Y2513 + 4*Y2613 + 2*Y2713 + 3*Y2813 + 3*Y2913 >=4;

Y113 + Y213 + Y313 + Y413 + Y513 + Y613 + Y713 + Y813 + Y913 + Y1013 + Y1113 + Y1213 + Y1313 + Y1413 + Y1513 +
+ Y1613 + Y1713 + Y1813 + Y1913 + Y2013 + Y2113 + Y2213 + Y2313 + Y2413 + Y2513 + Y2613 + Y2713 + Y2813 +
Y2913 = 1;

@Free(X13);
Y113 >=0; Y213 >=0; Y313 >=0; Y413 >=0; Y513 >=0; Y613 >=0; Y713 >=0; Y813 >=0; Y913 >=0; Y1013 >=0; Y1113
>=0; Y1213 >=0; Y1313 >=0; Y1413 >=0; Y1513 >=0; Y1613 >=0; Y1713 >=0; Y1813 >=0; Y1913 >=0;
Y2013 >=0; Y2113 >=0; Y2213 >=0; Y2313 >=0; Y2413 >=0; Y2513 >=0; Y2613 >=0; Y2713 >=0; Y2813 >=0; Y2913 >=0;

```

### SOLUTION OF BCC MODEL

File		Edit	LINGO	Window	Help
Global optimal solution found.					
Objective value:		1.000000			
Infeasibilities:		0.000000			
Total solver iterations:		1			
Variable	Value	Reduced Cost			
X13	1.000000	0.000000			
Y113	0.000000	6.781401			
Y213	0.000000	1.098592			
Y313	0.000000	0.6786959			
Y413	0.000000	2.642336			
Y513	0.000000	0.1519674			
Y613	0.000000	1.175464			
Y713	0.000000	3.267326			
Y813	0.000000	1.607404			
Y913	0.000000	1.325282			
Y1013	0.000000	0.7046181			
Y1113	0.000000	0.3615607			
Y1213	0.000000	11.13669			

Y1313	1.000000	0.000000
Y1413	0.000000	1.966843
Y1513	0.000000	0.7548746
Y1613	0.000000	16.28650
Y1713	0.000000	0.1943454
Y1813	0.000000	1.845064
Y1913	0.000000	0.7799768
Y2013	0.000000	7.527811
Y2113	0.000000	27.24755
Y2213	0.000000	19.44855
Y2313	0.000000	1.090838
Y2413	0.000000	15.26242
Y2513	0.000000	5.743633
Y2613	0.000000	2.615378
Y2713	0.000000	1.758121
Y2813	0.000000	1.531103
Y2913	0.000000	1.348689

## SUMMARY

Efficiency of Warehouse 13 (Hyderabad) = 1

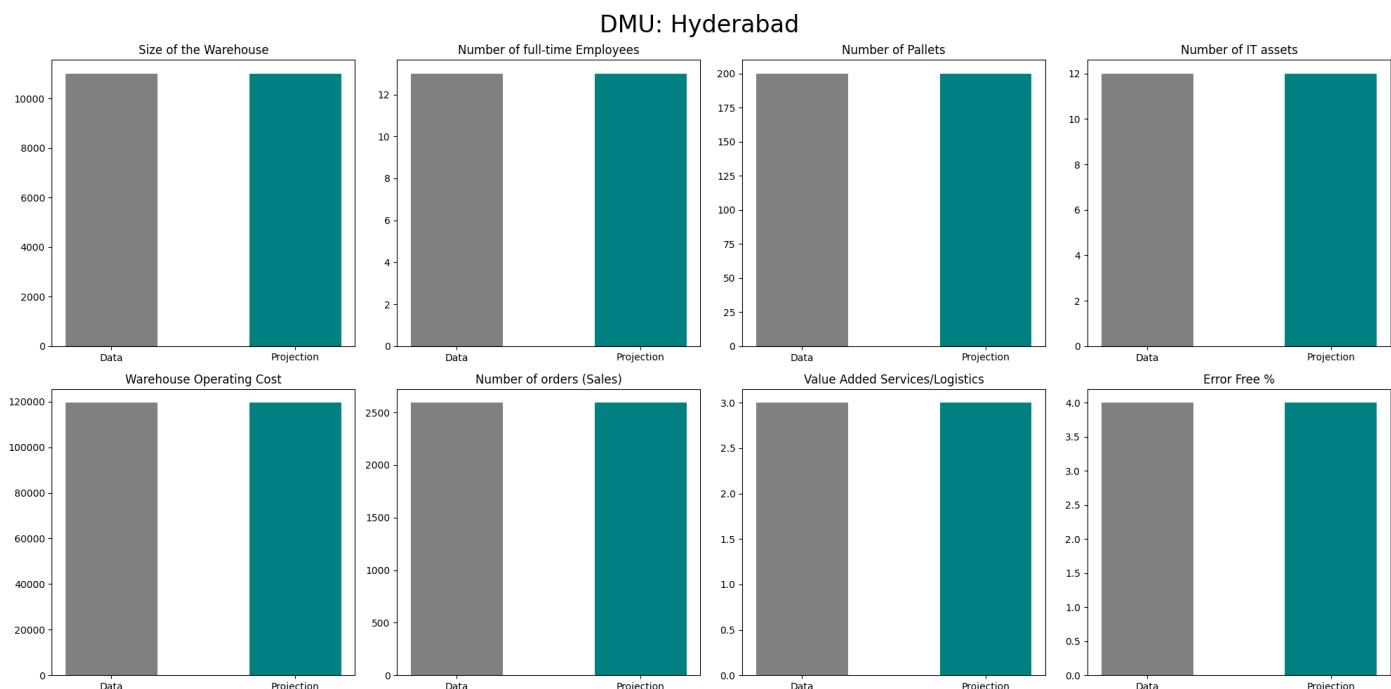
Warehouse 13 (Hyderabad) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	11000	11000	0
No. of Full-time Employees	13	13	0
No. of Pallets	200	200	0
No. of IT assets	12	12	0
Warehouse Operating Cost	119500	119500	0
No. of Orders (Sales)	2593	2593	0
Level of Value-Added Services	3	3	0
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 13 (Hyderabad)	1



## WAREHOUSE 14 (Indore)

### BCC MODEL

```

!Dual Objective Function;
MIN = X14;

!Subject to;
13100*Y114 + 2000*Y214 + 550*Y314 + 9800*Y414 + 7500*Y514 + 550*Y614 + 4800*Y714 + 10250*Y814 + 2300*Y914 +
1000*Y1014 + 20700*Y1114 + 1200*Y1214 + 11000*Y1314 + 4100*Y1414 + 2000*Y1514 + 21000*Y1614 + 500*Y1714 +
2152*Y1814 + 9700*Y1914 + 15000*Y2014 + 9000*Y2114 + 4600*Y2214 + 2000*Y2314 + 37324*Y2414 + 11000*Y2514 +
10000*Y2614 + 4000*Y2714 + 5500*Y2814 + 2000*Y2914 -4100*X14 <=0;

7*Y114 + 2*Y214 + 2*Y314 + 14*Y414 + 4*Y514 + 2*Y614 + 3*Y714 + 5*Y814 + 2*Y914 + 1*Y1014 + 21*Y1114 +
6*Y1214 + 13*Y1314 + 2*Y1414 + 2*Y1514 + 5*Y1614 + 2*Y1714 + 4*Y1814 + 5*Y1914 + 15*Y2014 + 6*Y2114 + 5*Y2214 +
2*Y2314 + 48*Y2414 + 9*Y2514 + 4*Y2614 + 2*Y2714 + 2*Y2814 + 8*Y2914 -2*X14<=0;

320*Y114 + 7*Y214 + 2*Y314 + 10*Y414 + 7*Y514 + 2*Y614 + 7*Y714 + 20*Y814 + 7*Y914 + 30*Y1014 + 200*Y1114 +
7*Y1214 + 200*Y1314 + 7*Y1414 + 2*Y1514 + 338*Y1614 + 2*Y1714 + 48*Y1814 + 7*Y1914 + 200*Y2014 + 7*Y2114 +
7*Y2214 + 7*Y2314 + 550*Y2414 + 200*Y2514 + 7*Y2614 + 2*Y2714 + 50*Y2814 + 2*Y2914 -7*X14 <=0;

9*Y114 + 4*Y214 + 2*Y314 + 9*Y414 + 4*Y514 + 3*Y614 + 6*Y714 + 7*Y814 + 4*Y914 + 4*Y1014 + 11*Y1114 + 5*Y1214 +
12*Y1314 + 3*Y1414 + 3*Y1514 + 10*Y1614 + 2*Y1714 + 7*Y1814 + 5*Y1914 + 12*Y2014 + 7*Y2114 + 5*Y2214 +
2*Y2314 + 25*Y2414 + 9*Y2514 + 5*Y2614 + 2*Y2714 + 5*Y2814 + 6*Y2914 -3*X14 <=0;

820931*Y114 + 147596*Y214 + 86404*Y314 + 584300*Y414 + 238265*Y514 + 147473*Y614 + 420908*Y714 +
239046*Y814 + 171183*Y914 + 86967*Y1014 + 142521*Y1114 + 1372680*Y1214 +
+ 119500*Y1314 + 247573*Y1414 + 93157*Y1514 + 1994765*Y1614 + 29538*Y1714 + 226845*Y1814 + 117310*Y1914 +
+ 955890*Y2014 + 3333230*Y2114 + 2349633*Y2214 + 139434*Y2314 + 2090879*Y2414 + 755723*Y2514 +
374615*Y2614 + 224382*Y2714 + 194903*Y2814 + 173934*Y2914 -247573*X14 <=0;

229*Y114 + 354*Y214 + 115*Y314 + 5827*Y414 + 4776*Y514 + 152*Y614 + 661*Y714 + 1019*Y814 + 278*Y914 +
60*Y1014 + 2155*Y1114 + 908*Y1214 + 2593*Y1314 + 272*Y1414 + 64*Y1514 + 1053*Y1614 + 137*Y1714 + 138*Y1814 +
523*Y1914 + 1222*Y2014 + 1674*Y2114 + 554*Y2214 + 197*Y2314 + 5794*Y2414 + 1505*Y2514 + 1347*Y2614 +
310*Y2714 + 259*Y2814 + 277*Y2914 >=272;

3*Y114 + 3*Y214 + 3*Y314 + 3*Y414 + 3*Y514 + 3*Y614 + 3*Y714 + 3*Y814 + 3*Y914 + 3*Y1014 + 3*Y1114 + 3*Y1214 +
+ 3*Y1314 + 3*Y1414 + 3*Y1514 + 3*Y1614 + 3*Y1714 + 3*Y1814 +
+ 3*Y1914 + 3*Y2014 + 3*Y2114 + 3*Y2214 + 3*Y2314 + 3*Y2414 + 3*Y2514 + 3*Y2614 + 3*Y2714 + 3*Y2814 + 3*Y2914
>=3;

4*Y114 + 3*Y214 + 1*Y314 + 4*Y414 + 3*Y514 + 1*Y614 + 3*Y714 + 4*Y814 + 2*Y914 + 1*Y1014 + 4*Y1114 + 2*Y1214 +
+ 4*Y1314 + 3*Y1414 + 2*Y1514 + 4*Y1614 + 1*Y1714 + 2*Y1814 + 3*Y1914 + 4*Y2014 + 3*Y2114 + 3*Y2214 + 2*Y2314 +
+ 4*Y2414 + 3*Y2514 + 4*Y2614 + 2*Y2714 + 3*Y2814 + 3*Y2914 >=3;

Y114 + Y214 + Y314 + Y414 + Y514 + Y614 + Y714 + Y814 + Y914 + Y1014 + Y1114 + Y1214 + Y1314 + Y1414 + Y1514 +
+ Y1614 + Y1714 + Y1814 + Y1914 + Y2014 + Y2114 + Y2214 + Y2314 + Y2414 + Y2514 + Y2614 + Y2714 + Y2814 +
Y2914 = 1;

@Free(X14);
Y114 >=0; Y214 >=0; Y314 >=0; Y414 >=0; Y514 >=0; Y614 >=0; Y714 >=0; Y814 >=0; Y914 >=0; Y1014 >=0; Y1114
>=0; Y1214 >=0; Y1314 >=0; Y1414 >=0; Y1514 >=0; Y1614 >=0; Y1714 >=0; Y1814 >=0; Y1914 >=0; Y2014 >=0; Y2114
>=0; Y2214 >=0; Y2314 >=0; Y2414 >=0; Y2514 >=0; Y2614 >=0; Y2714 >=0; Y2814 >=0; Y2914 >=0;

```

### SOLUTION OF BCC MODEL

Global optimal solution found.			
Objective value:	1.000000		
Infeasibilities:	0.9094947E-12		
Total solver iterations:	6		
Variable	Value	Reduced Cost	
X14	1.000000	0.000000	
Y114	0.000000	1.762734	
Y214	0.000000	-0.1110223E-15	
Y314	0.000000	0.2832600	
Y414	0.000000	1.330535	
Y514	0.000000	0.1656043	
Y614	0.000000	0.5774058	
Y714	0.000000	0.8644065	
Y814	0.000000	0.3347281	
Y914	0.000000	0.4231987	
Y1014	0.000000	0.6494905	
Y1114	0.000000	0.8888483	
Y1214	0.000000	2.800303	

Y1314	0.000000	1.029406
Y1414	1.000000	0.1110223E-15
Y1514	0.000000	0.9808148E-01
Y1614	0.000000	4.089313
Y1714	0.000000	0.1793959
Y1814	0.000000	1.072679
Y1914	0.000000	0.1272886
Y2014	0.000000	2.557048
Y2114	0.000000	6.366282
Y2214	0.000000	4.204561
Y2314	0.000000	0.000000
Y2414	0.000000	7.003938
Y2514	0.000000	2.023751
Y2614	0.000000	0.2171308
Y2714	0.000000	0.1551550
Y2814	0.000000	0.2690099
Y2914	0.000000	0.4133157

## SUMMARY

Efficiency of Warehouse 14 (Indore) = 1

Warehouse 14 (Indore) is an efficient warehouse.

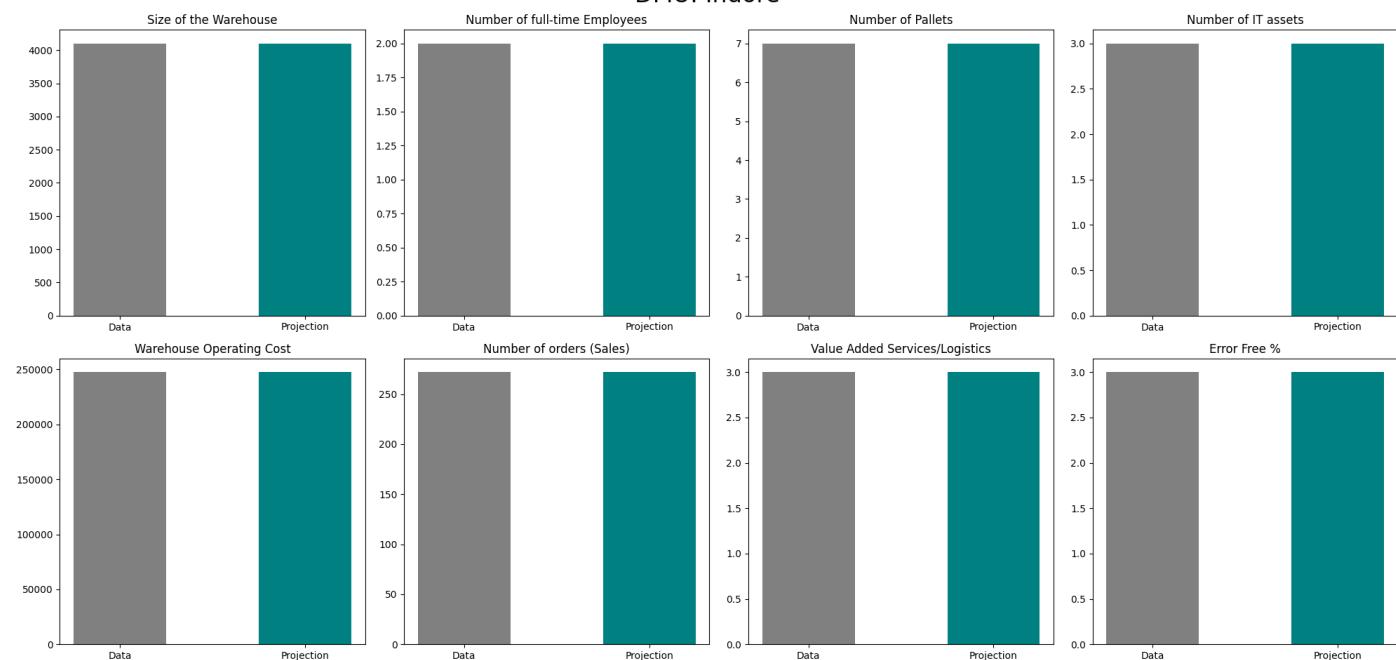
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	4100	4100	0
No. of Full-time Employees	2	2	0
No. of Pallets	7	7	0
No. of IT assets	3	3	0
Warehouse Operating Cost	247573	247573	0
No. of Orders (Sales)	272	272	0
Level of Value-Added Services	3	3	0
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 14 (Indore)	1

DMU: Indore



## WAREHOUSE 15 (Jabalpur)

### BCC MODEL

```

!Dual Objective Function;
MIN = X15;

!Subject to;
13100*Y115 + 2000*Y215 + 550*Y315 + 9800*Y415 + 7500*Y515 + 550*Y615 + 4800*Y715 + 10250*Y815 + 2300*Y915 +
1000*Y1015 + 20700*Y1115 + 1200*Y1215 + 11000*Y1315 + 4100*Y1415 + 2000*Y1515 + 21000*Y1615 + 500*Y1715 +
2152*Y1815 + 9700*Y1915 + 15000*Y2015 + 9000*Y2115 + 4600*Y2215 + 2000*Y2315 + 37324*Y2415 + 11000*Y2515 +
10000*Y2615 + 4000*Y2715 + 5500*Y2815 + 2000*Y2915 -2000*X15 <=0;

7*Y115 + 2*Y215 + 2*Y315 + 14*Y415 + 4*Y515 + 2*Y615 + 3*Y715 + 5*Y815 + 2*Y915 + 1*Y1015 + 21*Y1115 +
6*Y1215 + 13*Y1315 + 2*Y1415 + 2*Y1515 + 5*Y1615 + 2*Y1715 + 4*Y1815 + 5*Y1915 + 15*Y2015 + 6*Y2115 + 5*Y2215 +
2*Y2315 + 48*Y2415 + 9*Y2515 + 4*Y2615 + 2*Y2715 + 2*Y2815 + 8*Y2915 -2*X15 <=0;

320*Y115 + 7*Y215 + 2*Y315 + 10*Y415 + 7*Y515 + 2*Y615 + 7*Y715 + 20*Y815 + 7*Y915 + 30*Y1015 + 200*Y1115 +
7*Y1215 + 200*Y1315 + 7*Y1415 + 2*Y1515 + 338*Y1615 + 2*Y1715 + 48*Y1815 + 7*Y1915 + 200*Y2015 + 7*Y2115 +
7*Y2215 + 7*Y2315 + 550*Y2415 + 200*Y2515 + 7*Y2615 + 2*Y2715 + 50*Y2815 + 2*Y2915 -2*X15 <=0;

9*Y115 + 4*Y215 + 2*Y315 + 9*Y415 + 4*Y515 + 3*Y615 + 6*Y715 + 7*Y815 + 4*Y915 + 4*Y1015 + 11*Y1115 + 5*Y1215 +
12*Y1315 + 3*Y1415 + 3*Y1515 + 10*Y1615 + 2*Y1715 + 7*Y1815 + 5*Y1915 + 12*Y2015 + 7*Y2115 + 5*Y2215 +
2*Y2315 + 25*Y2415 + 9*Y2515 + 5*Y2615 + 2*Y2715 + 5*Y2815 + 6*Y2915 -3*X15 <=0;

820931*Y115 + 147596*Y215 + 86404*Y315 + 584300*Y415 + 238265*Y515 + 147473*Y615 + 420908*Y715 +
239046*Y815 + 171183*Y915 + 86967*Y1015 + 142521*Y1115 + 1372680*Y1215 +
+ 119500*Y1315 + 247573*Y1415 + 93157*Y1515 + 1994765*Y1615 + 29538*Y1715 + 226845*Y1815 + 117310*Y1915 +
+ 955890*Y2015 + 3333230*Y2115 + 2349633*Y2215 + 139434*Y2315 + 2090879*Y2415 + 755723*Y2515 +
374615*Y2615 + 224382*Y2715 + 194903*Y2815 + 173934*Y2915 -93157*X15 <=0;

229*Y115 + 354*Y215 + 115*Y315 + 5827*Y415 + 4776*Y515 + 152*Y615 + 661*Y715 + 1019*Y815 + 278*Y915 +
60*Y1015 + 2155*Y1115 + 908*Y1215 + 2593*Y1315 + 272*Y1415 + 64*Y1515 +
1053*Y1615 + 137*Y1715 + 138*Y1815 + 523*Y1915 + 1222*Y2015 + 1674*Y2115 + 554*Y2215 + 197*Y2315 + 5794*Y2415 +
+ 1505*Y2515 + 1347*Y2615 + 310*Y2715 + 259*Y2815 + 277*Y2915 >= 64;

3*Y115 + 3*Y215 + 3*Y315 + 3*Y415 + 3*Y515 + 3*Y615 + 3*Y715 + 3*Y815 + 3*Y915 + 3*Y1015 + 3*Y1115 + 3*Y1215 +
+ 3*Y1315 + 3*Y1415 + 3*Y1515 + 3*Y1615 + 3*Y1715 + 3*Y1815 +
+ 3*Y1915 + 3*Y2015 + 3*Y2115 + 3*Y2215 + 3*Y2315 + 3*Y2415 + 3*Y2515 + 3*Y2615 + 3*Y2715 + 3*Y2815 + 3*Y2915
>=3;

4*Y115 + 3*Y215 + 1*Y315 + 4*Y415 + 3*Y515 + 1*Y615 + 3*Y715 + 4*Y815 + 2*Y915 + 1*Y1015 + 4*Y1115 + 2*Y1215 +
+ 4*Y1315 + 3*Y1415 + 2*Y1515 + 4*Y1615 + 1*Y1715 + 2*Y1815 + 3*Y1915 + 4*Y2015 + 3*Y2115 + 3*Y2215 + 2*Y2315 +
+ 4*Y2415 + 3*Y2515 + 4*Y2615 + 2*Y2715 + 3*Y2815 + 3*Y2915 >=2;

Y115 + Y215 + Y315 + Y415 + Y515 + Y615 + Y715 + Y815 + Y915 + Y1015 + Y1115 + Y1215 + Y1315 + Y1415 + Y1515 +
+ Y1615 + Y1715 + Y1815 + Y1915 + Y2015 + Y2115 + Y2215 + Y2315 + Y2415 + Y2515 + Y2615 + Y2715 + Y2815 +
Y2915 = 1;

@Free(X15);
Y115 >=0; Y215 >=0; Y315 >=0; Y415 >=0; Y515 >=0; Y615 >=0; Y715 >=0; Y815 >=0; Y915 >=0; Y1015 >=0; Y1115
>=0; Y1215 >=0; Y1315 >=0; Y1415 >=0; Y1515 >=0; Y1615 >=0; Y1715 >=0; Y1815 >=0; Y1915 >=0;
Y2015 >=0; Y2115 >=0; Y2215 >=0; Y2315 >=0; Y2415 >=0; Y2515 >=0; Y2615 >=0; Y2715 >=0; Y2815 >=0; Y2915 >=0;

```

### SOLUTION OF BCC MODEL

File		Edit	LINGO	Window	Help
Global optimal solution found.					
Objective value:		1.000000			
Infeasibilities:		0.000000			
Total solver iterations:		6			
Variable	Value	Reduced Cost			
X15	1.000000	0.000000			
Y115	0.000000	10.55259			
Y215	0.000000	-0.2220446E-15			
Y315	0.000000	0.4859525			
Y415	0.000000	4.270539			
Y515	0.000000	0.9473593			
Y615	0.000000	1.007822			
Y715	0.000000	2.421878			
Y815	0.000000	0.7006087			
Y915	0.000000	0.7452252			
Y1015	0.000000	0.8438040			
Y1115	0.000000	4.080214			
Y1215	0.000000	11.35779			

Y1315	0.000000	3.193324
Y1415	0.000000	0.8543607
Y1515	1.000000	-0.2220446E-15
Y1615	0.000000	20.69355
Y1715	0.000000	0.5551115E-16
Y1815	0.000000	2.036706
Y1915	0.000000	-0.1665335E-15
Y2015	0.000000	10.51330
Y2115	0.000000	27.56815
Y2215	0.000000	19.07648
Y2315	0.000000	0.4739118
Y2415	0.000000	28.55073
Y2515	0.000000	8.828792
Y2615	0.000000	1.568887
Y2715	0.000000	1.121393
Y2815	0.000000	1.078921
Y2915	0.000000	0.6642473

## SUMMARY

Efficiency of Warehouse 15 (Jabalpur) = 1

Warehouse 15 (Jabalpur) is an efficient warehouse.

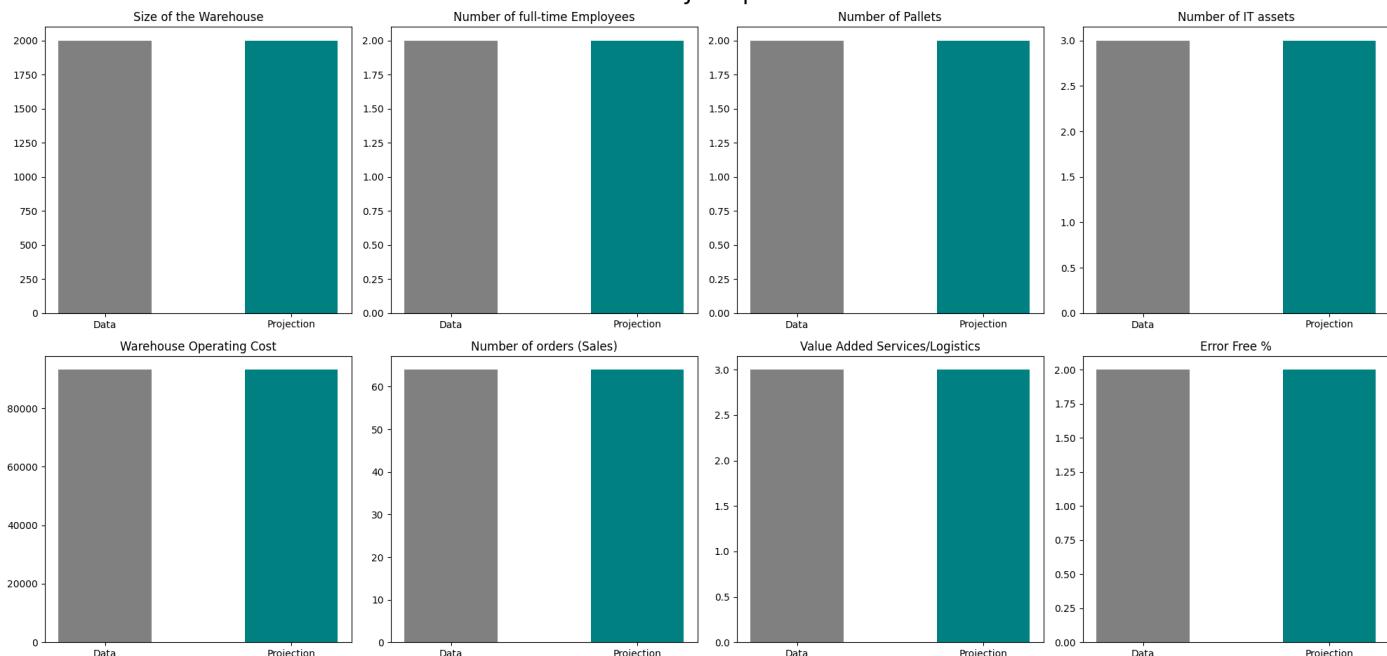
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	2000	2000	0
No. of Full-time Employees	2	2	0
No. of Pallets	2	2	0
No. of IT assets	3	3	0
Warehouse Operating Cost	93157	93157	0
No. of Orders (Sales)	64	64	0
Level of Value-Added Services	3	3	0
Error Free (%)	2	2	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 15 (Jabalpur)	1

DMU: Jabalpur



## WAREHOUSE 16 (Jaipur)

### BCC MODEL FORMULATION

```

!Dual Objective Function;
MIN = X16;

!Subject to;
13100*Y116 + 2000*Y216 + 550*Y316 + 9800*Y416 + 7500*Y516 + 550*Y616 + 4800*Y716 + 10250*Y816 + 2300*Y916 +
1000*Y1016 + 20700*Y1116 + 1200*Y1216 + 11000*Y1316 + 4100*Y1416 + 2000*Y1516 + 21000*Y1616 + 500*Y1716 +
2152*Y1816 + 9700*Y1916 + 15000*Y2016 + 9000*Y2116 + 4600*Y2216 + 2000*Y2316 + 37324*Y2416 + 11000*Y2516 +
10000*Y2616 + 4000*Y2716 + 5500*Y2816 + 2000*Y2916 -21000*X16 <=0;

7*Y116 + 2*Y216 + 2*Y316 + 14*Y416 + 4*Y516 + 2*Y616 + 3*Y716 + 5*Y816 + 2*Y916 + 1*Y1016 + 21*Y1116 +
6*Y1216 + 13*Y1316 + 2*Y1416 + 2*Y1516 + 5*Y1616 + 2*Y1716 + 4*Y1816 + 5*Y1916 + 15*Y2016 + 6*Y2116 + 5*Y2216 +
2*Y2316 + 48*Y2416 + 9*Y2516 + 4*Y2616 + 2*Y2716 + 2*Y2816 + 8*Y2916 -5*X16 <=0;

320*Y116 + 7*Y216 + 2*Y316 + 10*Y416 + 7*Y516 + 2*Y616 + 7*Y716 + 20*Y816 + 7*Y916 + 30*Y1016 + 200*Y1116 +
7*Y1216 + 200*Y1316 + 7*Y1416 + 2*Y1516 + 338*Y1616 + 2*Y1716 + 48*Y1816 + 7*Y1916 + 200*Y2016 + 7*Y2116 +
7*Y2216 + 7*Y2316 + 550*Y2416 + 200*Y2516 + 7*Y2616 + 2*Y2716 + 50*Y2816 + 2*Y2916 -338*X16 <=0;

9*Y116 + 4*Y216 + 2*Y316 + 9*Y416 + 4*Y516 + 3*Y616 + 6*Y716 + 7*Y816 + 4*Y916 + 4*Y1016 + 11*Y1116 + 5*Y1216 +
12*Y1316 + 3*Y1416 + 3*Y1516 + 10*Y1616 + 2*Y1716 + 7*Y1816 + 5*Y1916 + 12*Y2016 + 7*Y2116 + 5*Y2216 +
2*Y2316 + 25*Y2416 + 9*Y2516 + 5*Y2616 + 2*Y2716 + 5*Y2816 + 6*Y2916 -10*X16 <=0;

820931*Y116 + 147596*Y216 + 86404*Y316 + 584300*Y416 + 238265*Y516 + 147473*Y616 + 420908*Y716 +
239046*Y816 + 171183*Y916 + 86967*Y1016 + 142521*Y1116 + 1372680*Y1216 +
+ 119500*Y1316 + 247573*Y1416 + 93157*Y1516 + 1994765*Y1616 + 29538*Y1716 + 226845*Y1816 + 117310*Y1916 +
955890*Y2016 + 3333230*Y2116 + 2349633*Y2216 + 139434*Y2316 + 2090879*Y2416 + 755723*Y2516 + 374615*Y2616 +
224382*Y2716 + 194903*Y2816 + 173934*Y2916 -1994765*X16 <=0;

229*Y116 + 354*Y216 + 115*Y316 + 5827*Y416 + 4776*Y516 + 152*Y616 + 661*Y716 + 1019*Y816 + 278*Y916 +
60*Y1016 + 2155*Y1116 + 908*Y1216 + 2593*Y1316 + 272*Y1416 + 64*Y1516 +
1053*Y1616 + 137*Y1716 + 138*Y1816 + 523*Y1916 + 1222*Y2016 + 1674*Y2116 + 554*Y2216 + 197*Y2316 + 5794*Y2416 +
+ 1505*Y2516 + 1347*Y2616 + 310*Y2716 + 259*Y2816 + 277*Y2916 >=1053;

3*Y116 + 3*Y216 + 3*Y316 + 3*Y416 + 3*Y516 + 3*Y616 + 3*Y716 + 3*Y816 + 3*Y916 + 3*Y1016 + 3*Y1116 + 3*Y1216 +
+ 3*Y1316 + 3*Y1416 + 3*Y1516 + 3*Y1616 + 3*Y1716 + 3*Y1816 + 3*Y1916 + 3*Y2016 + 3*Y2116 + 3*Y2216 + 3*Y2316 +
+ 3*Y2416 + 3*Y2516 + 3*Y2616 + 3*Y2716 + 3*Y2816 + 3*Y2916 >=3;

4*Y116 + 3*Y216 + 1*Y316 + 4*Y416 + 3*Y516 + 1*Y616 + 3*Y716 + 4*Y816 + 2*Y916 + 1*Y1016 + 4*Y1116 + 2*Y1216 +
+ 4*Y1316 + 3*Y1416 + 2*Y1516 + 4*Y1616 + 1*Y1716 + 2*Y1816 +
+ 3*Y1916 + 4*Y2016 + 3*Y2116 + 3*Y2216 + 2*Y2316 + 4*Y2416 + 3*Y2516 + 4*Y2616 + 2*Y2716 + 3*Y2816 + 3*Y2916
>=4;

Y116 + Y216 + Y316 + Y416 + Y516 + Y616 + Y716 + Y816 + Y916 + Y1016 + Y1116 + Y1216 + Y1316 + Y1416 + Y1516 +
+ Y1616 + Y1716 + Y1816 + Y1916 + Y2016 + Y2116 + Y2216 + Y2316 + Y2416 + Y2516 + Y2616 + Y2716 + Y2816 +
Y2916 = 1;

@Free(X16);
Y116 >=0; Y216 >=0; Y316 >=0; Y416 >=0; Y516 >=0; Y616 >=0; Y716 >=0; Y816 >=0; Y916 >=0; Y1016 >=0; Y1116
>=0; Y1216 >=0; Y1316 >=0; Y1416 >=0; Y1516 >=0; Y1616 >=0; Y1716 >=0; Y1816 >=0; Y1916 >=0;
Y2016 >=0; Y2116 >=0; Y2216 >=0; Y2316 >=0; Y2416 >=0; Y2516 >=0; Y2616 >=0; Y2716 >=0; Y2816 >=0; Y2916 >=0;

```

### SOLUTION OF BCC MODEL

Global optimal solution found.		
Variable	Value	Reduced Cost
X16	0.8000000	0.0000000
Y116	0.0000000	0.6000000
Y216	0.0000000	0.0000000
Y316	0.0000000	0.8000000
Y416	0.0000000	2.0000000
Y516	0.0000000	0.4000000
Y616	0.0000000	0.8000000
Y716	0.0000000	0.2000000
Y816	0.0000000	0.2000000
Y916	0.0000000	0.4000000
Y1016	0.0000000	0.6000000
Y1116	0.0000000	3.4000000
Y1216	0.0000000	1.2000000
Y1316	0.0000000	1.8000000
Y1416	0.0000000	0.0000000
Y1516	0.0000000	0.4000000
Y1616	0.0000000	0.2000000
Y1716	0.0000000	0.8000000

Y1816	0.000000	0.8000000
Y1916	0.000000	0.6000000
Y2016	0.000000	2.200000
Y2116	0.000000	0.8000000
Y2216	0.000000	0.6000000
Y2316	0.000000	0.4000000
Y2416	0.000000	8.800000
Y2516	0.000000	1.400000
Y2616	1.000000	0.1110223E-15
Y2716	0.000000	0.4000000
Y2816	0.000000	0.000000
Y2916	0.000000	1.200000

## SUMMARY

Efficiency of Warehouse 16 (Jaipur) = 0.8

Warehouse 16 (Jaipur) is an inefficient warehouse.

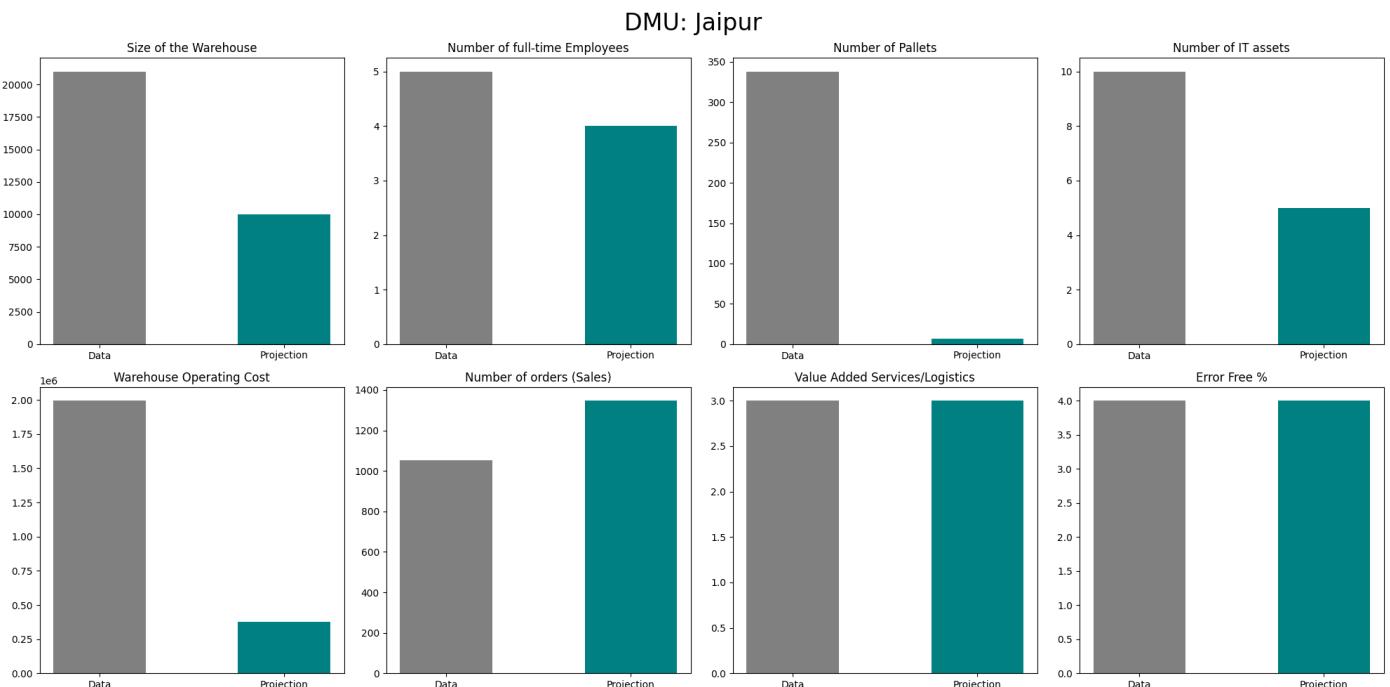
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	21000	9999.92	6799.912
No. of Full-time Employees	5	3.99996	0
No. of Pallets	338	7.00179	263.396
No. of IT assets	10	5.00005	3
Warehouse Operating Cost	1994765	374612	1221184
No. of Orders (Sales)	1053	1346.97	293.97
Level of Value-Added Services	3	3.00003	0
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 26 (Pune)	1

In order to make warehouse 16 (Jaipur) efficient, they need to decrease size of the warehouse by 52.381%, No of full-time employees by 20.001%, number of pallets by 97.928%, IT Assets by 49.999% , operating cost by 81.22%, whereas value-added logistics needs to be increased by 0.001% and no. of orders by 27.917%.



## WAREHOUSE 17 (Jammu)

### BCC MODEL FORMULATION

```

!Dual Objective Function;
MIN = X17;

!Subject to;
13100*Y117 + 2000*Y217 + 550*Y317 + 9800*Y417 + 7500*Y517 + 550*Y617 + 4800*Y717 + 10250*Y817 + 2300*Y917 +
1000*Y1017 + 20700*Y1117 + 1200*Y1217 + 11000*Y1317 + 4100*Y1417 + 2000*Y1517 + 21000*Y1617 + 500*Y1717 +
2152*Y1817 + 9700*Y1917 + 15000*Y2017 + 9000*Y2117 + 4600*Y2217 + 2000*Y2317 + 37324*Y2417 + 11000*Y2517 +
10000*Y2617 + 4000*Y2717 + 5500*Y2817 + 2000*Y2917 -500*X17 <=0;

7*Y117 + 2*Y217 + 2*Y317 + 14*Y417 + 4*Y517 + 2*Y617 + 3*Y717 + 5*Y817 + 2*Y917 + 1*Y1017 + 21*Y1117 +
6*Y1217 + 13*Y1317 + 2*Y1417 + 2*Y1517 + 5*Y1617 + 2*Y1717 + 4*Y1817 + 5*Y1917 + 15*Y2017 + 6*Y2117 + 5*Y2217 +
2*Y2317 + 48*Y2417 + 9*Y2517 + 4*Y2617 + 2*Y2717 + 2*Y2817 + 8*Y2917 -2*X17 <=0;

320*Y117 + 7*Y217 + 2*Y317 + 10*Y417 + 7*Y517 + 2*Y617 + 7*Y717 + 20*Y817 + 7*Y917 + 30*Y1017 + 200*Y1117 +
7*Y1217 + 200*Y1317 + 7*Y1417 + 2*Y1517 + 338*Y1617 + 2*Y1717 + 48*Y1817 + 7*Y1917 + 200*Y2017 + 7*Y2117 +
7*Y2217 + 7*Y2317 + 550*Y2417 + 200*Y2517 + 7*Y2617 + 2*Y2717 + 50*Y2817 + 2*Y2917 -2*X17 <=0;

9*Y117 + 4*Y217 + 2*Y317 + 9*Y417 + 4*Y517 + 3*Y617 + 6*Y717 + 7*Y817 + 4*Y917 + 4*Y1017 + 11*Y1117 + 5*Y1217 +
12*Y1317 + 3*Y1417 + 3*Y1517 + 10*Y1617 + 2*Y1717 + 7*Y1817 + 5*Y1917 + 12*Y2017 + 7*Y2117 + 5*Y2217 +
2*Y2317 + 25*Y2417 + 9*Y2517 + 5*Y2617 + 2*Y2717 + 5*Y2817 + 6*Y2917 -2*X17 <=0;

820931*Y117 + 147596*Y217 + 86404*Y317 + 584300*Y417 + 238265*Y517 + 147473*Y617 + 420908*Y717 +
239046*Y817 + 171183*Y917 + 86967*Y1017 + 142521*Y1117 + 1372680*Y1217 +
+ 119500*Y1317 + 247573*Y1417 + 93157*Y1517 + 1994765*Y1617 + 29538*Y1717 + 226845*Y1817 + 117310*Y1917 +
+ 955890*Y2017 + 3333230*Y2117 + 2349633*Y2217 + 139434*Y2317 + 2090879*Y2417 + 755723*Y2517 +
374615*Y2617 + 224382*Y2717 + 194903*Y2817 + 173934*Y2917 -29538*X17 <=0;

229*Y117 + 354*Y217 + 115*Y317 + 5827*Y417 + 4776*Y517 + 152*Y617 + 661*Y717 + 1019*Y817 + 278*Y917 +
60*Y1017 + 2155*Y1117 + 908*Y1217 + 2593*Y1317 + 272*Y1417 + 64*Y1517 +
1053*Y1617 + 137*Y1717 + 138*Y1817 + 523*Y1917 + 1222*Y2017 + 1674*Y2117 + 554*Y2217 + 197*Y2317 + 5794*Y2417 +
+ 1505*Y2517 + 1347*Y2617 + 310*Y2717 + 259*Y2817 + 277*Y2917 >=137;

3*Y117 + 3*Y217 + 3*Y317 + 3*Y417 + 3*Y517 + 3*Y617 + 3*Y717 + 3*Y817 + 3*Y917 + 3*Y1017 + 3*Y1117 + 3*Y1217 +
+ 3*Y1317 + 3*Y1417 + 3*Y1517 + 3*Y1617 + 3*Y1717 + 3*Y1817 + 3*Y1917 + 3*Y2017 + 3*Y2117 + 3*Y2217 + 3*Y2317 +
+ 3*Y2417 + 3*Y2517 + 3*Y2617 + 3*Y2717 + 3*Y2817 + 3*Y2917 >=3;

4*Y117 + 3*Y217 + 1*Y317 + 4*Y417 + 3*Y517 + 1*Y617 + 3*Y717 + 4*Y817 + 2*Y917 + 1*Y1017 + 4*Y1117 + 2*Y1217 +
+ 4*Y1317 + 3*Y1417 + 2*Y1517 + 4*Y1617 + 1*Y1717 + 2*Y1817 +
+ 3*Y1917 + 4*Y2017 + 3*Y2117 + 3*Y2217 + 2*Y2317 + 4*Y2417 + 3*Y2517 + 4*Y2617 + 2*Y2717 + 3*Y2817 + 3*Y2917
>=1;

Y117 + Y217 + Y317 + Y417 + Y517 + Y617 + Y717 + Y817 + Y917 + Y1017 + Y1117 + Y1217 + Y1317 + Y1417 + Y1517 +
+ Y1617 + Y1717 + Y1817 + Y1917 + Y2017 + Y2117 + Y2217 + Y2317 + Y2417 + Y2517 + Y2617 + Y2717 + Y2817 +
Y2917 = 1;

@Free(X17);
Y117 >=0; Y217 >=0; Y317 >=0; Y417 >=0; Y517 >=0; Y617 >=0; Y717 >=0; Y817 >=0; Y917 >=0; Y1017 >=0; Y1117
>=0; Y1217 >=0; Y1317 >=0; Y1417 >=0; Y1517 >=0; Y1617 >=0; Y1717 >=0; Y1817 >=0; Y1917 >=0; Y2017 >=0; Y2117
>=0; Y2217 >=0; Y2317 >=0; Y2417 >=0; Y2517 >=0; Y2617 >=0; Y2717 >=0; Y2817 >=0; Y2917 >=0;

```

### SOLUTION OF BCC MODEL

File		Edit	LINGO	Window	Help
Global optimal solution found.					
Objective value:		1.000000			
Infeasibilities:		0.000000			
Total solver iterations:		1			
Variable	Value	Reduced Cost			
X17	1.000000	0.000000			
Y117	0.000000	26.79237			
Y217	0.000000	3.996818			
Y317	0.000000	1.925181			
Y417	0.000000	18.78130			
Y517	0.000000	7.066389			
Y617	0.000000	3.992654			
Y717	0.000000	13.24971			
Y817	0.000000	7.092830			
Y917	0.000000	4.795348			
Y1017	0.000000	1.944241			
Y1117	0.000000	3.825005			
Y1217	0.000000	45.47166			

Y1317	0.000000	3.045636
Y1417	0.000000	7.381509
Y1517	0.000000	2.153802
Y1617	0.000000	66.53216
Y1717	1.000000	0.000000
Y1817	0.000000	6.679768
Y1917	0.000000	2.971494
Y2017	0.000000	31.36137
Y2117	0.000000	111.8455
Y2217	0.000000	78.54611
Y2317	0.000000	3.720496
Y2417	0.000000	69.78607
Y2517	0.000000	24.58477
Y2617	0.000000	11.68248
Y2717	0.000000	6.596384
Y2817	0.000000	5.598382
Y2917	0.000000	4.888483

## SUMMARY

Efficiency of Warehouse 17 (Jammu) = 1

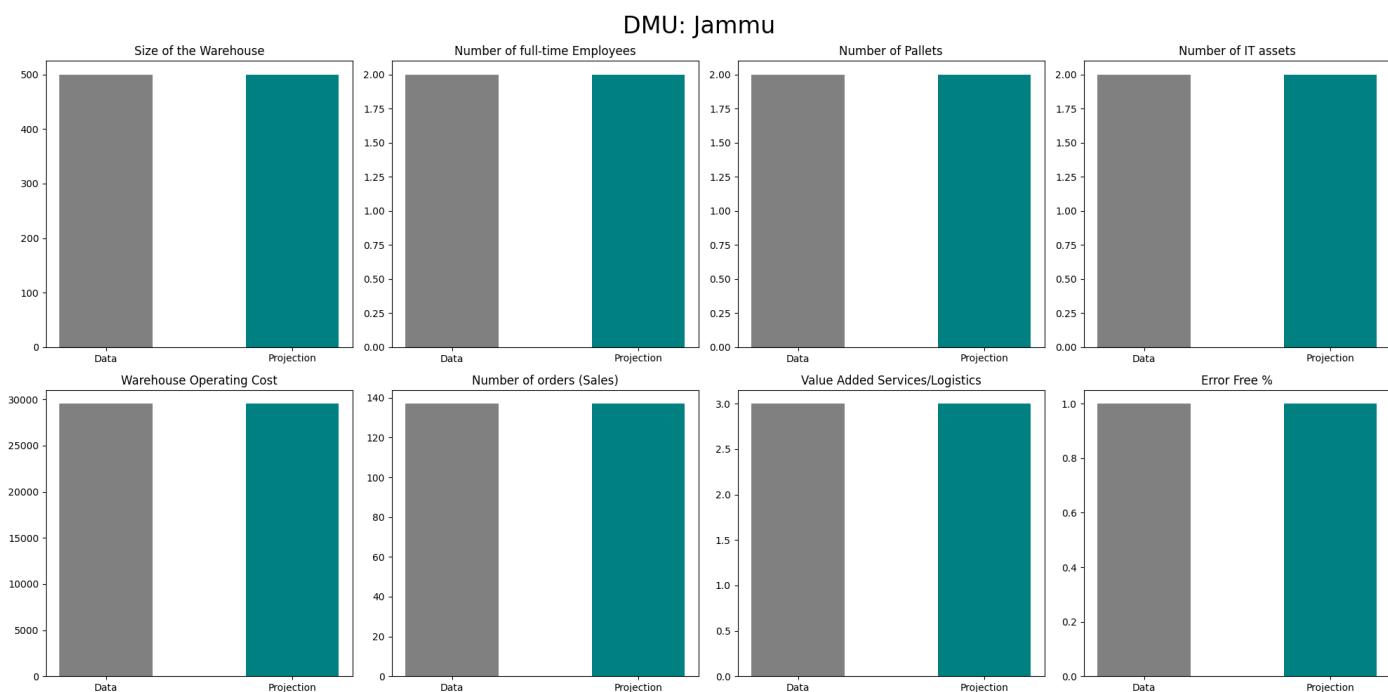
Warehouse 17 (Jammu) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	500	500	0
No. of Full-time Employees	2	2	0
No. of Pallets	2	2	0
No. of IT assets	2	2	0
Warehouse Operating Cost	29538	29538	0
No. of Orders (Sales)	137	137	0
Level of Value-Added Services	3	3	0
Error Free (%)	1	1	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 17 (Jammu)	1



## WAREHOUSE 18 (Kanpur)

### BCC MODEL FORMULATION

```

!Dual Objective Function;
MIN = X18;

!Subject to;
13100*Y118 + 2000*Y218 + 550*Y318 + 9800*Y418 + 7500*Y518 + 550*Y618 + 4800*Y718 + 10250*Y818 + 2300*Y918 +
1000*Y1018 + 20700*Y1118 + 1200*Y1218 + 11000*Y1318 + 4100*Y1418 + 2000*Y1518 + 21000*Y1618 + 500*Y1718 +
2152*Y1818 + 9700*Y1918 + 15000*Y2018 + 9000*Y2118 + 4600*Y2218 + 2000*Y2318 + 37324*Y2418 + 11000*Y2518 +
10000*Y2618 + 4000*Y2718 + 5500*Y2818 + 2000*Y2918 - 2152*X18 <=0;

7*Y118 + 2*Y218 + 2*Y318 + 14*Y418 + 4*Y518 + 2*Y618 + 3*Y718 + 5*Y818 + 2*Y918 + 1*Y1018 + 21*Y1118 +
6*Y1218 + 13*Y1318 + 2*Y1418 + 2*Y1518 + 5*Y1618 + 2*Y1718 + 4*Y1818 + 5*Y1918 + 15*Y2018 + 6*Y2118 + 5*Y2218 +
2*Y2318 + 48*Y2418 + 9*Y2518 + 4*Y2618 + 2*Y2718 + 2*Y2818 + 8*Y2918 - 4*X18 <=0;

320*Y118 + 7*Y218 + 2*Y318 + 10*Y418 + 7*Y518 + 2*Y618 + 7*Y718 + 20*Y818 + 7*Y918 + 30*Y1018 + 200*Y1118 +
7*Y1218 + 200*Y1318 + 7*Y1418 + 2*Y1518 + 338*Y1618 + 2*Y1718 + 48*Y1818 + 7*Y1918 + 200*Y2018 + 7*Y2118 +
7*Y2218 + 7*Y2318 + 550*Y2418 + 200*Y2518 + 7*Y2618 + 2*Y2718 + 50*Y2818 + 2*Y2918 - 48*X18 <=0;

9*Y118 + 4*Y218 + 2*Y318 + 9*Y418 + 4*Y518 + 3*Y618 + 6*Y718 + 7*Y818 + 4*Y918 + 4*Y1018 + 11*Y1118 + 5*Y1218 +
12*Y1318 + 3*Y1418 + 3*Y1518 + 10*Y1618 + 2*Y1718 + 7*Y1818 + 5*Y1918 + 12*Y2018 + 7*Y2118 + 5*Y2218 +
2*Y2318 + 25*Y2418 + 9*Y2518 + 5*Y2618 + 2*Y2718 + 5*Y2818 + 6*Y2918 - 7*X18 <=0;

820931*Y118 + 147596*Y218 + 86404*Y318 + 584300*Y418 + 238265*Y518 + 147473*Y618 + 420908*Y718 +
239046*Y818 + 171183*Y918 + 86967*Y1018 + 142521*Y1118 + 1372680*Y1218 +
+ 119500*Y1318 + 247573*Y1418 + 93157*Y1518 + 1994765*Y1618 + 29538*Y1718 + 226845*Y1818 + 117310*Y1918 +
+ 955890*Y2018 + 3333230*Y2118 + 2349633*Y2218 + 139434*Y2318 + 2090879*Y2418 + 755723*Y2518 +
374615*Y2618 + 224382*Y2718 + 194903*Y2818 + 173934*Y2918 - 226845*X18 <=0;

229*Y118 + 354*Y218 + 115*Y318 + 5827*Y418 + 4776*Y518 + 152*Y618 + 661*Y718 + 1019*Y818 + 278*Y918 +
60*Y1018 + 2155*Y1118 + 908*Y1218 + 2593*Y1318 + 272*Y1418 + 64*Y1518 +
1053*Y1618 + 137*Y1718 + 138*Y1818 + 523*Y1918 + 1222*Y2018 + 1674*Y2118 + 554*Y2218 + 197*Y2318 + 5794*Y2418 +
+ 1505*Y2518 + 1347*Y2618 + 310*Y2718 + 259*Y2818 + 277*Y2918 >=138;

3*Y118 + 3*Y218 + 3*Y318 + 3*Y418 + 3*Y518 + 3*Y618 + 3*Y718 + 3*Y818 + 3*Y918 + 3*Y1018 + 3*Y1118 + 3*Y1218 +
+ 3*Y1318 + 3*Y1418 + 3*Y1518 + 3*Y1618 + 3*Y1718 + 3*Y1818 +
+ 3*Y1918 + 3*Y2018 + 3*Y2118 + 3*Y2218 + 3*Y2318 + 3*Y2418 + 3*Y2518 + 3*Y2618 + 3*Y2718 + 3*Y2818 + 3*Y2918
>=3;

4*Y118 + 3*Y218 + 1*Y318 + 4*Y418 + 3*Y518 + 1*Y618 + 3*Y718 + 4*Y818 + 2*Y918 + 1*Y1018 + 4*Y1118 + 2*Y1218 +
+ 4*Y1318 + 3*Y1418 + 2*Y1518 + 4*Y1618 + 1*Y1718 + 2*Y1818 + 3*Y1918 + 4*Y2018 + 3*Y2118 + 3*Y2218 + 2*Y2318 +
+ 4*Y2418 + 3*Y2518 + 4*Y2618 + 2*Y2718 + 3*Y2818 + 3*Y2918 >=2;

Y118 + Y218 + Y318 + Y418 + Y518 + Y618 + Y718 + Y818 + Y918 + Y1018 + Y1118 + Y1218 + Y1318 + Y1418 + Y1518 +
+ Y1618 + Y1718 + Y1818 + Y1918 + Y2018 + Y2118 + Y2218 + Y2318 + Y2418 + Y2518 + Y2618 + Y2718 + Y2818 +
Y2918 = 1;

@Free(X18);
Y118 >=0; Y218 >=0; Y318 >=0; Y418 >=0; Y518 >=0; Y618 >=0; Y718 >=0; Y818 >=0; Y918 >=0; Y1018 >=0; Y1118
>=0; Y1218 >=0; Y1318 >=0; Y1418 >=0; Y1518 >=0; Y1618 >=0; Y1718 >=0; Y1818 >=0; Y1918 >=0;
Y2018 >=0; Y2118 >=0; Y2218 >=0; Y2318 >=0; Y2418 >=0; Y2518 >=0; Y2618 >=0; Y2718 >=0; Y2818 >=0; Y2918 >=0;

```

### SOLUTION OF BCC MODEL

File		Edit	LINGO	Window	Help
Global optimal solution found.					
Objective value:	0.5800766				
Infeasibilities:	0.000000				
Total solver iterations:	5				
Variable	Value	Reduced Cost			
X18	0.5800766	-0.5984796E-16			
Y118	0.000000	4.800890			
Y218	0.4832490	0.1387779E-15			
Y318	0.000000	0.2416393E-01			
Y418	0.000000	3.269437			
Y518	0.000000	2.546949			
Y618	0.000000	0.2526437E-01			
Y718	0.000000	1.300722			
Y818	0.000000	3.471468			
Y918	0.000000	0.4874125			
Y1018	0.000000	0.2324271			
Y1118	0.000000	8.305827			
Y1218	0.3350210E-01	-0.4440892E-15			
Y1318	0.000000	3.816403			
Y1418	0.000000	0.9736491			
Y1518	0.000000	0.3471711			
Y1618	0.000000	8.478040			
Y1718	0.4832490	-0.1387779E-16			
Y1818	0.000000	0.4199234			
Y1918	0.000000	3.562895			

Y2018	0.000000	5.682612
Y2118	0.000000	3.296896
Y2218	0.000000	1.242920
Y2318	0.000000	0.3480050
Y2418	0.000000	16.03427
Y2518	0.000000	4.176019
Y2618	0.000000	3.358215
Y2718	0.000000	1.275105
Y2818	0.000000	1.620598
Y2918	0.000000	0.4746007E-03

## SUMMARY

Efficiency of Warehouse 18 (Kanpur) = 0.5801

Warehouse 18 (Kanpur) is an inefficient warehouse.

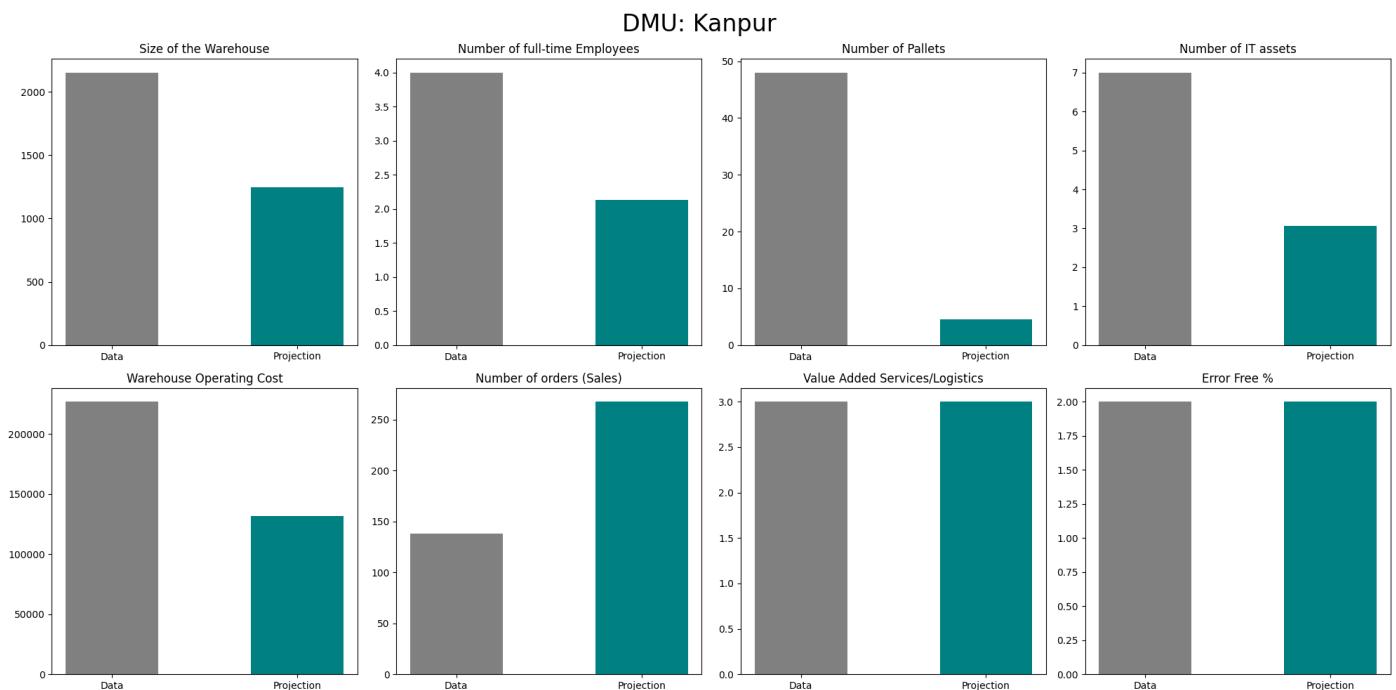
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	2152	1248.32	0
No. of Full-time Employees	4	2.13403	0.186
No. of Pallets	48	4.58375	23.26
No. of IT assets	7	3.06701	0.994
Warehouse Operating Cost	226845	131587	0
No. of Orders (Sales)	138	267.695	129.695
Level of Value-Added Services	3	3.00003	0
Error Free (%)	2	2	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 2 (Ahmedabad)	0.483249
Warehouse 12 (Gorakhpur)	0.0335021
Warehouse 17 (Jammu)	0.483249

In order to make warehouse 18 (Kanpur) efficient, they need to decrease size of the warehouse by 41.992%, No of full-time employees by 46.649%, number of pallets by 90.451%, IT Assets by 56.186% , operating cost by 41.992%, whereas value-added logistics needs to be increased by 0.001% and no. of Orders by 93.982%.



## WAREHOUSE 19 (Karnal)

### BCC MODEL FORMULATION

```

!Dual Objective Function;
MIN = X19;

!Subject to;
13100*Y119 + 2000*Y219 + 550*Y319 + 9800*Y419 + 7500*Y519 + 550*Y619 + 4800*Y719 + 10250*Y819 + 2300*Y919 +
1000*Y1019 + 20700*Y1119 + 1200*Y1219 + 11000*Y1319 + 4100*Y1419 + 2000*Y1519 + 21000*Y1619 + 500*Y1719 +
2152*Y1819 + 9700*Y1919 + 15000*Y2019 + 9000*Y2119 + 4600*Y2219 + 2000*Y2319 + 37324*Y2419 + 11000*Y2519 +
10000*Y2619 + 4000*Y2719 + 5500*Y2819 + 2000*Y2919 - 9700*X19 <=0;

7*Y119 + 2*Y219 + 2*Y319 + 14*Y419 + 4*Y519 + 2*Y619 + 3*Y719 + 5*Y819 + 2*Y919 + 1*Y1019 + 21*Y1119 +
6*Y1219 + 13*Y1319 + 2*Y1419 + 2*Y1519 + 5*Y1619 + 2*Y1719 + 4*Y1819 + 5*Y1919 + 15*Y2019 + 6*Y2119 + 5*Y2219 +
+ 2*Y2319 + 48*Y2419 + 9*Y2519 + 4*Y2619 + 2*Y2719 + 2*Y2819 + 8*Y2919 - 5*X19 <= 0;

320*Y119 + 7*Y219 + 2*Y319 + 10*Y419 + 7*Y519 + 2*Y619 + 7*Y719 + 20*Y819 + 7*Y919 + 30*Y1019 + 200*Y1119 +
7*Y1219 + 200*Y1319 + 7*Y1419 + 2*Y1519 + 338*Y1619 + 2*Y1719 + 48*Y1819 + 7*Y1919 + 200*Y2019 + 7*Y2119 +
7*Y2219 + 7*Y2319 + 550*Y2419 + 200*Y2519 + 7*Y2619 + 2*Y2719 + 50*Y2819 + 2*Y2919 - 7*X19 <=0;

9*Y119 + 4*Y219 + 2*Y319 + 9*Y419 + 4*Y519 + 3*Y619 + 6*Y719 + 7*Y819 + 4*Y919 + 4*Y1019 + 11*Y1119 + 5*Y1219 +
+ 12*Y1319 + 3*Y1419 + 3*Y1519 + 10*Y1619 + 2*Y1719 + 7*Y1819 + 5*Y1919 + 12*Y2019 + 7*Y2119 + 5*Y2219 +
2*Y2319 + 25*Y2419 + 9*Y2519 + 5*Y2619 + 2*Y2719 + 5*Y2819 + 6*Y2919 - 5*X19 <=0;

820931*Y119 + 147596*Y219 + 86404*Y319 + 584300*Y419 + 238265*Y519 + 147473*Y619 + 420908*Y719 +
239046*Y819 + 171183*Y919 + 86967*Y1019 + 142521*Y1119 + 1372680*Y1219
+ 119500*Y1319 + 247573*Y1419 + 93157*Y1519 + 1994765*Y1619 + 29538*Y1719 + 226845*Y1819 + 117310*Y1919
+ 955890*Y2019 + 3333230*Y2119 + 2349633*Y2219 + 139434*Y2319 + 2090879*Y2419 + 755723*Y2519 +
374615*Y2619 + 224382*Y2719 + 194903*Y2819 + 173934*Y2919 - 117310*X19 <=0;

229*Y119 + 354*Y219 + 115*Y319 + 5827*Y419 + 4776*Y519 + 152*Y619 + 661*Y719 + 1019*Y819 + 278*Y919 +
60*Y1019 + 2155*Y1119 + 908*Y1219 + 2593*Y1319 + 272*Y1419 + 64*Y1519 +
1053*Y1619 + 137*Y1719 + 138*Y1819 + 523*Y1919 + 1222*Y2019 + 1674*Y2119 + 554*Y2219 + 197*Y2319 + 5794*Y2419 +
+ 1505*Y2519 + 1347*Y2619 + 310*Y2719 + 259*Y2819 + 277*Y2919 >=523;

3*Y119 + 3*Y219 + 3*Y319 + 3*Y419 + 3*Y519 + 3*Y619 + 3*Y719 + 3*Y819 + 3*Y919 + 3*Y1019 + 3*Y1119 + 3*Y1219 +
+ 3*Y1319 + 3*Y1419 + 3*Y1519 + 3*Y1619 + 3*Y1719 + 3*Y1819
+ 3*Y1919 + 3*Y2019 + 3*Y2119 + 3*Y2219 + 3*Y2319 + 3*Y2419 + 3*Y2519 + 3*Y2619 + 3*Y2719 + 3*Y2819 + 3*Y2919
>= 3;

4*Y119 + 3*Y219 + 1*Y319 + 4*Y419 + 3*Y519 + 1*Y619 + 3*Y719 + 4*Y819 + 2*Y919 + 1*Y1019 + 4*Y1119 + 2*Y1219 +
+ 4*Y1319 + 3*Y1419 + 2*Y1519 + 4*Y1619 + 1*Y1719 + 2*Y1819 + 3*Y1919 + 4*Y2019 + 3*Y2119 + 3*Y2219 + 2*Y2319 +
+ 4*Y2419 + 3*Y2519 + 4*Y2619 + 2*Y2719 + 3*Y2819 + 3*Y2919 >= 3;

Y119 + Y219 + Y319 + Y419 + Y519 + Y619 + Y719 + Y819 + Y919 + Y1019 + Y1119 + Y1219 + Y1319 + Y1419 + Y1519 +
+ Y1619 + Y1719 + Y1819 + Y1919 + Y2019 + Y2119 + Y2219 + Y2319 + Y2419 + Y2519 + Y2619 + Y2719 + Y2819 +
Y2919 = 1;

@Free(X19);
Y119 >=0; Y219 >=0; Y319 >=0; Y419 >=0; Y519 >=0; Y619 >=0; Y719 >=0; Y819 >=0; Y919 >=0; Y1019 >=0; Y1119
>=0; Y1219 >=0; Y1319 >=0; Y1419 >=0; Y1519 >=0; Y1619 >=0; Y1719 >=0; Y1819 >=0; Y1919 >=0;
Y2019 >=0; Y2119 >=0; Y2219 >=0; Y2319 >=0; Y2419 >=0; Y2519 >=0; Y2619 >=0; Y2719 >=0; Y2819 >=0; Y2919 >=0;

```

### SOLUTION OF BCC MODEL

File		Edit	LINGO	Window	Help
Global optimal solution found.					
Objective value:		1.000000			
Infeasibilities:		0.000000			
Total solver iterations:		3			
Variable	Value	Reduced Cost			
X19	1.000000	-0.1110223E-15			
Y119	0.000000	4.437845			
Y219	0.000000	0.7391490E-01			
Y319	0.000000	0.3806703			
Y419	0.000000	3.154389			
Y519	0.000000	0.7667511			
Y619	0.000000	0.7894763			
Y719	0.000000	1.946452			
Y819	0.000000	0.4567284			
Y919	0.000000	0.5900025			
Y1019	0.000000	0.3414976			
Y1119	0.000000	0.4976385			
Y1219	0.000000	8.804787			

Y1319	0.000000	-0.1110223E-15
Y1419	0.000000	0.7431774
Y1519	0.000000	0.6768366E-01
Y1619	0.000000	12.20980
Y1719	0.000000	0.000000
Y1819	0.000000	1.048496
Y1919	1.000000	0.2220446E-15
Y2019	0.000000	5.684815
Y2119	0.000000	21.57084
Y2219	0.000000	14.94354
Y2319	0.000000	0.3774695
Y2419	0.000000	14.69969
Y2519	0.000000	4.445408
Y2619	0.000000	1.321308
Y2719	0.000000	0.9461254
Y2819	0.000000	0.3905957
Y2919	0.000000	0.5078749

## SUMMARY

Efficiency of Warehouse 19 (Karnal) = 1

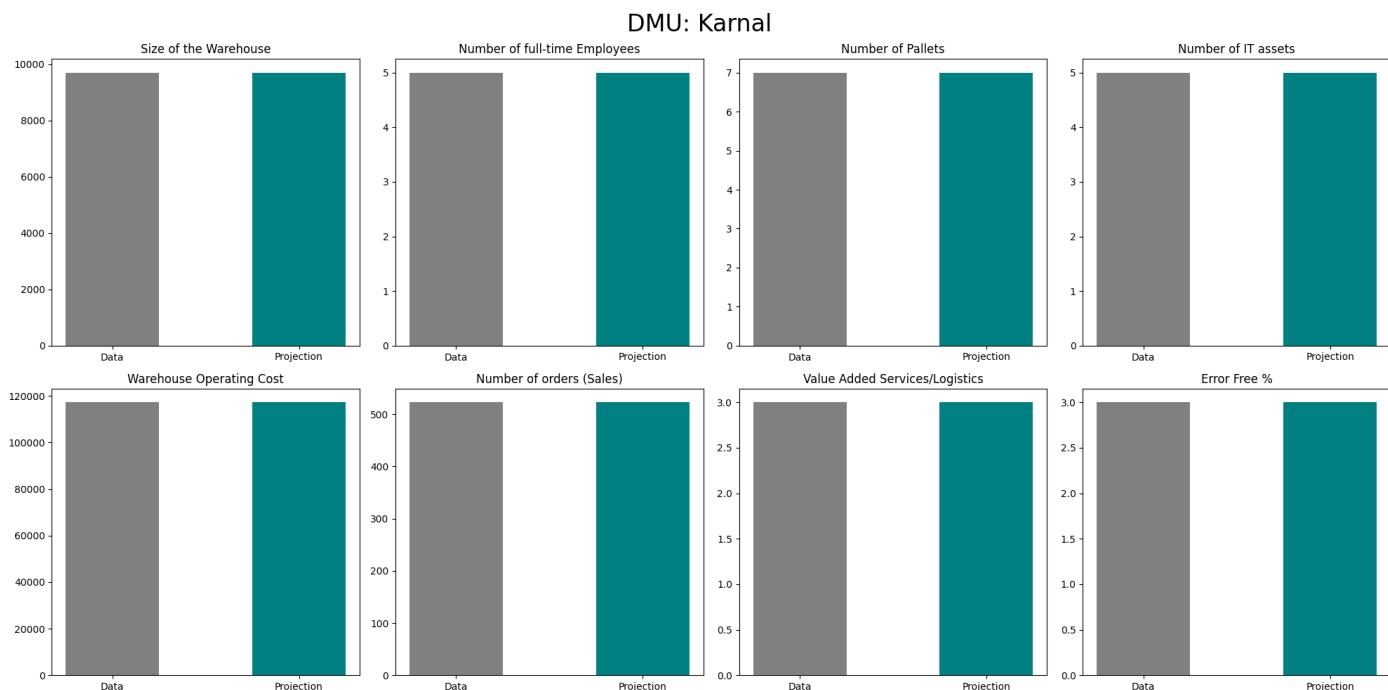
Warehouse 19 (Karnal) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	9700	9700	0
No. of Full-time Employees	5	5	0
No. of Pallets	7	7	0
No. of IT assets	5	5	0
Warehouse Operating Cost	117310	117310	0
No. of Orders (Sales)	523	523	0
Level of Value-Added Services	3	3	0
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 19 (Karnal)	1



## WAREHOUSE 20 (Kolkata)

### BCC MODEL FORMULATION

```

!Dual Objective Function;
MIN = X20;

!Subject to;
13100*Y120 + 2000*Y220 + 550*Y320 + 9800*Y420 + 7500*Y520 + 550*Y620 + 4800*Y720 + 10250*Y820 + 2300*Y920 +
1000*Y1020 + 20700*Y1120 + 1200*Y1220 + 11000*Y1320 + 4100*Y1420 + 2000*Y1520 + 21000*Y1620 + 500*Y1720 +
2152*Y1820 + 9700*Y1920 + 15000*Y2020 + 9000*Y2120 + 4600*Y2220 + 2000*Y2320 + 37324*Y2420 + 11000*Y2520 +
10000*Y2620 + 4000*Y2720 + 5500*Y2820 + 2000*Y2920-15000*X20 <=0;

7*Y120 + 2*Y220 + 2*Y320 + 14*Y420 + 4*Y520 + 2*Y620 + 3*Y720 + 5*Y820 + 2*Y920 + 1*Y1020 + 21*Y1120 +
6*Y1220 + 13*Y1320 + 2*Y1420 + 2*Y1520 + 5*Y1620 + 2*Y1720 + 4*Y1820 + 5*Y1920 + 15*Y2020 + 6*Y2120 + 5*Y2220 +
2*Y2320 + 48*Y2420 + 9*Y2520 + 4*Y2620 + 2*Y2720 + 2*Y2820 + 8*Y2920 - 15*X20 <= 0;

320*Y120 + 7*Y220 + 2*Y320 + 10*Y420 + 7*Y520 + 2*Y620 + 7*Y720 + 20*Y820 + 7*Y920 + 30*Y1020 + 200*Y1120 +
7*Y1220 + 200*Y1320 + 7*Y1420 + 2*Y1520 + 338*Y1620 + 2*Y1720 + 48*Y1820 + 7*Y1920 + 200*Y2020 + 7*Y2120 +
7*Y2220 + 7*Y2320 + 550*Y2420 + 200*Y2520 + 7*Y2620 + 2*Y2720 + 50*Y2820 + 2*Y2920 - 200*X20 <= 0;

9*Y120 + 4*Y220 + 2*Y320 + 9*Y420 + 4*Y520 + 3*Y620 + 6*Y720 + 7*Y820 + 4*Y920 + 4*Y1020 + 11*Y1120 + 5*Y1220 +
12*Y1320 + 3*Y1420 + 3*Y1520 + 10*Y1620 + 2*Y1720 + 7*Y1820 + 5*Y1920 + 12*Y2020 + 7*Y2120 + 5*Y2220 +
2*Y2320 + 25*Y2420 + 9*Y2520 + 5*Y2620 + 2*Y2720 + 5*Y2820 + 6*Y2920 - 12*X20 <= 0;

820931*Y120 + 147596*Y220 + 86404*Y320 + 584300*Y420 + 238265*Y520 + 147473*Y620 + 420908*Y720 +
239046*Y820 + 171183*Y920 + 86967*Y1020 + 142521*Y1120 + 1372680*Y1220 +
+ 119500*Y1320 + 247573*Y1420 + 93157*Y1520 + 1994765*Y1620 + 29538*Y1720 + 226845*Y1820 + 117310*Y1920 +
+ 955890*Y2020 + 3333230*Y2120 + 2349633*Y2220 + 139434*Y2320 + 2090879*Y2420 + 755723*Y2520 +
374615*Y2620 + 224382*Y2720 + 194903*Y2820 + 173934*Y2920 - 955890*X20 <= 0;

229*Y120 + 354*Y220 + 115*Y320 + 5827*Y420 + 4776*Y520 + 152*Y620 + 661*Y720 + 1019*Y820 + 278*Y920 +
60*Y1020 + 2155*Y1120 + 908*Y1220 + 2593*Y1320 + 272*Y1420 + 64*Y1520 +
1053*Y1620 + 137*Y1720 + 138*Y1820 + 523*Y1920 + 1222*Y2020 + 1674*Y2120 + 554*Y2220 + 197*Y2320 + 5794*Y2420 +
+ 1505*Y2520 + 1347*Y2620 + 310*Y2720 + 259*Y2820 + 277*Y2920 >= 1222;

3*Y120 + 3*Y220 + 3*Y320 + 3*Y420 + 3*Y520 + 3*Y620 + 3*Y720 + 3*Y820 + 3*Y920 + 3*Y1020 + 3*Y1120 + 3*Y1220 +
+ 3*Y1320 + 3*Y1420 + 3*Y1520 + 3*Y1620 + 3*Y1720 + 3*Y1820 + 3*Y1920 + 3*Y2020 + 3*Y2120 + 3*Y2220 + 3*Y2320 +
+ 3*Y2420 + 3*Y2520 + 3*Y2620 + 3*Y2720 + 3*Y2820 + 3*Y2920 >= 3;

4*Y120 + 3*Y220 + 1*Y320 + 4*Y420 + 3*Y520 + 1*Y620 + 3*Y720 + 4*Y820 + 2*Y920 + 1*Y1020 + 4*Y1120 + 2*Y1220 +
+ 4*Y1320 + 3*Y1420 + 2*Y1520 + 4*Y1620 + 1*Y1720 + 2*Y1820 + 3*Y1920 + 4*Y2020 + 3*Y2120 + 3*Y2220 + 2*Y2320 +
+ 4*Y2420 + 3*Y2520 + 4*Y2620 + 2*Y2720 + 3*Y2820 + 3*Y2920 >= 4;

Y120 + Y220 + Y320 + Y420 + Y520 + Y620 + Y720 + Y820 + Y920 + Y1020 + Y1120 + Y1220 + Y1320 + Y1420 + Y1520 +
+ Y1620 + Y1720 + Y1820 + Y1920 + Y2020 + Y2120 + Y2220 + Y2320 + Y2420 + Y2520 + Y2620 + Y2720 + Y2820 +
Y2920 = 1;

@Free (X20);
Y120 >=0; Y220 >=0; Y320 >=0; Y420 >=0; Y520 >=0; Y620 >=0; Y720 >=0; Y820 >=0; Y920 >=0; Y1020 >=0; Y1120 >=0;
Y1220 >=0; Y1320 >=0; Y1420 >=0; Y1520 >=0; Y1620 >=0; Y1720 >=0; Y1820 >=0; Y1920 >=0;
Y2020 >=0; Y2120 >=0; Y2220 >=0; Y2320 >=0; Y2420 >=0; Y2520 >=0; Y2620 >=0; Y2720 >=0; Y2820 >=0; Y2920 >=0;

```

### SOLUTION OF BCC MODEL

Global optimal solution found.		
Objective value:	0.6588235	
Infeasibilities:	0.000000	
Total solver iterations:	13	
Variable	Value	Reduced Cost
X20	0.6588235	0.2428613E-16
Y120	0.000000	0.2065359
Y220	0.000000	-0.2220446E-15
Y320	0.000000	0.9562092
Y420	0.5882353	0.000000
Y520	0.000000	0.3620915
Y620	0.000000	0.9562092
Y720	0.000000	0.1843137
Y820	0.000000	0.1764706E-01
Y920	0.000000	0.5450980
Y1020	0.000000	0.9843137
Y1120	0.000000	0.7215686
Y1220	0.000000	0.4784314
Y1320	0.000000	0.7712418E-01
Y1420	0.000000	0.1372549
Y1520	0.000000	0.5254902
Y1620	0.000000	0.7202614
Y1720	0.000000	0.9529412
Y1820	0.000000	0.5380392
Y1920	0.000000	0.5071895
Y2020	0.000000	0.3411765

Y2120	0.000000	0.4627451
Y2220	0.000000	0.1738562
Y2320	0.000000	0.5254902
Y2420	0.000000	1.843399
Y2520	0.000000	0.5973856
Y2620	0.4117647	-0.1691355E-15
Y2720	0.000000	0.6562092
Y2820	0.000000	0.2287582
Y2920	0.000000	0.7843137E-02

## SUMMARY

Efficiency of Warehouse 20 (Kolkata) = 0.6588235

Warehouse 20 (Kolkata) is an inefficient warehouse.

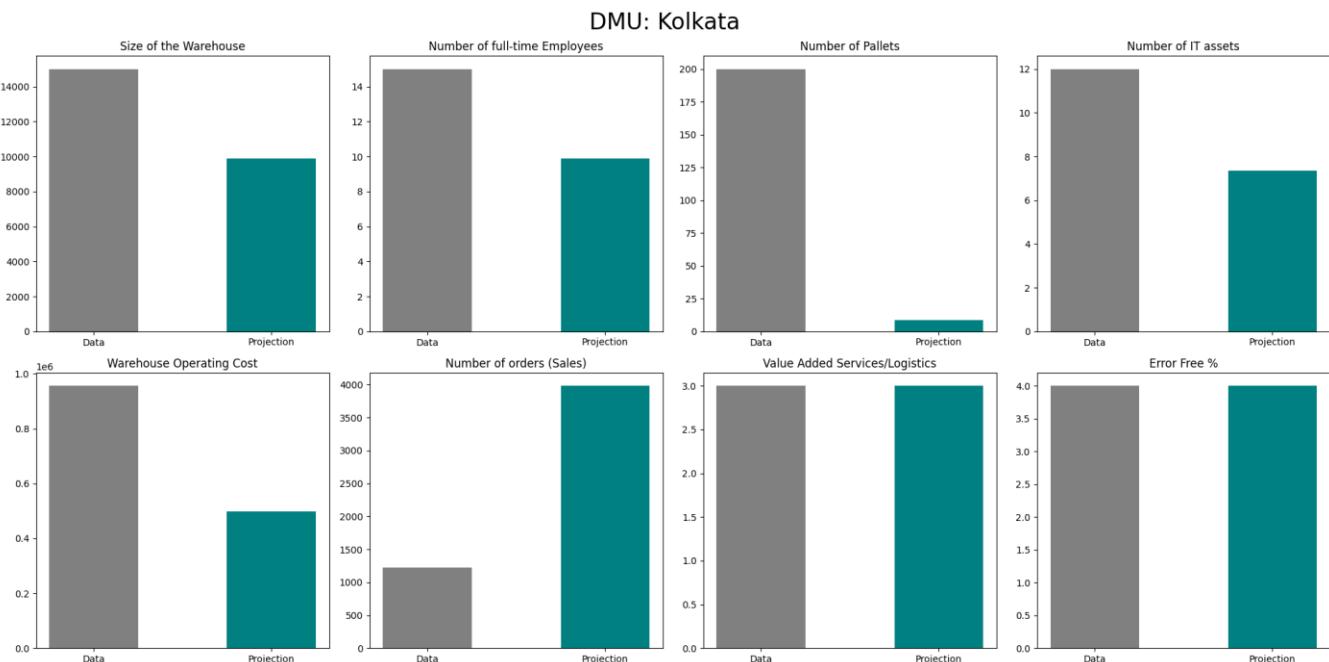
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	15000	9882.14	0
No. of Full-time Employees	15	9.88214	0
No. of Pallets	200	8.76472	122.997
No. of IT assets	12	7.35288	0.553
Warehouse Operating Cost	955890	497950	131798.9
No. of Orders (Sales)	1222	3982.19	2760.189
Level of Value-Added Services	3	3.00003	0
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 4 (Bangalore)	0.5882353
Warehouse 26 (Pune)	0.4117647

In order to make warehouse 20 (Kolkata) efficient, they need to decrease size of the warehouse by 34.119%, No of full-time employees by 34.119%, number of pallets by 95.618%, IT Assets by 38.726% , operating cost by 47.907%, whereas value-added logistics needs to be increased by 0.001% and no. of orders by 225.875.



## WAREHOUSE 21 (Lucknow)

### BCC MODEL FORMULATION

```

!Dual Objective Function;
MIN = X21;

!Subject to;
13100*Y121 + 2000*Y221 + 550*Y321 + 9800*Y421 + 7500*Y521 + 550*Y621 + 4800*Y721 + 10250*Y821 + 2300*Y921 +
1000*Y1021 + 20700*Y1121 + 1200*Y1221 + 11000*Y1321 + 4100*Y1421 + 2000*Y1521 + 21000*Y1621 + 500*Y1721 +
2152*Y1821 + 9700*Y1921 + 15000*Y2021 + 9000*Y2121 + 4600*Y2221 + 2000*Y2321 + 37324*Y2421 + 11000*Y2521 +
10000*Y2621 + 4000*Y2721 + 5500*Y2821 + 2000*Y2921 - 9000*X21 <= 0;

7*Y121 + 2*Y221 + 2*Y321 + 14*Y421 + 4*Y521 + 2*Y621 + 3*Y721 + 5*Y821 + 2*Y921 + 1*Y1021 + 21*Y1121 +
6*Y1221 + 13*Y1321 + 2*Y1421 + 2*Y1521 + 5*Y1621 + 2*Y1721 + 4*Y1821 + 5*Y1921 + 15*Y2021 + 6*Y2121 + 5*Y2221 +
2*Y2321 + 48*Y2421 + 9*Y2521 + 4*Y2621 + 2*Y2721 + 2*Y2821 + 8*Y2921 - 6*X21 <= 0;

320*Y121 + 7*Y221 + 2*Y321 + 10*Y421 + 7*Y521 + 2*Y621 + 7*Y721 + 20*Y821 + 7*Y921 + 30*Y1021 + 200*Y1121 +
7*Y1221 + 200*Y1321 + 7*Y1421 + 2*Y1521 + 338*Y1621 + 2*Y1721 + 48*Y1821 + 7*Y1921 + 200*Y2021 + 7*Y2121 +
7*Y2221 + 7*Y2321 + 550*Y2421 + 200*Y2521 + 7*Y2621 + 2*Y2721 + 50*Y2821 + 2*Y2921 - 7*X21 <= 0;

9*Y121 + 4*Y221 + 2*Y321 + 9*Y421 + 4*Y521 + 3*Y621 + 6*Y721 + 7*Y821 + 4*Y921 + 4*Y1021 + 11*Y1121 + 5*Y1221 +
12*Y1321 + 3*Y1421 + 3*Y1521 + 10*Y1621 + 2*Y1721 + 7*Y1821 + 5*Y1921 + 12*Y2021 + 7*Y2121 + 5*Y2221 +
2*Y2321 + 25*Y2421 + 9*Y2521 + 5*Y2621 + 2*Y2721 + 5*Y2821 + 6*Y2921 - 7*X21 <= 0;

820931*Y121 + 147596*Y221 + 86404*Y321 + 584300*Y421 + 238265*Y521 + 147473*Y621 + 420908*Y721 + 239046*Y821 +
171183*Y921 + 86967*Y1021 + 142521*Y1121 + 1372680*Y1221 +
+ 119500*Y1321 + 247573*Y1421 + 93157*Y1521 + 1994765*Y1621 + 29538*Y1721 + 226845*Y1821 + 117310*Y1921 +
955890*Y2021 + 3333230*Y2121 + 2349633*Y2221 + 139434*Y2321 + 2090879*Y2421 + 755723*Y2521 + 374615*Y2621 +
224382*Y2721 + 194903*Y2821 + 173934*Y2921 - 3333230*X21 <= 0;

229*Y121 + 354*Y221 + 115*Y321 + 5827*Y421 + 4776*Y521 + 152*Y621 + 661*Y721 + 1019*Y821 + 278*Y921 +
60*Y1021 + 2155*Y1121 + 908*Y1221 + 2593*Y1321 + 272*Y1421 + 64*Y1521 +
1053*Y1621 + 137*Y1721 + 138*Y1821 + 523*Y1921 + 1222*Y2021 + 1674*Y2121 + 554*Y2221 + 197*Y2321 + 5794*Y2421 +
+ 1505*Y2521 + 1347*Y2621 + 310*Y2721 + 259*Y2821 + 277*Y2921 >= 1674;

3*Y121 + 3*Y221 + 3*Y321 + 3*Y421 + 3*Y521 + 3*Y621 + 3*Y721 + 3*Y821 + 3*Y921 + 3*Y1021 + 3*Y1121 + 3*Y1221 +
+ 3*Y1321 + 3*Y1421 + 3*Y1521 + 3*Y1621 + 3*Y1721 + 3*Y1821 + 3*Y1921 + 3*Y2021 + 3*Y2121 + 3*Y2221 + 3*Y2321 +
+ 3*Y2421 + 3*Y2521 + 3*Y2621 + 3*Y2721 + 3*Y2821 + 3*Y2921 >= 3;

4*Y121 + 3*Y221 + 1*Y321 + 4*Y421 + 3*Y521 + 1*Y621 + 3*Y721 + 4*Y821 + 2*Y921 + 1*Y1021 + 4*Y1121 + 2*Y1221 +
+ 4*Y1321 + 3*Y1421 + 2*Y1521 + 4*Y1621 + 1*Y1721 + 2*Y1821 + 3*Y1921 + 4*Y2021 + 3*Y2121 + 3*Y2221 + 2*Y2321 +
+ 4*Y2421 + 3*Y2521 + 4*Y2621 + 2*Y2721 + 3*Y2821 + 3*Y2921 >= 3;

Y121 + Y221 + Y321 + Y421 + Y521 + Y621 + Y721 + Y821 + Y921 + Y1021 + Y1121 + Y1221 + Y1321 + Y1421 + Y1521 +
+ Y1621 + Y1721 + Y1821 + Y1921 + Y2021 + Y2121 + Y2221 + Y2321 + Y2421 + Y2521 + Y2621 + Y2721 + Y2821 +
Y2921 = 1;

@Free(X21);
Y121 >=0; Y221 >=0; Y321 >=0; Y421 >=0; Y521 >=0; Y621 >=0; Y721 >=0; Y821 >=0; Y921 >=0; Y1021 >=0; Y1121
>=0; Y1221 >=0; Y1321 >=0; Y1421 >=0; Y1521 >=0; Y1621 >=0; Y1721 >=0; Y1821 >=0; Y1921 >=0;
Y2021 >=0; Y2121 >=0; Y2221 >=0; Y2321 >=0; Y2421 >=0; Y2521 >=0; Y2621 >=0; Y2721 >=0; Y2821 >=0; Y2921 >=0;

```

### SOLUTION OF BCC MODEL

File		Edit	LINGO	Window	Help
<b>Global optimal solution found.</b>					
Objective value:	0.6734118				
Infeasibilities:	0.000000				
Total solver iterations:	15				
Variable	Value	Reduced Cost			
X21	0.6734118	0.5551115E-16			
Y121	0.000000	28.91887			
Y221	0.000000	0.1723404			
Y321	0.000000	0.2488364			
Y421	0.000000	0.4222446			
Y521	0.2447059	0.9714451E-15			
Y621	0.000000	0.2462112			
Y721	0.000000	0.2216976			
Y821	0.000000	1.263023			
Y921	0.000000	0.4454598			
Y1021	0.000000	2.774904			
Y1121	0.000000	18.50979			
Y1221	0.000000	0.5779753			
Y1321	0.000000	18.02043			
Y1421	0.000000	0.1964851			
Y1521	0.1329412	-0.2220446E-15			
Y1621	0.000000	30.48483			
Y1721	0.000000	0.2468391			
Y1821	0.000000	4.303316			
Y1921	0.000000	0.3676583			
Y2021	0.000000	18.24602			

Y2121	0.000000	0.3265882
Y2221	0.000000	0.3209512
Y2321	0.000000	0.4485888
Y2421	0.000000	51.71944
Y2521	0.000000	18.17592
Y2621	0.2980706	-0.1665335E-15
Y2721	0.1651294	-0.4163336E-16
Y2821	0.000000	4.148643
Y2921	0.1591529	-0.2151057E-15

## SUMMARY

Efficiency of Warehouse 21 (Lucknow) = 0.6734118

Warehouse 21 (Lucknow) is an inefficient warehouse.

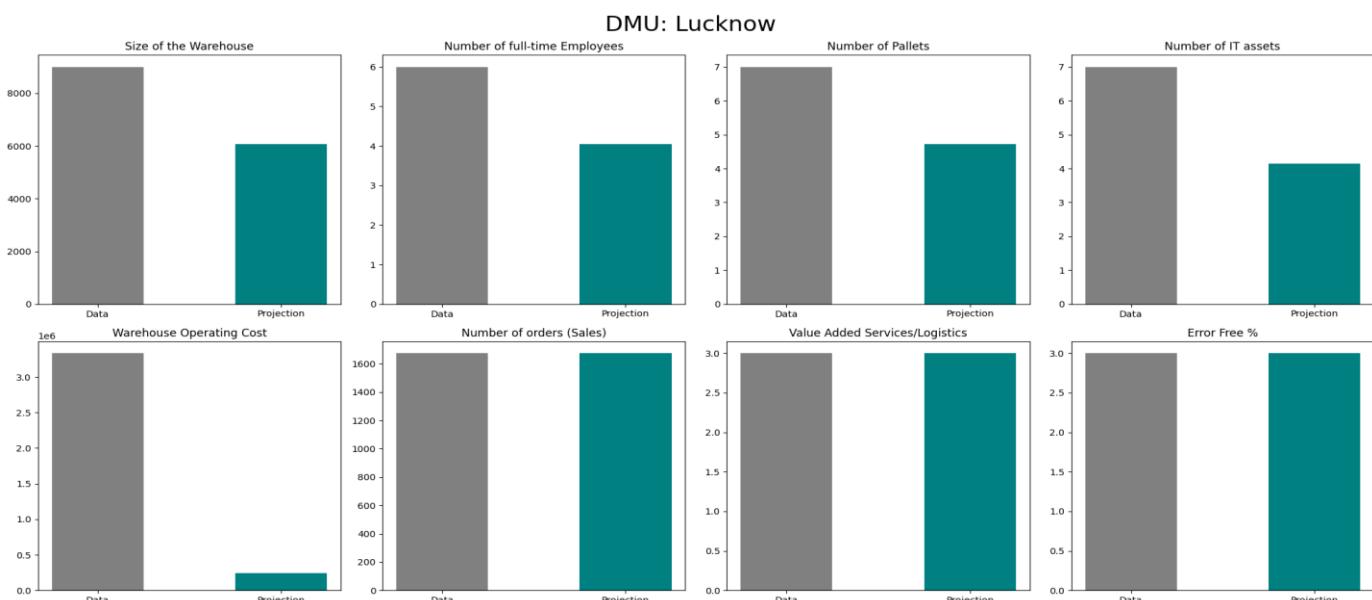
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	9000	6060.68	0
No. of Full-time Employees	6	4.04046	0
No. of Pallets	7	4.71387	0
No. of IT assets	7	4.15317	0.561
Warehouse Operating Cost	3333230	247085	1997543
No. of Orders (Sales)	1674	1674	0
Level of Value-Added Services	3	3.00003	0
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 5 (Bhiwandi)	0.2447059
Warehouse 15 (Jabalpur)	0.1329412
Warehouse 26 (Pune)	0.2980706
Warehouse 27 (Raipur)	0.1651294
Warehouse 29 (Varanasi)	0.1591529

In order to make warehouse 21 (Lucknow) efficient, they need to decrease size of the warehouse by 32.659%, No of full-time employees by 32.659%, number of pallets by 32.659%, IT Assets by 40.669% , operating cost by 92.587%, whereas value-added logistics needs to be increased by 0.001%.



## WAREHOUSE 22 (Ludhiana)

### BCC MODEL FORMULATION

```

!Dual Objective Function;
MIN = X22;

!Subject to;
13100*Y122 + 2000*Y222 + 550*Y322 + 9800*Y422 + 7500*Y522 + 550*Y622 + 4800*Y722 + 10250*Y822 + 2300*Y922 +
1000*Y1022 + 20700*Y1122 + 1200*Y1222 + 11000*Y1322 + 4100*Y1422 + 2000*Y1522 + 21000*Y1622 + 500*Y1722 +
2152*Y1822 + 9700*Y1922 + 15000*Y2022 + 9000*Y2122 + 4600*Y2222 + 2000*Y2322 + 37324*Y2422 + 11000*Y2522 +
10000*Y2622 + 4000*Y2722 + 5500*Y2822 + 2000*Y2922-4600*X22 <= 0;

7*Y122 + 2*Y222 + 2*Y322 + 14*Y422 + 4*Y522 + 2*Y622 + 3*Y722 + 5*Y822 + 2*Y922 + 1*Y1022 + 21*Y1122 +
6*Y1222 + 13*Y1322 + 2*Y1422 + 2*Y1522 + 5*Y1622 + 2*Y1722 + 4*Y1822 + 5*Y1922 + 15*Y2022 + 6*Y2122 + 5*Y2222 +
2*Y2322 + 48*Y2422 + 9*Y2522 + 4*Y2622 + 2*Y2722 + 2*Y2822 + 8*Y2922 - 5*X22 <= 0;

320*Y122 + 7*Y222 + 2*Y322 + 10*Y422 + 7*Y522 + 2*Y622 + 7*Y722 + 20*Y822 + 7*Y922 + 30*Y1022 + 200*Y1122 +
7*Y1222 + 200*Y1322 + 7*Y1422 + 2*Y1522 + 338*Y1622 + 2*Y1722 + 48*Y1822 + 7*Y1922 + 200*Y2022 + 7*Y2122 +
7*Y2222 + 7*Y2322 + 550*Y2422 + 200*Y2522 + 7*Y2622 + 2*Y2722 + 50*Y2822 + 2*Y2922 - 7*X22 <= 0;

9*Y122 + 4*Y222 + 2*Y322 + 9*Y422 + 4*Y522 + 3*Y622 + 6*Y722 + 7*Y822 + 4*Y922 + 4*Y1022 + 11*Y1122 + 5*Y1222 +
12*Y1322 + 3*Y1422 + 3*Y1522 + 10*Y1622 + 2*Y1722 + 7*Y1822 + 5*Y1922 + 12*Y2022 + 7*Y2122 + 5*Y2222 +
2*Y2322 + 25*Y2422 + 9*Y2522 + 5*Y2622 + 2*Y2722 + 5*Y2822 + 6*Y2922 - 5*X22 <= 0;

820931*Y122 + 147596*Y222 + 86404*Y322 + 584300*Y422 + 238265*Y522 + 147473*Y622 + 420908*Y722 +
239046*Y822 + 171183*Y922 + 86967*Y1022 + 142521*Y1122 + 1372680*Y1222 +
+ 119500*Y1322 + 247573*Y1422 + 93157*Y1522 + 1994765*Y1622 + 29538*Y1722 + 226845*Y1822 + 117310*Y1922 +
+ 955890*Y2022 + 3333230*Y2122 + 2349633*Y2222 + 139434*Y2322 + 2090879*Y2422 + 755723*Y2522 +
374615*Y2622 + 224382*Y2722 + 194903*Y2822 + 173934*Y2922 - 2349633*X22 <= 0;

229*Y122 + 354*Y222 + 115*Y322 + 5827*Y422 + 4776*Y522 + 152*Y622 + 661*Y722 + 1019*Y822 + 278*Y922 +
60*Y1022 + 2155*Y1122 + 908*Y1222 + 2593*Y1322 + 272*Y1422 + 64*Y1522 +
1053*Y1622 + 137*Y1722 + 138*Y1822 + 523*Y1922 + 1222*Y2022 + 1674*Y2122 + 554*Y2222 + 197*Y2322 + 5794*Y2422 +
+ 1505*Y2522 + 1347*Y2622 + 310*Y2722 + 259*Y2822 + 277*Y2922 >= 554;

3*Y122 + 3*Y222 + 3*Y322 + 3*Y422 + 3*Y522 + 3*Y622 + 3*Y722 + 3*Y822 + 3*Y922 + 3*Y1022 + 3*Y1122 + 3*Y1222 +
+ 3*Y1322 + 3*Y1422 + 3*Y1522 + 3*Y1622 + 3*Y1722 + 3*Y1822 + 3*Y1922 + 3*Y2022 + 3*Y2122 + 3*Y2222 + 3*Y2322 +
+ 3*Y2422 + 3*Y2522 + 3*Y2622 + 3*Y2722 + 3*Y2822 + 3*Y2922 >= 3;

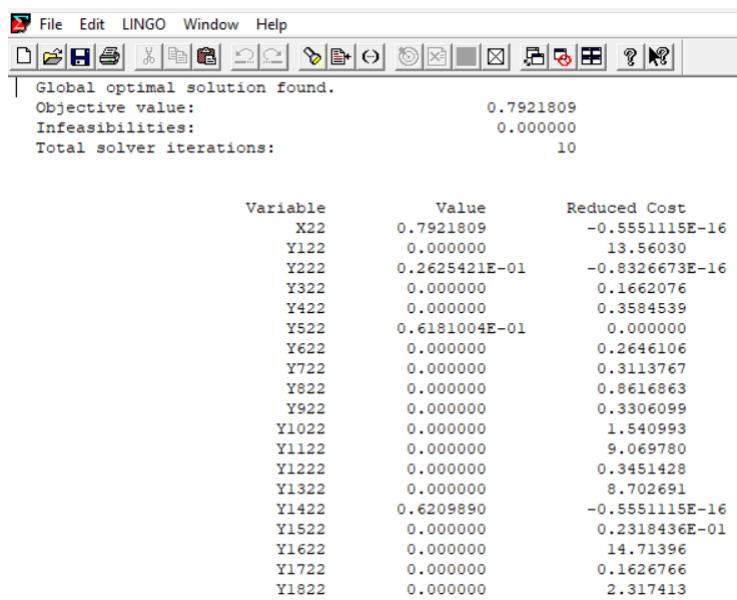
4*Y122 + 3*Y222 + 1*Y322 + 4*Y422 + 3*Y522 + 1*Y622 + 3*Y722 + 4*Y822 + 2*Y922 + 1*Y1022 + 4*Y1122 + 2*Y1222 +
+ 4*Y1322 + 3*Y1422 + 2*Y1522 + 4*Y1622 + 1*Y1722 + 2*Y1822 + 3*Y1922 + 4*Y2022 + 3*Y2122 + 3*Y2222 + 2*Y2322 +
+ 4*Y2422 + 3*Y2522 + 4*Y2622 + 2*Y2722 + 3*Y2822 + 3*Y2922 >= 3;

Y122 + Y222 + Y322 + Y422 + Y522 + Y622 + Y722 + Y822 + Y922 + Y1022 + Y1122 + Y1222 + Y1322 + Y1422 + Y1522 +
+ Y1622 + Y1722 + Y1822 + Y1922 + Y2022 + Y2122 + Y2222 + Y2322 + Y2422 + Y2522 + Y2622 + Y2722 + Y2822 +
Y2922 = 1;

@Free(X22);
Y122 >=0; Y222 >=0; Y322 >=0; Y422 >=0; Y522 >=0; Y622 >=0; Y722 >=0; Y822 >=0; Y922 >=0; Y1022 >=0; Y1122
>=0; Y1222 >=0; Y1322 >=0; Y1422 >=0; Y1522 >=0; Y1622 >=0; Y1722 >=0; Y1822 >=0; Y1922 >=0;
Y2022 >=0; Y2122 >=0; Y2222 >=0; Y2322 >=0; Y2422 >=0; Y2522 >=0; Y2622 >=0; Y2722 >=0; Y2822 >=0; Y2922 >=0;

```

### SOLUTION OF BCC MODEL



The screenshot shows the LINGO software interface with the following output:

```

File Edit Window Help
Global optimal solution found.
Objective value: 0.7921809
Infeasibilities: 0.000000
Total solver iterations: 10

Variable      Value      Reduced Cost
X22          0.7921809   -0.5551115E-16
Y122         0.000000    13.56030
Y222         0.2625421E-01  -0.8326673E-16
Y322         0.000000    0.1662076
Y422         0.000000    0.3584539
Y522         0.6181004E-01  0.0000000
Y622         0.000000    0.2646106
Y722         0.000000    0.3113767
Y822         0.000000    0.8616863
Y922         0.000000    0.3306099
Y1022        0.000000    1.540993
Y1122        0.000000    9.069780
Y1222        0.000000    0.3451428
Y1322        0.000000    8.702691
Y1422        0.6209890   -0.5551115E-16
Y1522        0.000000    0.2318436E-01
Y1622        0.000000    14.71396
Y1722        0.000000    0.1626766
Y1822        0.000000    2.317413

```

Y1922	0.000000	0.4423536
Y2022	0.000000	8.963089
Y2122	0.000000	0.5460701
Y2222	0.000000	0.2078191
Y2322	0.000000	0.1205087
Y2422	0.000000	25.40546
Y2522	0.000000	8.775548
Y2622	0.000000	0.9666586E-01
Y2722	0.3113658E-15	0.6245005E-16
Y2822	0.000000	2.031895
Y2922	0.2909467	-0.1006140E-15

## SUMMARY

Efficiency of Warehouse 22 (Ludhiana) = 0.7921809

Warehouse 22 (Ludhiana) is an inefficient warehouse.

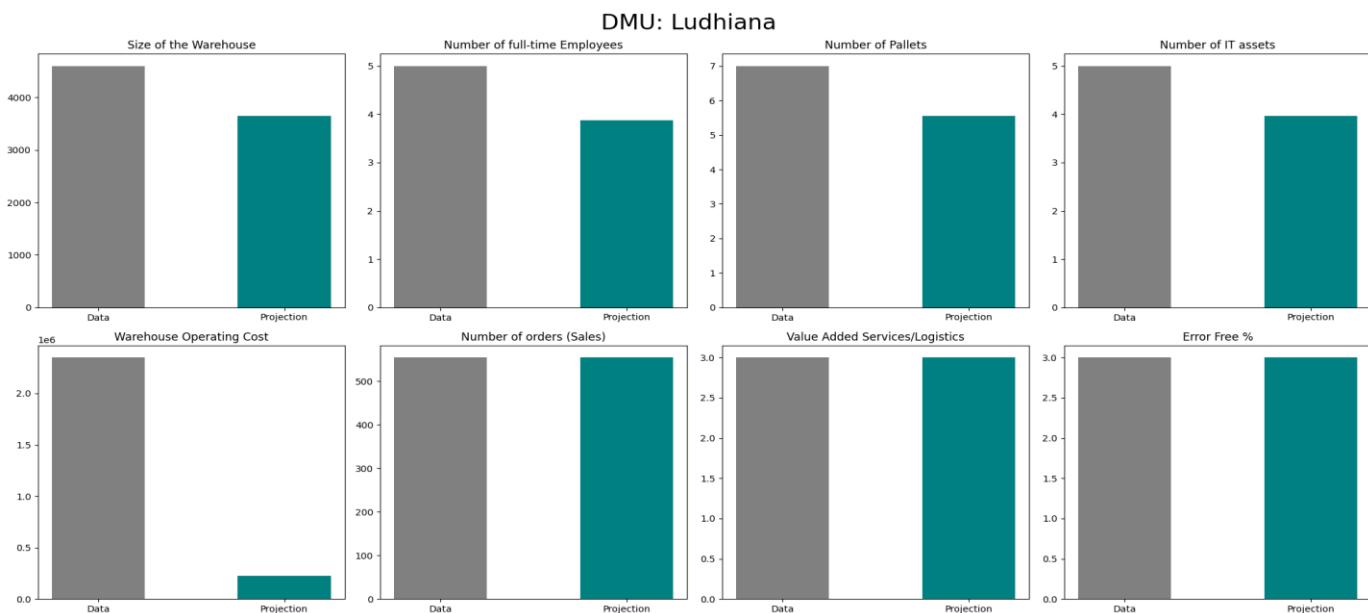
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	4600	3644.02	0
No. of Full-time Employees	5	3.86924	0.092
No. of Pallets	7	5.54525	0
No. of IT assets	5	3.9609	0
Warehouse Operating Cost	2349633	222947	1638383
No. of Orders (Sales)	554	554	0
Level of Value-Added Services	3	3.00003	0
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 2 (Ahmedabad)	0.02625421
Warehouse 5 (Bhiwandi)	0.06181004
Warehouse 14 (Indore)	0.620989
Warehouse 29 (Varanasi)	0.2909467

In order to make warehouse 22 (Ludhiana) efficient, they need to decrease size of the warehouse by 20.782%, No of full-time employees by 22.615%, number of pallets by 20.782%, IT Assets by 20.782% ,operating cost by 90.511%, whereas value-added logistics needs to be increased by 0.001%.



## WAREHOUSE 23 (Nagpur)

### BCC MODEL FORMULATION

```

!Dual Objective Function;
MIN = X23;

!Subject to;
13100*Y123 + 2000*Y223 + 550*Y323 + 9800*Y423 + 7500*Y523 + 550*Y623 + 4800*Y723 + 10250*Y823 + 2300*Y923 +
1000*Y1023 + 20700*Y1123 + 1200*Y1223 + 11000*Y1323 + 4100*Y1423 + 2000*Y1523 + 21000*Y1623 + 500*Y1723 +
2152*Y1823 + 9700*Y1923 + 15000*Y2023 + 9000*Y2123 + 4600*Y2223 + 2000*Y2323 + 37324*Y2423 + 11000*Y2523 +
10000*Y2623 + 4000*Y2723 + 5500*Y2823 + 2000*Y2923 -2000*X23 <= 0;

7*Y123 + 2*Y223 + 2*Y323 + 14*Y423 + 4*Y523 + 2*Y623 + 3*Y723 + 5*Y823 + 2*Y923 + 1*Y1023 + 21*Y1123 +
6*Y1223 + 13*Y1323 + 2*Y1423 + 2*Y1523 + 5*Y1623 + 2*Y1723 + 4*Y1823 + 5*Y1923 + 15*Y2023 + 6*Y2123 + 5*Y2223 +
2*Y2323 + 48*Y2423 + 9*Y2523 + 4*Y2623 + 2*Y2723 + 2*Y2823 + 8*Y2923 -2*X23 <=0;

320*Y123 + 7*Y223 + 2*Y323 + 10*Y423 + 7*Y523 + 2*Y623 + 7*Y723 + 20*Y823 + 7*Y923 + 30*Y1023 + 200*Y1123 +
7*Y1223 + 200*Y1323 + 7*Y1423 + 2*Y1523 + 338*Y1623 + 2*Y1723 + 48*Y1823 + 7*Y1923 + 200*Y2023 + 7*Y2123 +
7*Y2223 + 7*Y2323 + 550*Y2423 + 200*Y2523 + 7*Y2623 + 2*Y2723 + 50*Y2823 + 2*Y2923 - 7*X23 <=0;

9*Y123 + 4*Y223 + 2*Y323 + 9*Y423 + 4*Y523 + 3*Y623 + 6*Y723 + 7*Y823 + 4*Y923 + 4*Y1023 + 11*Y1123 + 5*Y1223 +
12*Y1323 + 3*Y1423 + 3*Y1523 + 10*Y1623 + 2*Y1723 + 7*Y1823 + 5*Y1923 + 12*Y2023 + 7*Y2123 + 5*Y2223 +
2*Y2323 + 25*Y2423 + 9*Y2523 + 5*Y2623 + 2*Y2723 + 5*Y2823 + 6*Y2923 - 2*X23 <=0;

820931*Y123 + 147596*Y223 + 86404*Y323 + 584300*Y423 + 238265*Y523 + 147473*Y623 + 420908*Y723 +
239046*Y823 + 171183*Y923 + 86967*Y1023 + 142521*Y1123 + 1372680*Y1223 +
+ 119500*Y1323 + 247573*Y1423 + 93157*Y1523 + 1994765*Y1623 + 29538*Y1723 + 226845*Y1823 + 117310*Y1923 +
+ 955890*Y2023 + 3333230*Y2123 + 2349633*Y2223 + 139434*Y2323 + 2090879*Y2423 + 755723*Y2523 +
374615*Y2623 + 224382*Y2723 + 194903*Y2823 + 173934*Y2923 - 139434*X23 <=0;

229*Y123 + 354*Y223 + 115*Y323 + 5827*Y423 + 4776*Y523 + 152*Y623 + 661*Y723 + 1019*Y823 + 278*Y923 +
60*Y1023 + 2155*Y1123 + 908*Y1223 + 2593*Y1323 + 272*Y1423 + 64*Y1523 +
1053*Y1623 + 137*Y1723 + 138*Y1823 + 523*Y1923 + 1222*Y2023 + 1674*Y2123 + 554*Y2223 + 197*Y2323 + 5794*Y2423 +
+ 1505*Y2523 + 1347*Y2623 + 310*Y2723 + 259*Y2823 + 277*Y2923 >= 197;

3*Y123 + 3*Y223 + 3*Y323 + 3*Y423 + 3*Y523 + 3*Y623 + 3*Y723 + 3*Y823 + 3*Y923 + 3*Y1023 + 3*Y1123 + 3*Y1223 +
+ 3*Y1323 + 3*Y1423 + 3*Y1523 + 3*Y1623 + 3*Y1723 + 3*Y1823 + 3*Y1923 + 3*Y2023 + 3*Y2123 + 3*Y2223 + 3*Y2323 +
+ 3*Y2423 + 3*Y2523 + 3*Y2623 + 3*Y2723 + 3*Y2823 + 3*Y2923 >= 3;

4*Y123 + 3*Y223 + 1*Y323 + 4*Y423 + 3*Y523 + 1*Y623 + 3*Y723 + 4*Y823 + 2*Y923 + 1*Y1023 + 4*Y1123 + 2*Y1223 +
+ 4*Y1323 + 3*Y1423 + 2*Y1523 + 4*Y1623 + 1*Y1723 + 2*Y1823 + 3*Y1923 + 4*Y2023 + 3*Y2123 + 3*Y2223 + 2*Y2323 +
+ 4*Y2423 + 3*Y2523 + 4*Y2623 + 2*Y2723 + 3*Y2823 + 3*Y2923 >= 2;

Y123 + Y223 + Y323 + Y423 + Y523 + Y623 + Y723 + Y823 + Y923 + Y1023 + Y1123 + Y1223 + Y1323 + Y1423 + Y1523 +
+ Y1623 + Y1723 + Y1823 + Y1923 + Y2023 + Y2123 + Y2223 + Y2323 + Y2423 + Y2523 + Y2623 + Y2723 + Y2823 +
Y2923 = 1;

@Free (X23);
Y123 >=0; Y223 >=0; Y323 >=0; Y423 >=0; Y523 >=0; Y623 >=0; Y723 >=0; Y823 >=0; Y923 >=0; Y1023 >=0; Y1123
>=0; Y1223 >=0; Y1323 >=0; Y1423 >=0; Y1523 >=0; Y1623 >=0; Y1723 >=0; Y1823 >=0; Y1923 >=0;
Y2023 >=0; Y2123 >=0; Y2223 >=0; Y2323 >=0; Y2423 >=0; Y2523 >=0; Y2623 >=0; Y2723 >=0; Y2823 >=0; Y2923 >=0;

```

### SOLUTION OF BCC MODEL



```

File Edit LINGO Window Help
□ File Edit LINGO Window Help
Global optimal solution found.
Objective value: 1.000000
Infeasibilities: 0.000000
Total solver iterations: 4

Variable      Value      Reduced Cost
X23          1.000000     -0.5551115E-16
Y123         0.000000     2.884015
Y223         0.000000     0.1110223E-15
Y323         0.000000     0.1016383
Y423         0.000000     4.452414
Y523         0.000000     0.7310087
Y623         0.000000     0.3017048
Y723         0.000000     0.9548074
Y823         0.000000     1.093209
Y923         0.000000     0.2385781
Y1023        0.000000     0.1110223E-15
Y1123        0.000000     5.835979
Y1223        0.000000     3.614872
Y1323        0.000000     3.609935
Y1423        0.000000     0.8777574E-01

```

Y1523	0.000000	0.8203841E-02
Y1623	0.000000	4.504005
Y1723	0.000000	0.5551115E-15
Y1823	0.000000	1.179766
Y1923	0.000000	0.8902151
Y2023	0.000000	5.673793
Y2123	0.000000	7.104432
Y2223	0.000000	4.880111
Y2323	1.000000	0.000000
Y2423	0.000000	18.27203
Y2523	0.000000	3.532840
Y2623	0.000000	0.8692068
Y2723	0.000000	0.1518300
Y2823	0.000000	0.1754693
Y2923	0.000000	1.935767

## SUMMARY

Efficiency of Warehouse 23 (Nagpur) = 1

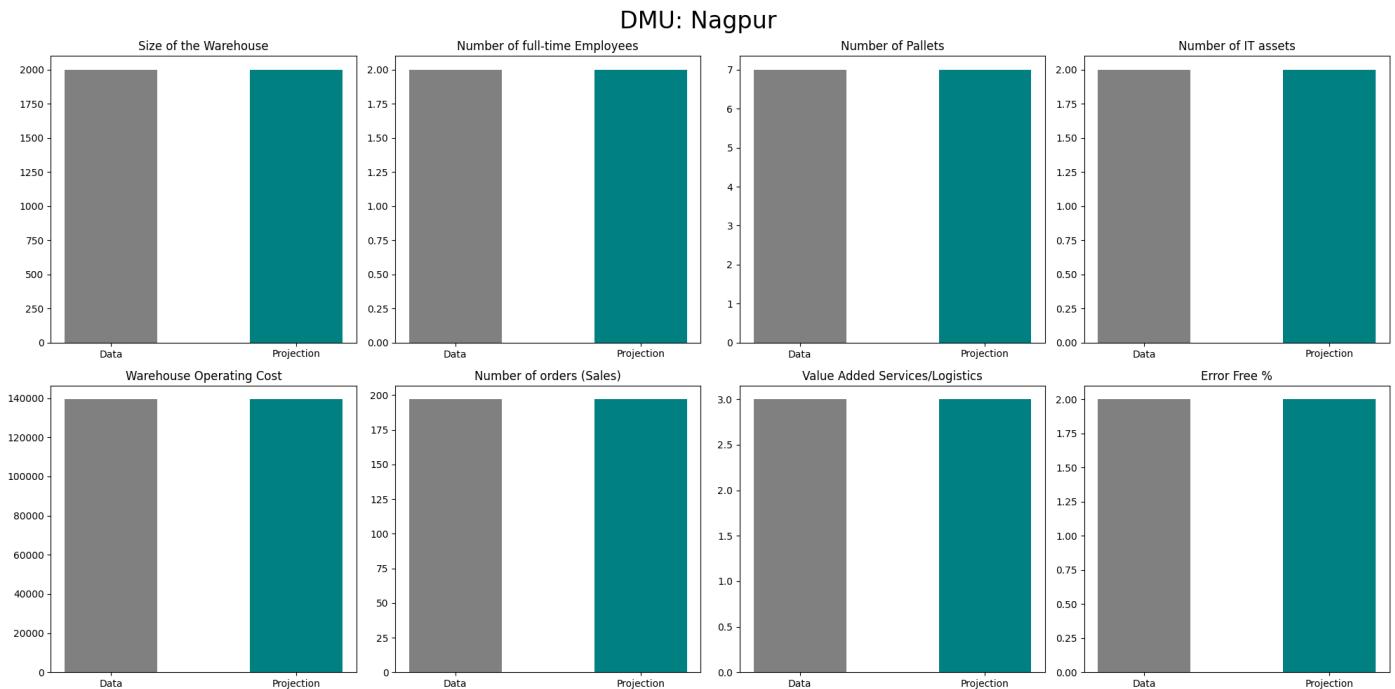
Warehouse 23 (Nagpur) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	2000	2000	0
No. of Full-time Employees	2	2	0
No. of Pallets	7	7	0
No. of IT assets	2	2	0
Warehouse Operating Cost	139434	139434	0
No. of Orders (Sales)	197	197	0
Level of Value-Added Services	3	3	0
Error Free (%)	2	2	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 23 (Nagpur)	1



## WAREHOUSE 24 (New Delhi)

### BCC MODEL FORMULATION

```

!Dual Objective Function;

MIN = X24;

!Subject to;
13100*Y124 + 2000*Y224 + 550*Y324 + 9800*Y424 + 7500*Y524 + 550*Y624 + 4800*Y724 + 10250*Y824 + 2300*Y924 +
1000*Y1024 + 20700*Y1124 + 1200*Y1224 + 11000*Y1324 + 4100*Y1424 + 2000*Y1524 + 21000*Y1624 + 500*Y1724 +
2152*Y1824 + 9700*Y1924 + 15000*Y2024 + 9000*Y2124 + 4600*Y2224 + 2000*Y2324 + 37324*Y2424 + 11000*Y2524 +
10000*Y2624 + 4000*Y2724 + 5500*Y2824 + 2000*Y2924 -37324*X24 <=0;

7*Y124 + 2*Y224 + 2*Y324 + 14*Y424 + 4*Y524 + 2*Y624 + 3*Y724 + 5*Y824 + 2*Y924 + 1*Y1024 + 21*Y1124 +
6*Y1224 + 13*Y1324 + 2*Y1424 + 2*Y1524 + 5*Y1624 + 2*Y1724 + 4*Y1824 + 5*Y1924 + 15*Y2024 + 6*Y2124 + 5*Y2224 +
2*Y2324 + 48*Y2424 + 9*Y2524 + 4*Y2624 + 2*Y2724 + 2*Y2824 + 8*Y2924 - 48*X24 <= 0;

320*Y124 + 7*Y224 + 2*Y324 + 10*Y424 + 7*Y524 + 2*Y624 + 7*Y724 + 20*Y824 + 7*Y924 + 30*Y1024 + 200*Y1124 +
7*Y1224 + 200*Y1324 + 7*Y1424 + 2*Y1524 + 338*Y1624 + 2*Y1724 + 48*Y1824 + 7*Y1924 + 200*Y2024 + 7*Y2124 +
7*Y2224 + 7*Y2324 + 550*Y2424 + 200*Y2524 + 7*Y2624 + 2*Y2724 + 50*Y2824 + 2*Y2924 - 550*X24 <=0;

9*Y124 + 4*Y224 + 2*Y324 + 9*Y424 + 4*Y524 + 3*Y624 + 6*Y724 + 7*Y824 + 4*Y924 + 4*Y1024 + 11*Y1124 + 5*Y1224 +
12*Y1324 + 3*Y1424 + 3*Y1524 + 10*Y1624 + 2*Y1724 + 7*Y1824 + 5*Y1924 + 12*Y2024 + 7*Y2124 + 5*Y2224 +
2*Y2324 + 25*Y2424 + 9*Y2524 + 5*Y2624 + 2*Y2724 + 5*Y2824 + 6*Y2924 - 25*X24 <=0;

820931*Y124 + 147596*Y224 + 86404*Y324 + 584300*Y424 + 238265*Y524 + 147473*Y624 + 420908*Y724 +
239046*Y824 + 171183*Y924 + 86967*Y1024 + 142521*Y1124 + 1372680*Y1224 + 119500*Y1324 + 247573*Y1424 +
93157*Y1524 + 1994765*Y1624 + 29538*Y1724 + 226845*Y1824 + 117310*Y1924 + 955890*Y2024 + 3333230*Y2124 +
2349633*Y2224 + 139434*Y2324 + 2090879*Y2424 + 755723*Y2524 + 374615*Y2624 + 224382*Y2724 + 194903*Y2824 +
173934*Y2924 - 2090879*X24 <=0;

229*Y124 + 354*Y224 + 115*Y324 + 5827*Y424 + 4776*Y524 + 152*Y624 + 661*Y724 + 1019*Y824 + 278*Y924 +
60*Y1024 + 2155*Y1124 + 908*Y1224 + 2593*Y1324 + 272*Y1424 + 64*Y1524 + 1053*Y1624 + 137*Y1724 + 138*Y1824 +
523*Y1924 + 1222*Y2024 + 1674*Y2124 + 554*Y2224 + 197*Y2324 + 5794*Y2424 + 1505*Y2524 + 1347*Y2624 +
310*Y2724 + 259*Y2824 + 277*Y2924 >=5794;

3*Y124 + 3*Y224 + 3*Y324 + 3*Y424 + 3*Y524 + 3*Y624 + 3*Y724 + 3*Y824 + 3*Y924 + 3*Y1024 + 3*Y1124 + 3*Y1224 +
3*Y1324 + 3*Y1424 + 3*Y1524 + 3*Y1624 + 3*Y1724 + 3*Y1824 +
3*Y1924 + 3*Y2024 + 3*Y2124 + 3*Y2224 + 3*Y2324 + 3*Y2424 + 3*Y2524 + 3*Y2624 + 3*Y2724 + 3*Y2824 + 3*Y2924
>= 3;

4*Y124 + 3*Y224 + 1*Y324 + 4*Y424 + 3*Y524 + 1*Y624 + 3*Y724 + 4*Y824 + 2*Y924 + 1*Y1024 + 4*Y1124 + 2*Y1224 +
4*Y1324 + 3*Y1424 + 2*Y1524 + 4*Y1624 + 1*Y1724 + 2*Y1824 + 3*Y1924 + 4*Y2024 + 3*Y2124 + 3*Y2224 + 2*Y2324 +
4*Y2424 + 3*Y2524 + 4*Y2624 + 2*Y2724 + 3*Y2824 + 3*Y2924 >= 4;

Y124 + Y224 + Y324 + Y424 + Y524 + Y624 + Y724 + Y824 + Y924 + Y1024 + Y1124 + Y1224 + Y1324 + Y1424 + Y1524 +
Y1624 + Y1724 + Y1824 + Y1924 + Y2024 + Y2124 + Y2224 + Y2324 + Y2424 + Y2524 + Y2624 + Y2724 + Y2824 +
Y2924 = 1;

@Free(X24);
Y124 >=0; Y224 >=0; Y324 >=0; Y424 >=0; Y524 >=0; Y624 >=0; Y724 >=0; Y824 >=0; Y924 >=0; Y1024 >=0; Y1124
>=0; Y1224 >=0; Y1324 >=0; Y1424 >=0; Y1524 >=0; Y1624 >=0; Y1724 >=0; Y1824 >=0; Y1924 >=0;
Y2024 >=0; Y2124 >=0; Y2224 >=0; Y2324 >=0; Y2424 >=0; Y2524 >=0; Y2624 >=0; Y2724 >=0; Y2824 >=0; Y2924 >=0;

```

### SOLUTION OF BCC MODEL

Global optimal solution found.		
Objective value:	0.3588214	
Infeasibilities:	0.000000	
Total solver iterations:	8	
Variable	Value	Reduced Cost
X24	0.3588214	0.000000
Y124	0.000000	0.1999286
Y224	0.000000	0.1579286
Y324	0.000000	0.4113929
Y424	0.9926339	0.000000
Y524	0.000000	0.2775558E-16
Y624	0.000000	0.4500714
Y724	0.000000	0.2269643
Y824	0.000000	0.9171429E-01
Y924	0.000000	0.3231071
Y1024	0.000000	0.4933571
Y1124	0.000000	0.2111429
Y1224	0.000000	0.3406071
Y1324	0.000000	0.2355000
Y1424	0.000000	0.1208571
Y1524	0.000000	0.2907500
Y1624	0.000000	0.2105000

Y1724	0.000000	0.4106071
Y1824	0.000000	0.4481071
Y1924	0.000000	0.1918929
Y2024	0.000000	0.2844643
Y2124	0.000000	0.2307857
Y2224	0.000000	0.1907857
Y2324	0.000000	0.2460000
Y2424	0.000000	0.6411786
Y2524	0.000000	0.3168214
Y2624	0.7366071E-02	0.000000
Y2724	0.000000	0.2419643
Y2824	0.000000	0.2013214
Y2924	0.000000	0.2406786

## SUMMARY

Efficiency of Warehouse 24 (New Delhi) = 0.3588214

Warehouse 24 (New Delhi) is an inefficient warehouse.

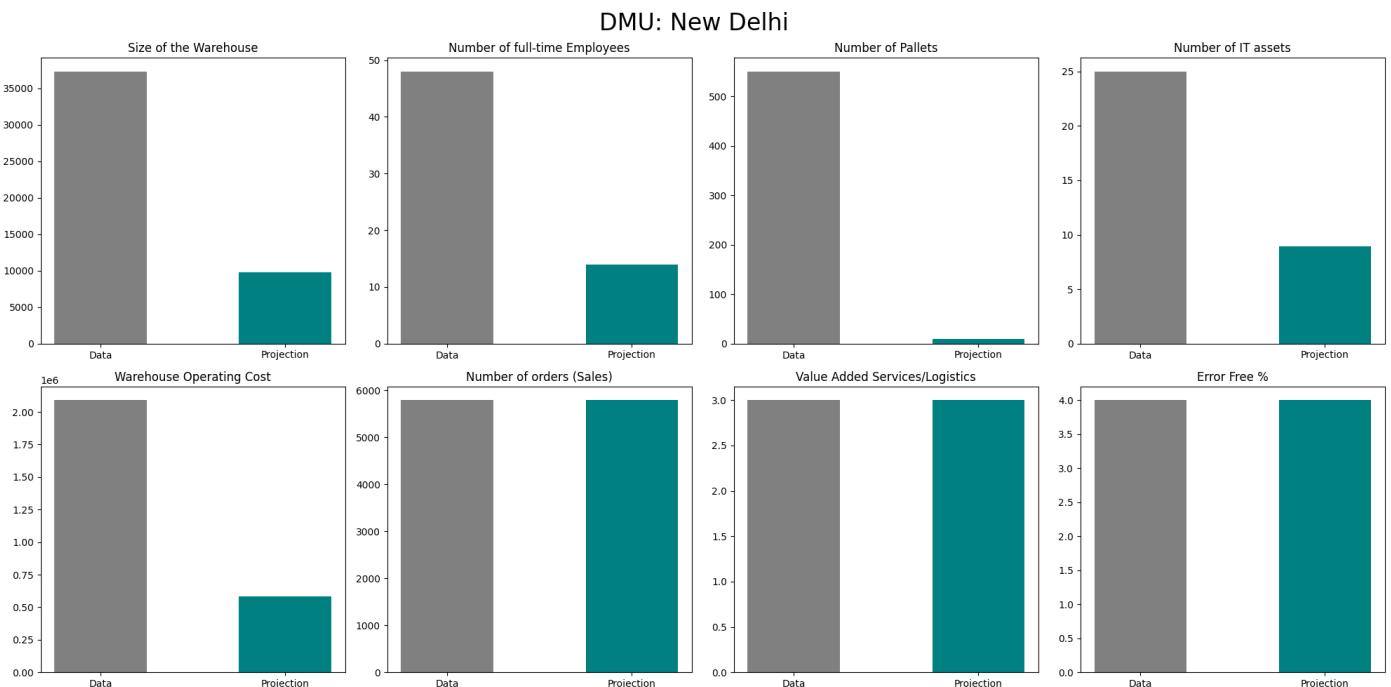
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	37324	9801.48	3590.985
No. of Full-time Employees	48	13.926	3.297
No. of Pallets	550	9.97787	187.371
No. of IT assets	25	8.97041	0
Warehouse Operating Cost	2090879	582747	167495.1
No. of Orders (Sales)	5794	5794	0
Level of Value-Added Services	3	3	0
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 4 (Bangalore)	0.9926339
Warehouse 26 (Pune)	0.007366071

In order to make warehouse 8 (Chennai) efficient, they need to decrease size of the warehouse by 73.739%, No of full-time employees by 70.987%, number of pallets by 98.186%, IT Assets by 64.118% , operating cost by 72.129%.



## WAREHOUSE 25 (Patna)

### BCC MODEL FORMULATION

```

!Dual Objective Function;
MIN = X25;

!Subject to;
13100*Y125 + 2000*Y225 + 550*Y325 + 9800*Y425 + 7500*Y525 + 550*Y625 + 4800*Y725 + 10250*Y825 + 2300*Y925 +
1000*Y1025 + 20700*Y1125 + 1200*Y1225 + 11000*Y1325 + 4100*Y1425 + 2000*Y1525 + 21000*Y1625 + 500*Y1725 +
2152*Y1825 + 9700*Y1925 + 15000*Y2025 + 9000*Y2125 + 4600*Y2225 + 2000*Y2325 + 37324*Y2425 + 11000*Y2525 +
10000*Y2625 + 4000*Y2725 + 5500*Y2825 + 2000*Y2925 -11000*X25 <=0;

7*Y125 + 2*Y225 + 2*Y325 + 14*Y425 + 4*Y525 + 2*Y625 + 3*Y725 + 5*Y825 + 2*Y925 + 1*Y1025 + 21*Y1125 +
6*Y1225 + 13*Y1325 + 2*Y1425 + 2*Y1525 + 5*Y1625 + 2*Y1725 + 4*Y1825 + 5*Y1925 +
+ 15*Y2025 + 6*Y2125 + 5*Y2225 + 2*Y2325 + 48*Y2425 + 9*Y2525 + 4*Y2625 + 2*Y2725 + 2*Y2825 + 8*Y2925 -9*X25
<=0;

320*Y125 + 7*Y225 + 2*Y325 + 10*Y425 + 7*Y525 + 2*Y625 + 7*Y725 + 20*Y825 + 7*Y925 + 30*Y1025 + 200*Y1125 +
7*Y1225 + 200*Y1325 + 7*Y1425 + 2*Y1525 + 338*Y1625 + 2*Y1725 + 48*Y1825 + 7*Y1925 + 200*Y2025 + 7*Y2125 +
7*Y2225 + 7*Y2325 + 550*Y2425 + 200*Y2525 + 7*Y2625 + 2*Y2725 + 50*Y2825 + 2*Y2925 - 200*X25 <=0;

9*Y125 + 4*Y225 + 2*Y325 + 9*Y425 + 4*Y525 + 3*Y625 + 6*Y725 + 7*Y825 + 4*Y925 + 4*Y1025 + 11*Y1125 + 5*Y1225
+ 12*Y1325 + 3*Y1425 + 3*Y1525 + 10*Y1625 + 2*Y1725 + 7*Y1825 + 5*Y1925 + 12*Y2025 + 7*Y2125 + 5*Y2225 +
2*Y2325 + 25*Y2425 + 9*Y2525 + 5*Y2625 + 2*Y2725 + 5*Y2825 + 6*Y2925 - 9*X25 <= 0;

820931*Y125 + 147596*Y225 + 86404*Y325 + 584300*Y425 + 238265*Y525 + 147473*Y625 + 420908*Y725 +
239046*Y825 + 171183*Y925 + 86967*Y1025 + 142521*Y1125 + 1372680*Y1225
+ 119500*Y1325 + 247573*Y1425 + 93157*Y1525 + 1994765*Y1625 + 29538*Y1725 + 226845*Y1825 + 117310*Y1925
+ 955890*Y2025 + 3333230*Y2125 + 2349633*Y2225 + 139434*Y2325 + 2090879*Y2425 + 755723*Y2525 +
374615*Y2625 + 224382*Y2725 + 194903*Y2825 + 173934*Y2925 - 755723*X25 <= 0;

229*Y125 + 354*Y225 + 115*Y325 + 5827*Y425 + 4776*Y525 + 152*Y625 + 661*Y725 + 1019*Y825 + 278*Y925 +
60*Y1025 + 2155*Y1125 + 908*Y1225 + 2593*Y1325 + 272*Y1425 + 64*Y1525 +
1053*Y1625 + 137*Y1725 + 138*Y1825 + 523*Y1925 + 1222*Y2025 + 1674*Y2125 + 554*Y2225 + 197*Y2325 + 5794*Y2425
+ 1505*Y2525 + 1347*Y2625 + 310*Y2725 + 259*Y2825 + 277*Y2925 >= 1505;

3*Y125 + 3*Y225 + 3*Y325 + 3*Y425 + 3*Y525 + 3*Y625 + 3*Y725 + 3*Y825 + 3*Y925 + 3*Y1025 + 3*Y1125 + 3*Y1225
+ 3*Y1325 + 3*Y1425 + 3*Y1525 + 3*Y1625 + 3*Y1725 + 3*Y1825
+ 3*Y1925 + 3*Y2025 + 3*Y2125 + 3*Y2225 + 3*Y2325 + 3*Y2425 + 3*Y2525 + 3*Y2625 + 3*Y2725 + 3*Y2825 + 3*Y2925
>= 3;

4*Y125 + 3*Y225 + 1*Y325 + 4*Y425 + 3*Y525 + 1*Y625 + 3*Y725 + 4*Y825 + 2*Y925 + 1*Y1025 + 4*Y1125 + 2*Y1225
+ 4*Y1325 + 3*Y1425 + 2*Y1525 + 4*Y1625 + 1*Y1725 + 2*Y1825 + 3*Y1925 + 4*Y2025 + 3*Y2125 + 3*Y2225 + 2*Y2325
+ 4*Y2425 + 3*Y2525 + 4*Y2625 + 2*Y2725 + 3*Y2825 + 3*Y2925 >= 3;

Y125 + Y225 + Y325 + Y425 + Y525 + Y625 + Y725 + Y825 + Y925 + Y1025 + Y1125 + Y1225 + Y1325 + Y1425 + Y1525
+ Y1625 + Y1725 + Y1825 + Y1925 + Y2025 + Y2125 + Y2225 + Y2325 + Y2425 + Y2525 + Y2625 + Y2725 + Y2825 +
Y2925 = 1;

@Free(X25);
Y125 >=0; Y225 >=0; Y325 >=0; Y425 >=0; Y525 >=0; Y625 >=0; Y725 >=0; Y825 >=0; Y925 >=0; Y1025 >=0; Y1125
>=0; Y1225 >=0; Y1325 >=0; Y1425 >=0; Y1525 >=0; Y1625 >=0; Y1725 >=0; Y1825 >=0; Y1925 >=0; Y2025 >=0; Y2125
>=0; Y2225 >=0; Y2325 >=0; Y2425 >=0; Y2525 >=0; Y2625 >=0; Y2725 >=0; Y2825 >=0; Y2925 >=0;

```

### SOLUTION OF BCC MODEL

File		Edit	LINGO	Window	Help
Global optimal solution found.					
Objective value:	0.3971571				
Infeasibilities:	0.000000				
Total solver iterations:	9				
Variable	Value	Reduced Cost			
X25	0.3971571	0.5551115E-16			
Y125	0.000000	0.5859163			
Y225	0.3062326	0.000000			
Y325	0.000000	0.9282578E-01			
Y425	0.000000	0.2529059			
Y525	0.2681814	-0.5551115E-16			
Y625	0.000000	0.1627841			
Y725	0.000000	0.2213693			
Y825	0.000000	0.3186507			
Y925	0.000000	0.1493688			
Y1025	0.000000	0.2525507			
Y1125	0.000000	0.8976979			
Y1225	0.000000	0.1597007			
Y1325	0.000000	0.6367203			
Y1425	0.4255860	0.2775558E-16			
Y1525	0.000000	0.7681939E-01			
Y1625	0.000000	0.8804565			
Y1725	0.000000	0.9031545E-01			
Y1825	0.000000	0.3645715			

Y1925	0.000000	0.3144857
Y2025	0.000000	0.8218472
Y2125	0.000000	0.3882216
Y2225	0.000000	0.1477464
Y2325	0.1875544E-14	0.000000
Y2425	0.000000	2.290581
Y2525	0.000000	0.6028429
Y2625	0.000000	0.1543975
Y2725	0.000000	0.6033676E-01
Y2825	0.000000	0.1888561
Y2925	0.000000	0.1460109

## SUMMARY

Efficiency of Warehouse 25 (Patna) = 0.3971571

Warehouse 25 (Patna) is an inefficient warehouse.

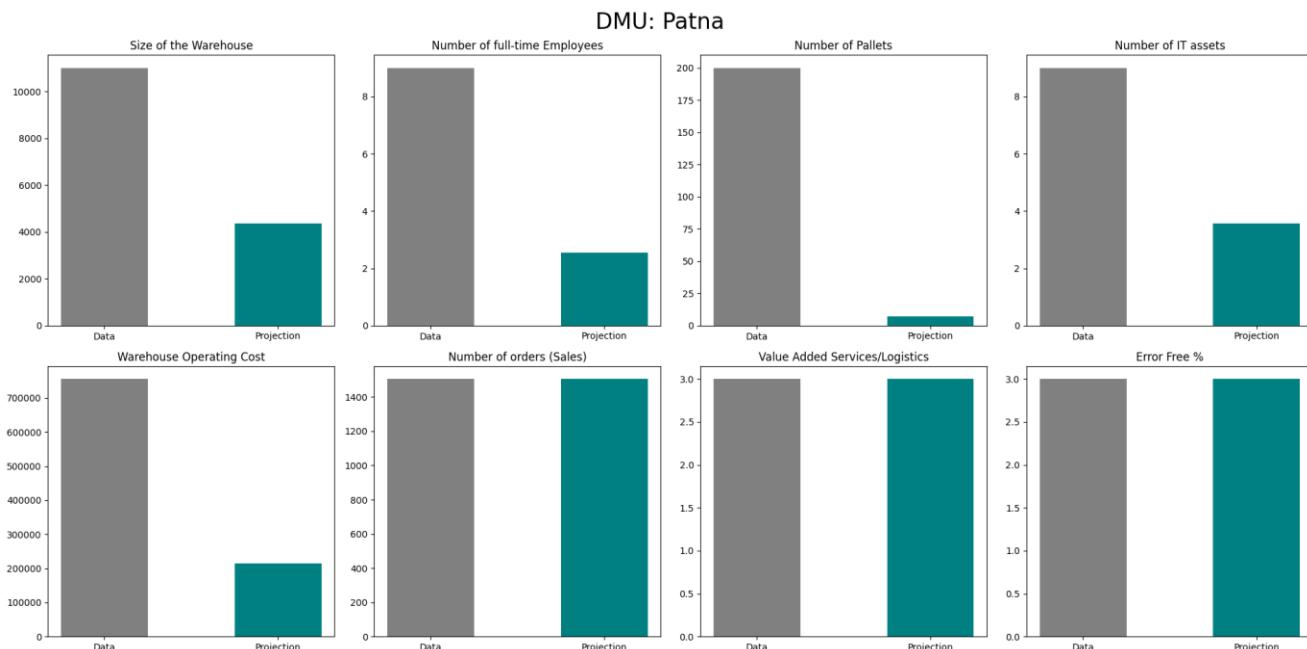
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	11000	4368.72	0
No. of Full-time Employees	9	2.53638	1.038
No. of Pallets	200	7.00007	72.431
No. of IT assets	9	3.57441	0
Warehouse Operating Cost	755723	214460	85679.77
No. of Orders (Sales)	1505	1505	0
Level of Value-Added Services	3	3	0
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 2 (Ahmedabad)	0.3062326
Warehouse 5 (Bhiwandi)	0.2681814
Warehouse 14 (Indore)	0.4255860

In order to make warehouse 25 (Patna) efficient, they need to decrease size of the warehouse by 60.284%, No of full-time employees by 71.818%, number of pallets by 96.5%, IT Assets by 60.284% , operating cost by 71.622%,



## WAREHOUSE 26 (Pune)

### BCC MODEL FORMULATION

```

!Dual Objective Function;
MIN = X26;

!Subject to;
13100*Y126 + 2000*Y226 + 550*Y326 + 9800*Y426 + 7500*Y526 + 550*Y626 + 4800*Y726 + 10250*Y826 + 2300*Y926 +
1000*Y1026 + 20700*Y1126 + 1200*Y1226 + 11000*Y1326 + 4100*Y1426 + 2000*Y1526 + 21000*Y1626 + 500*Y1726 +
2152*Y1826 + 9700*Y1926 + 15000*Y2026 + 9000*Y2126 + 4600*Y2226 + 2000*Y2326 + 37324*Y2426 + 11000*Y2526 +
10000*Y2626 + 4000*Y2726 + 5500*Y2826 + 2000*Y2926 - 10000*X26 <=0;

7*Y126 + 2*Y226 + 2*Y326 + 14*Y426 + 4*Y526 + 2*Y626 + 3*Y726 + 5*Y826 + 2*Y926 + 1*Y1026 + 21*Y1126 +
6*Y1226 + 13*Y1326 + 2*Y1426 + 2*Y1526 + 5*Y1626 + 2*Y1726 + 4*Y1826 + 5*Y1926 + 15*Y2026 + 6*Y2126 + 5*Y2226 +
2*Y2326 + 48*Y2426 + 9*Y2526 + 4*Y2626 + 2*Y2726 + 2*Y2826 + 8*Y2926 - 4*X26 <=0;

320*Y126 + 7*Y226 + 2*Y326 + 10*Y426 + 7*Y526 + 2*Y626 + 7*Y726 + 20*Y826 + 7*Y926 + 30*Y1026 + 200*Y1126 +
7*Y1226 + 200*Y1326 + 7*Y1426 + 2*Y1526 + 338*Y1626 + 2*Y1726 + 48*Y1826 + 7*Y1926 + 200*Y2026 + 7*Y2126 +
7*Y2226 + 7*Y2326 + 550*Y2426 + 200*Y2526 + 7*Y2626 + 2*Y2726 + 50*Y2826 + 2*Y2926 - 7*X26 <=0;

9*Y126 + 4*Y226 + 2*Y326 + 9*Y426 + 4*Y526 + 3*Y626 + 6*Y726 + 7*Y826 + 4*Y926 + 4*Y1026 + 11*Y1126 + 5*Y1226 +
12*Y1326 + 3*Y1426 + 3*Y1526 + 10*Y1626 + 2*Y1726 + 7*Y1826 + 5*Y1926 + 12*Y2026 + 7*Y2126 + 5*Y2226 +
2*Y2326 + 25*Y2426 + 9*Y2526 + 5*Y2626 + 2*Y2726 + 5*Y2826 + 6*Y2926 - 5*X26 <=0;

820931*Y126 + 147596*Y226 + 86404*Y326 + 584300*Y426 + 238265*Y526 + 147473*Y626 + 420908*Y726 +
239046*Y826 + 171183*Y926 + 86967*Y1026 + 142521*Y1126 + 1372680*Y1226 +
+ 119500*Y1326 + 247573*Y1426 + 93157*Y1526 + 1994765*Y1626 + 29538*Y1726 + 226845*Y1826 + 117310*Y1926 +
+ 955890*Y2026 + 3333230*Y2126 + 2349633*Y2226 + 139434*Y2326 + 2090879*Y2426 + 755723*Y2526 +
374615*Y2626 + 224382*Y2726 + 194903*Y2826 + 173934*Y2926 - 374615*X26 <=0;

229*Y126 + 354*Y226 + 115*Y326 + 5827*Y426 + 4776*Y526 + 152*Y626 + 661*Y726 + 1019*Y826 + 278*Y926 +
60*Y1026 + 2155*Y1126 + 908*Y1226 + 2593*Y1326 + 272*Y1426 + 64*Y1526 +
1053*Y1626 + 137*Y1726 + 138*Y1826 + 523*Y1926 + 1222*Y2026 + 1674*Y2126 + 554*Y2226 + 197*Y2326 + 5794*Y2426 +
+ 1505*Y2526 + 1347*Y2626 + 310*Y2726 + 259*Y2826 + 277*Y2926 >= 1347;

3*Y126 + 3*Y226 + 3*Y326 + 3*Y426 + 3*Y526 + 3*Y626 + 3*Y726 + 3*Y826 + 3*Y926 + 3*Y1026 + 3*Y1126 + 3*Y1226 +
+ 3*Y1326 + 3*Y1426 + 3*Y1526 + 3*Y1626 + 3*Y1726 + 3*Y1826 +
+ 3*Y1926 + 3*Y2026 + 3*Y2126 + 3*Y2226 + 3*Y2326 + 3*Y2426 + 3*Y2526 + 3*Y2626 + 3*Y2726 + 3*Y2826 + 3*Y2926
>= 3;

4*Y126 + 3*Y226 + 1*Y326 + 4*Y426 + 3*Y526 + 1*Y626 + 3*Y726 + 4*Y826 + 2*Y926 + 1*Y1026 + 4*Y1126 + 2*Y1226 +
+ 4*Y1326 + 3*Y1426 + 2*Y1526 + 4*Y1626 + 1*Y1726 + 2*Y1826 + 3*Y1926 + 4*Y2026 + 3*Y2126 + 3*Y2226 + 2*Y2326 +
+ 4*Y2426 + 3*Y2526 + 4*Y2626 + 2*Y2726 + 3*Y2826 + 3*Y2926 >= 4;

Y126 + Y226 + Y326 + Y426 + Y526 + Y626 + Y726 + Y826 + Y926 + Y1026 + Y1126 + Y1226 + Y1326 + Y1426 + Y1526 +
+ Y1626 + Y1726 + Y1826 + Y1926 + Y2026 + Y2126 + Y2226 + Y2326 + Y2426 + Y2526 + Y2626 + Y2726 + Y2826 +
Y2926 = 1;

@Free(X26);
Y126 >=0; Y226 >=0; Y326 >=0; Y426 >=0; Y526 >=0; Y626 >=0; Y726 >=0; Y826 >=0; Y926 >=0; Y1026 >=0; Y1126 >=0;
Y1226 >=0; Y1326 >=0; Y1426 >=0; Y1526 >=0; Y1626 >=0; Y1726 >=0; Y1826 >=0; Y1926 >=0; Y2026 >=0; Y2126 >=0;
Y2226 >=0; Y2326 >=0; Y2426 >=0; Y2526 >=0; Y2626 >=0; Y2726 >=0; Y2826 >=0; Y2926 >=0;

```

### SOLUTION OF BCC MODEL

File		Edit	LINGO	Window	Help
Global optimal solution found.					
Objective value:		1.000000			
Infeasibilities:		0.000000			
Total solver iterations:		8			
Variable	Value	Reduced Cost			
X26	1.000000	0.1110223E-15			
Y126	0.000000	0.9920334			
Y226	0.000000	-0.5551115E-16			
Y326	0.000000	0.4043750			
Y426	0.000000	0.5940153			
Y526	0.000000	0.3330669E-15			
Y626	0.000000	0.5878244			
Y726	0.000000	0.5327108			
Y826	0.000000	0.8434980E-01			
Y926	0.000000	0.3776867			
Y1026	0.000000	0.6365710			
Y1126	0.000000	0.4092037			
Y1226	0.000000	1.839039			

Y1326	0.000000	0.4880983
Y1426	0.000000	-0.1665335E-15
Y1526	0.000000	0.1791420
Y1626	0.000000	2.417549
Y1726	0.000000	0.3394564
Y1826	0.000000	0.7894036
Y1926	0.000000	0.7691316E-01
Y2026	0.000000	1.467252
Y2126	0.000000	3.922888
Y2226	0.000000	2.604573
Y2326	0.000000	0.1133271
Y2426	0.000000	4.143415
Y2526	0.000000	1.237751
Y2626	1.000000	-0.1526557E-15
Y2726	0.000000	0.2069169
Y2826	0.000000	0.1709277
Y2926	0.000000	0.2619003

## SUMMARY

Efficiency of Warehouse 26 (Pune) = 1

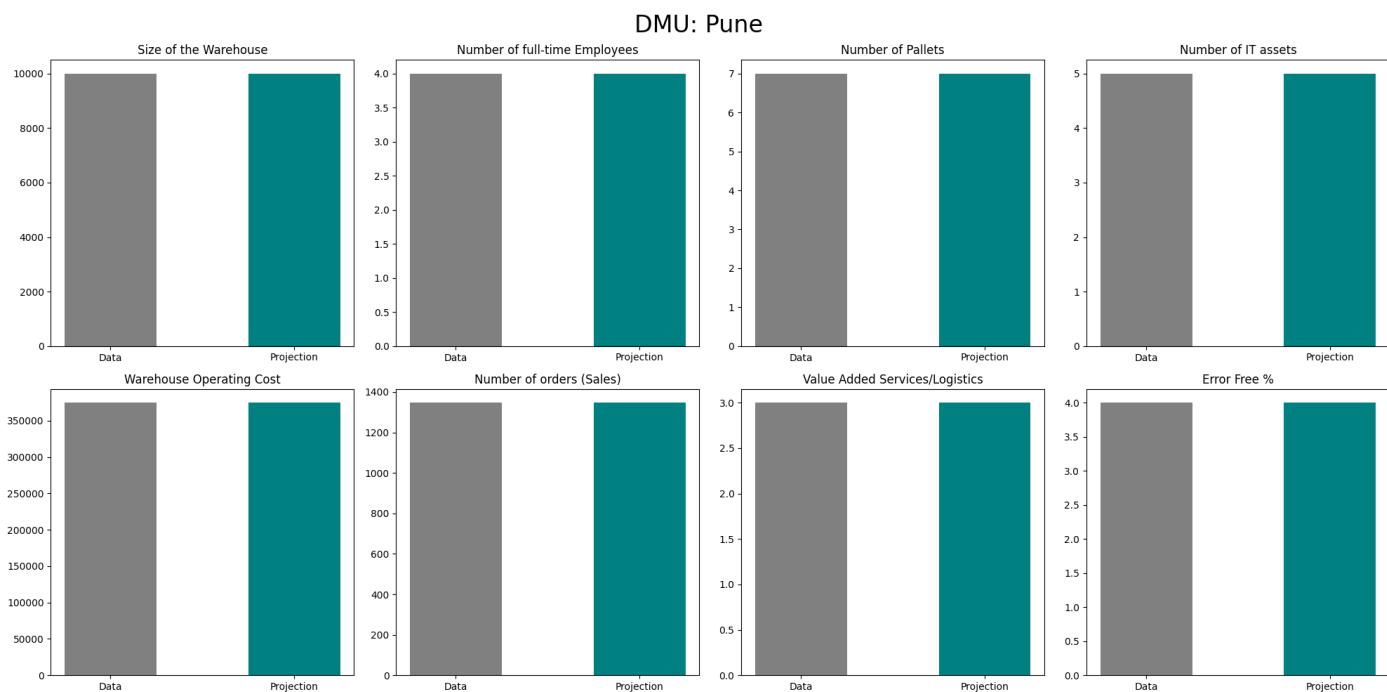
Warehouse 26 (Pune) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	10000	10000	0
No. of Full-time Employees	4	4	0
No. of Pallets	7	7	0
No. of IT assets	5	5	0
Warehouse Operating Cost	374615	374615	0
No. of Orders (Sales)	1347	1347	0
Level of Value-Added Services	3	3	0
Error Free (%)	4	4	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 26 (Pune)	1



## WAREHOUSE 27 (Raipur)

### BCC MODEL FORMULATION

```

!Dual Objective Function;
MIN = X27;

!Subject to;
13100*Y127 + 2000*Y227 + 550*Y327 + 9800*Y427 + 7500*Y527 + 550*Y627 + 4800*Y727 + 10250*Y827 + 2300*Y927 +
1000*Y1027 + 20700*Y1127 + 1200*Y1227 + 11000*Y1327 + 4100*Y1427 + 2000*Y1527 + 21000*Y1627 + 500*Y1727 +
2152*Y1827 + 9700*Y1927 + 15000*Y2027 + 9000*Y2127 + 4600*Y2227 + 2000*Y2327 + 37324*Y2427 + 11000*Y2527 +
10000*Y2627 + 4000*Y2727 + 5500*Y2827 + 2000*Y2927 -4000*X27 <=0;

7*Y127 + 2*Y227 + 2*Y327 + 14*Y427 + 4*Y527 + 2*Y627 + 3*Y727 + 5*Y827 + 2*Y927 + 1*Y1027 + 21*Y1127 +
6*Y1227 + 13*Y1327 + 2*Y1427 + 2*Y1527 + 5*Y1627 + 2*Y1727 + 4*Y1827 + 5*Y1927 + 15*Y2027 + 6*Y2127 + 5*Y2227 +
2*Y2327 + 48*Y2427 + 9*Y2527 + 4*Y2627 + 2*Y2727 + 2*Y2827 + 8*Y2927 -2*X27 <=0;

320*Y127 + 7*Y227 + 2*Y327 + 10*Y427 + 7*Y527 + 2*Y627 + 7*Y727 + 20*Y827 + 7*Y927 + 30*Y1027 + 200*Y1127 +
7*Y1227 + 200*Y1327 + 7*Y1427 + 2*Y1527 + 338*Y1627 + 2*Y1727 + 48*Y1827 + 7*Y1927 + 200*Y2027 + 7*Y2127 +
7*Y2227 + 7*Y2327 + 550*Y2427 + 200*Y2527 + 7*Y2627 + 2*Y2727 + 50*Y2827 + 2*Y2927 - 2*X27 <=0;

9*Y127 + 4*Y227 + 2*Y327 + 9*Y427 + 4*Y527 + 3*Y627 + 6*Y727 + 7*Y827 + 4*Y927 + 4*Y1027 + 11*Y1127 + 5*Y1227 +
12*Y1327 + 3*Y1427 + 3*Y1527 + 10*Y1627 + 2*Y1727 + 7*Y1827 + 5*Y1927 + 12*Y2027 + 7*Y2127 + 5*Y2227 +
2*Y2327 + 25*Y2427 + 9*Y2527 + 5*Y2627 + 2*Y2727 + 5*Y2827 + 6*Y2927 - 2*X27 <=0;

820931*Y127 + 147596*Y227 + 86404*Y327 + 584300*Y427 + 238265*Y527 + 147473*Y627 + 420908*Y727 +
239046*Y827 + 171183*Y927 + 86967*Y1027 + 142521*Y1127 + 1372680*Y1227 +
+ 119500*Y1327 + 247573*Y1427 + 93157*Y1527 + 1994765*Y1627 + 29538*Y1727 + 226845*Y1827 + 117310*Y1927 +
+ 955890*Y2027 + 3333230*Y2127 + 2349633*Y2227 + 139434*Y2327 + 2090879*Y2427 + 755723*Y2527 +
374615*Y2627 + 224382*Y2727 + 194903*Y2827 + 173934*Y2927 - 224382*X27 <=0;

229*Y127 + 354*Y227 + 115*Y327 + 5827*Y427 + 4776*Y527 + 152*Y627 + 661*Y727 + 1019*Y827 + 278*Y927 +
60*Y1027 + 2155*Y1127 + 908*Y1227 + 2593*Y1327 + 272*Y1427 + 64*Y1527 +
1053*Y1627 + 137*Y1727 + 138*Y1827 + 523*Y1927 + 1222*Y2027 + 1674*Y2127 + 554*Y2227 + 197*Y2327 + 5794*Y2427 +
+ 1505*Y2527 + 1347*Y2627 + 310*Y2727 + 259*Y2827 + 277*Y2927 >= 310;

3*Y127 + 3*Y227 + 3*Y327 + 3*Y427 + 3*Y527 + 3*Y627 + 3*Y727 + 3*Y827 + 3*Y927 + 3*Y1027 + 3*Y1127 + 3*Y1227 +
+ 3*Y1327 + 3*Y1427 + 3*Y1527 + 3*Y1627 + 3*Y1727 + 3*Y1827 + 3*Y1927 + 3*Y2027 + 3*Y2127 + 3*Y2227 + 3*Y2327 +
+ 3*Y2427 + 3*Y2527 + 3*Y2627 + 3*Y2727 + 3*Y2827 + 3*Y2927 >= 3;

4*Y127 + 3*Y227 + 1*Y327 + 4*Y427 + 3*Y527 + 1*Y627 + 3*Y727 + 4*Y827 + 2*Y927 + 1*Y1027 + 4*Y1127 + 2*Y1227 +
+ 4*Y1327 + 3*Y1427 + 2*Y1527 + 4*Y1627 + 1*Y1727 + 2*Y1827 + 3*Y1927 + 4*Y2027 + 3*Y2127 + 3*Y2227 + 2*Y2327 +
+ 4*Y2427 + 3*Y2527 + 4*Y2627 + 2*Y2727 + 3*Y2827 + 3*Y2927 >= 2;

Y127 + Y227 + Y327 + Y427 + Y527 + Y627 + Y727 + Y827 + Y927 + Y1027 + Y1127 + Y1227 + Y1327 + Y1427 + Y1527 +
+ Y1627 + Y1727 + Y1827 + Y1927 + Y2027 + Y2127 + Y2227 + Y2327 + Y2427 + Y2527 + Y2627 + Y2727 + Y2827 +
Y2927 = 1;

@Free (X27);
Y127 >=0; Y227 >=0; Y327 >=0; Y427 >=0; Y527 >=0; Y627 >=0; Y727 >=0; Y827 >=0; Y927 >=0; Y1027 >=0; Y1127
>=0; Y1227 >=0; Y1327 >=0; Y1427 >=0; Y1527 >=0; Y1627 >=0; Y1727 >=0; Y1827 >=0; Y1927 >=0;
Y2027 >=0; Y2127 >=0; Y2227 >=0; Y2327 >=0; Y2427 >=0; Y2527 >=0; Y2627 >=0; Y2727 >=0; Y2827 >=0; Y2927 >=0;

```

### SOLUTION OF BCC MODEL

File Edit LINGO Window Help		
Global optimal solution found.		
Objective value:	1.000000	
Infeasibilities:	0.4547474E-12	
Total solver iterations:	6	
Variable	Value	Reduced Cost
X27	1.000000	0.3198566E-16
Y127	0.000000	3.500000
Y227	0.000000	1.000000
Y327	0.000000	0.1110223E-15
Y427	0.000000	3.500000
Y527	0.000000	1.000000
Y627	0.000000	0.5000000
Y727	0.000000	2.000000
Y827	0.000000	2.500000
Y927	0.000000	1.000000
Y1027	0.000000	1.000000
Y1127	0.000000	4.500000
Y1227	0.000000	1.500000

Y1327	0.000000	5.000000
Y1427	0.000000	0.500000
Y1527	0.000000	0.500000
Y1627	0.000000	4.000000
Y1727	0.000000	0.000000
Y1827	0.000000	2.500000
Y1927	0.000000	1.500000
Y2027	0.000000	5.000000
Y2127	0.000000	2.500000
Y2227	0.000000	1.500000
Y2327	0.000000	0.000000
Y2427	0.000000	11.50000
Y2527	0.000000	3.500000
Y2627	0.000000	1.500000
Y2727	1.000000	0.1110223E-15
Y2827	0.000000	1.500000
Y2927	0.000000	2.000000

## SUMMARY

Efficiency of Warehouse 27 (Raipur) = 1

Warehouse 27 (Raipur) is an efficient warehouse.

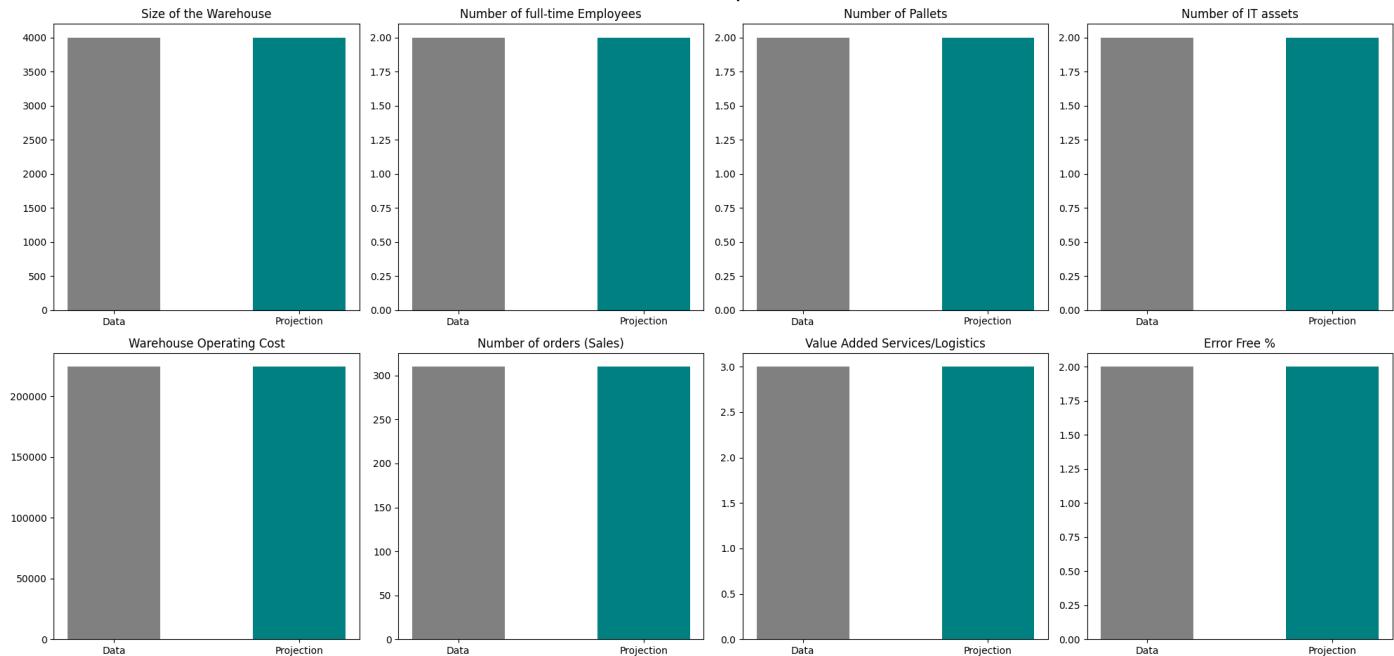
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	4000	4000	0
No. of Full-time Employees	2	2	0
No. of Pallets	2	2	0
No. of IT assets	2	2	0
Warehouse Operating Cost	224382	224382	0
No. of Orders (Sales)	310	310	0
Level of Value-Added Services	3	3	0
Error Free (%)	2	2	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 27 (Raipur)	1

DMU: Raipur



## WAREHOUSE 28 (Ranchi)

### BCC MODEL FORMULATION

```

!Dual Objective Function;
MIN = X28;

!Subject to;
13100*Y128 + 2000*Y228 + 550*Y328 + 9800*Y428 + 7500*Y528 + 550*Y628 + 4800*Y728 + 10250*Y828 + 2300*Y928 +
1000*Y1028 + 20700*Y1128 + 1200*Y1228 + 11000*Y1328 + 4100*Y1428 + 2000*Y1528 + 21000*Y1628 + 500*Y1728 +
2152*Y1828 + 9700*Y1928 + 15000*Y2028 + 9000*Y2128 + 4600*Y2228 + 2000*Y2328 + 37324*Y2428 + 11000*Y2528 +
10000*Y2628 + 4000*Y2728 + 5500*Y2828 + 2000*Y2928 - 5500*X28 <=0;

7*Y128 + 2*Y228 + 2*Y328 + 14*Y428 + 4*Y528 + 2*Y628 + 3*Y728 + 5*Y828 + 2*Y928 + 1*Y1028 + 21*Y1128 +
6*Y1228 + 13*Y1328 + 2*Y1428 + 2*Y1528 + 5*Y1628 + 2*Y1728 + 4*Y1828 + 5*Y1928 + 15*Y2028 + 6*Y2128 + 5*Y2228 +
2*Y2328 + 48*Y2428 + 9*Y2528 + 4*Y2628 + 2*Y2728 + 2*Y2828 + 8*Y2928 - 2*X28 <=0;

320*Y128 + 7*Y228 + 2*Y328 + 10*Y428 + 7*Y528 + 2*Y628 + 7*Y728 + 20*Y828 + 7*Y928 + 30*Y1028 + 200*Y1128 +
7*Y1228 + 200*Y1328 + 7*Y1428 + 2*Y1528 + 338*Y1628 + 2*Y1728 + 48*Y1828 + 7*Y1928 + 200*Y2028 + 7*Y2128 +
7*Y2228 + 7*Y2328 + 550*Y2428 + 200*Y2528 + 7*Y2628 + 2*Y2728 + 50*Y2828 + 2*Y2928 - 50*X28 <=0;

9*Y128 + 4*Y228 + 2*Y328 + 9*Y428 + 4*Y528 + 3*Y628 + 6*Y728 + 7*Y828 + 4*Y928 + 4*Y1028 + 11*Y1128 + 5*Y1228 +
12*Y1328 + 3*Y1428 + 3*Y1528 + 10*Y1628 + 2*Y1728 + 7*Y1828 + 5*Y1928 + 12*Y2028 + 7*Y2128 + 5*Y2228 +
2*Y2328 + 25*Y2428 + 9*Y2528 + 5*Y2628 + 2*Y2728 + 5*Y2828 + 6*Y2928 - 5*X28 <=0;

820931*Y128 + 147596*Y228 + 86404*Y328 + 584300*Y428 + 238265*Y528 + 147473*Y628 + 420908*Y728 +
239046*Y828 + 171183*Y928 + 86967*Y1028 + 142521*Y1128 + 1372680*Y1228 +
+ 119500*Y1328 + 247573*Y1428 + 93157*Y1528 + 1994765*Y1628 + 29538*Y1728 + 226845*Y1828 + 117310*Y1928 +
+ 955890*Y2028 + 3333230*Y2128 + 2349633*Y2228 + 139434*Y2328 + 2090879*Y2428 + 755723*Y2528 +
374615*Y2628 + 224382*Y2728 + 194903*Y2828 + 173934*Y2928 - 194903*X28 <=0;

229*Y128 + 354*Y228 + 115*Y328 + 5827*Y428 + 4776*Y528 + 152*Y628 + 661*Y728 + 1019*Y828 + 278*Y928 +
60*Y1028 + 2155*Y1128 + 908*Y1228 + 2593*Y1328 + 272*Y1428 + 64*Y1528 +
1053*Y1628 + 137*Y1728 + 138*Y1828 + 523*Y1928 + 1222*Y2028 + 1674*Y2128 + 554*Y2228 + 197*Y2328 + 5794*Y2428 +
+ 1505*Y2528 + 1347*Y2628 + 310*Y2728 + 259*Y2828 + 277*Y2928 >= 259;

3*Y128 + 3*Y228 + 3*Y328 + 3*Y428 + 3*Y528 + 3*Y628 + 3*Y728 + 3*Y828 + 3*Y928 + 3*Y1028 + 3*Y1128 + 3*Y1228 +
+ 3*Y1328 + 3*Y1428 + 3*Y1528 + 3*Y1628 + 3*Y1728 + 3*Y1828 + 3*Y1928 + 3*Y2028 + 3*Y2128 + 3*Y2228 + 3*Y2328 +
+ 3*Y2428 + 3*Y2528 + 3*Y2628 + 3*Y2728 + 3*Y2828 + 3*Y2928 >= 3;

4*Y128 + 3*Y228 + 1*Y328 + 4*Y428 + 3*Y528 + 1*Y628 + 3*Y728 + 4*Y828 + 2*Y928 + 1*Y1028 + 4*Y1128 + 2*Y1228 +
+ 4*Y1328 + 3*Y1428 + 2*Y1528 + 4*Y1628 + 1*Y1728 + 2*Y1828 + 3*Y1928 + 4*Y2028 + 3*Y2128 + 3*Y2228 + 2*Y2328 +
+ 4*Y2428 + 3*Y2528 + 4*Y2628 + 2*Y2728 + 3*Y2828 + 3*Y2928 >= 3;

Y128 + Y228 + Y328 + Y428 + Y528 + Y628 + Y728 + Y828 + Y928 + Y1028 + Y1128 + Y1228 + Y1328 + Y1428 + Y1528 +
+ Y1628 + Y1728 + Y1828 + Y1928 + Y2028 + Y2128 + Y2228 + Y2328 + Y2428 + Y2528 + Y2628 + Y2728 + Y2828 +
Y2928 = 1;
@Free(X28);
Y128 >=0; Y228 >=0; Y328 >=0; Y428 >=0; Y528 >=0; Y628 >=0; Y728 >=0; Y828 >=0; Y928 >=0; Y1028 >=0; Y1128
>=0; Y1228 >=0; Y1328 >=0; Y1428 >=0; Y1528 >=0; Y1628 >=0; Y1728 >=0; Y1828 >=0; Y1928 >=0;
Y2028 >=0; Y2128 >=0; Y2228 >=0; Y2328 >=0; Y2428 >=0; Y2528 >=0; Y2628 >=0; Y2728 >=0; Y2828 >=0; Y2928 >=0;

```

### SOLUTION OF BCC MODEL

Global optimal solution found.		
Objective value:	1.000000	
Infeasibilities:	0.000000	
Total solver iterations:	4	
Variable	Value	Reduced Cost
X28	1.000000	0.000000
Y128	0.000000	2.250000
Y228	0.000000	0.000000
Y328	0.000000	0.5000000
Y428	0.000000	5.750000
Y528	0.000000	1.000000
Y628	0.000000	0.5000000
Y728	0.000000	0.5000000
Y828	0.000000	1.250000
Y928	0.000000	0.2500000
Y1028	0.000000	0.000000
Y1128	0.000000	9.250000
Y1228	0.000000	2.250000

Y1328	0.000000	5.250000
Y1428	0.000000	0.000000
Y1528	0.000000	0.250000
Y1628	0.000000	1.250000
Y1728	0.000000	0.500000
Y1828	0.000000	1.250000
Y1928	0.000000	1.500000
Y2028	0.000000	6.250000
Y2128	0.000000	2.000000
Y2228	0.000000	1.500000
Y2328	0.000000	0.250000
Y2428	0.000000	22.750000
Y2528	0.000000	3.500000
Y2628	0.000000	0.750000
Y2728	0.000000	0.250000
Y2828	1.000000	0.000000
Y2928	0.000000	3.000000

## SUMMARY

Efficiency of Warehouse 28 (Ranchi) = 1

Warehouse 27 (Ranchi) is an efficient warehouse.

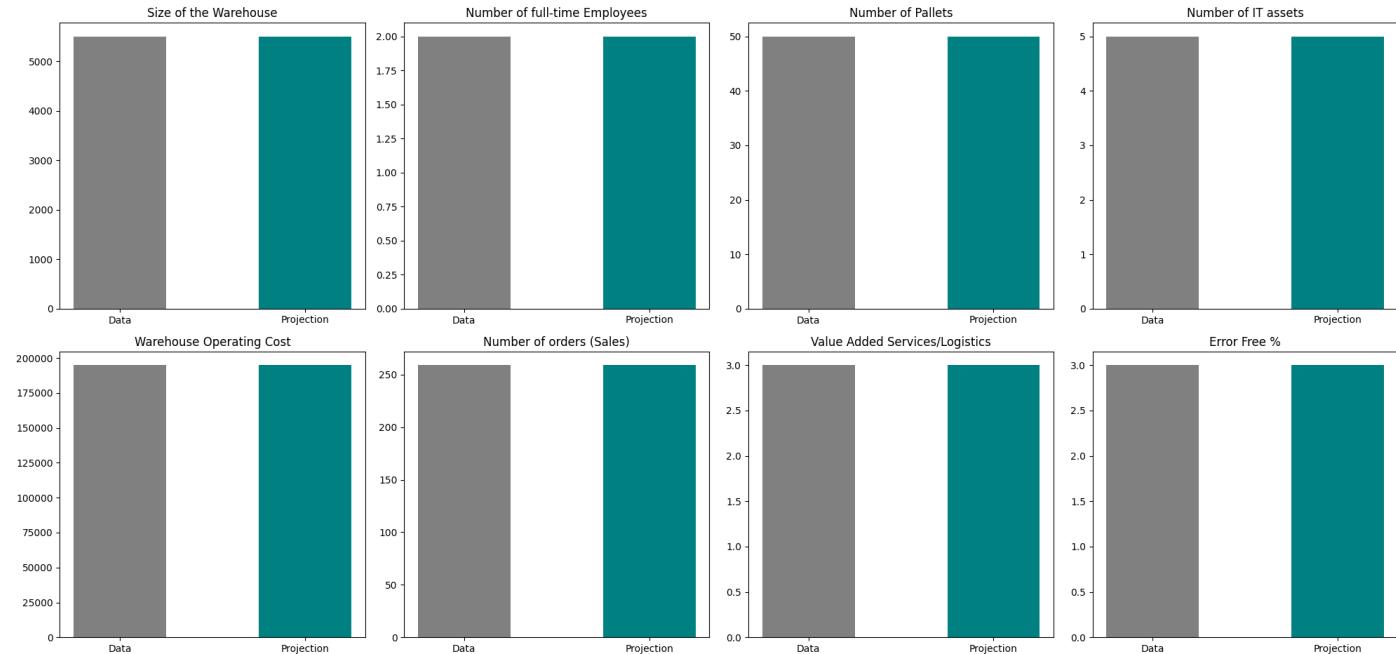
## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	5500	5500	0
No. of Full-time Employees	2	2	0
No. of Pallets	50	50	0
No. of IT assets	5	5	0
Warehouse Operating Cost	194903	194903	0
No. of Orders (Sales)	259	259	0
Level of Value-Added Services	3	3	0
Error Free (%)	3	3	0

## LISTING OF PEERS

Peers	Lambda Weight
Warehouse 28 (Ranchi)	1

DMU: Ranchi



## WAREHOUSE 29 (Varanasi)

### BCC MODEL FORMULATION

```

!Dual Objective Function;
MIN = X29;

!Subject to;
13100*Y129 + 2000*Y229 + 550*Y329 + 9800*Y429 + 7500*Y529 + 550*Y629 + 4800*Y729 + 10250*Y829 +
2300*Y929 + 1000*Y1029 + 20700*Y1129 + 1200*Y1229 + 11000*Y1329 + 4100*Y1429 + 2000*Y1529 + 21000*Y1629 +
500*Y1729 + 2152*Y1829 + 9700*Y1929 + 15000*Y2029 + 9000*Y2129 + 4600*Y2229 + 2000*Y2329 +
37324*Y2429 + 11000*Y2529 + 10000*Y2629 + 4000*Y2729 + 5500*Y2829 + 2000*Y2929 - 2000*X29 <= 0;

7*Y129 + 2*Y229 + 2*Y329 + 14*Y429 + 4*Y529 + 2*Y629 + 3*Y729 + 5*Y829 + 2*Y929 + 1*Y1029 + 21*Y1129 +
6*Y1229 + 13*Y1329 + 2*Y1429 + 2*Y1529 + 5*Y1629 + 2*Y1729 + 4*Y1829 + 5*Y1929 + 15*Y2029 + 6*Y2129 +
5*Y2229 + 2*Y2329 + 48*Y2429 + 9*Y2529 + 4*Y2629 + 2*Y2729 + 2*Y2829 + 8*Y2929 - 8*X29 <= 0;

320*Y129 + 7*Y229 + 2*Y329 + 10*Y429 + 7*Y529 + 2*Y629 + 7*Y729 + 20*Y829 + 7*Y929 + 30*Y1029 +
200*Y1129 + 7*Y1229 + 200*Y1329 + 7*Y1429 + 2*Y1529 + 338*Y1629 + 2*Y1729 + 48*Y1829 + 7*Y1929 +
200*Y2029 + 7*Y2129 + 7*Y2229 + 7*Y2329 + 550*Y2429 + 200*Y2529 + 7*Y2629 + 2*Y2729 + 50*Y2829 +
2*Y2929 - 2*X29 <=0;

9*Y129 + 4*Y229 + 2*Y329 + 9*Y429 + 4*Y529 + 3*Y629 + 6*Y729 + 7*Y829 + 4*Y929 + 4*Y1029 + 11*Y1129 +
5*Y1229 + 12*Y1329 + 3*Y1429 + 3*Y1529 + 10*Y1629 + 2*Y1729 + 7*Y1829 + 5*Y1929 + 12*Y2029 + 7*Y2129 +
5*Y2229 + 2*Y2329 + 25*Y2429 + 9*Y2529 + 5*Y2629 + 2*Y2729 + 5*Y2829 + 6*Y2929 - 6*X29 <=0;

820931*Y129 + 147596*Y229 + 86404*Y329 + 584300*Y429 + 238265*Y529 + 147473*Y629 + 420908*Y729 +
239046*Y829 + 171183*Y929 + 86967*Y1029 + 142521*Y1129 + 1372680*Y1229 +
119500*Y1329 + 247573*Y1429 + 93157*Y1529 + 1994765*Y1629 + 29538*Y1729 + 226845*Y1829 +
117310*Y1929 + 955890*Y2029 + 3333230*Y2129 + 2349633*Y2229 + 139434*Y2329 + 2090879*Y2429 +
755723*Y2529 + 374615*Y2629 + 224382*Y2729 + 194903*Y2829 + 173934*Y2929 - 173934*X29 <=0;

229*Y129 + 354*Y229 + 115*Y329 + 5827*Y429 + 4776*Y529 + 152*Y629 + 661*Y729 + 1019*Y829 + 278*Y929 +
60*Y1029 + 2155*Y1129 + 908*Y1229 + 2593*Y1329 + 272*Y1429 + 64*Y1529 +
1053*Y1629 + 137*Y1729 + 138*Y1829 + 523*Y1929 + 1222*Y2029 + 1674*Y2129 + 554*Y2229 + 197*Y2329 +
5794*Y2429 + 1505*Y2529 + 1347*Y2629 + 310*Y2729 + 259*Y2829 + 277*Y2929 >= 277;

3*Y129 + 3*Y229 + 3*Y329 + 3*Y429 + 3*Y529 + 3*Y629 + 3*Y729 + 3*Y829 + 3*Y929 + 3*Y1029 + 3*Y1129 +
3*Y1229 + 3*Y1329 + 3*Y1429 + 3*Y1529 + 3*Y1629 + 3*Y1729 + 3*Y1829 + 3*Y1929 + 3*Y2029 + 3*Y2129 +
3*Y2229 + 3*Y2329 + 3*Y2429 + 3*Y2529 + 3*Y2629 + 3*Y2729 + 3*Y2829 + 3*Y2929 >= 3;

4*Y129 + 3*Y229 + 1*Y329 + 4*Y429 + 3*Y529 + 1*Y629 + 3*Y729 + 4*Y829 + 2*Y929 + 1*Y1029 + 4*Y1129 +
2*Y1229 + 4*Y1329 + 3*Y1429 + 2*Y1529 + 4*Y1629 + 1*Y1729 + 2*Y1829 + 3*Y1929 + 4*Y2029 + 3*Y2129 +
3*Y2229 + 2*Y2329 + 4*Y2429 + 3*Y2529 + 4*Y2629 + 2*Y2729 + 3*Y2829 + 3*Y2929 >= 3;

Y129 + Y229 + Y329 + Y429 + Y529 + Y629 + Y729 + Y829 + Y929 + Y1029 + Y1129 + Y1229 + Y1329 + Y1429 +
Y1529 + Y1629 + Y1729 + Y1829 + Y1929 + Y2029 + Y2129 + Y2229 + Y2329 + Y2429 + Y2529 + Y2629 + Y2729 +
Y2829 + Y2929 = 1;
@Free(X29);
Y129 >=0; Y229 >=0; Y329 >=0; Y429 >=0; Y529 >=0; Y629 >=0; Y729 >=0; Y829 >=0; Y929 >=0; Y1029 >=0;
Y1129 >=0; Y1229 >=0; Y1329 >=0; Y1429 >=0; Y1529 >=0; Y1629 >=0; Y1729 >=0; Y1829 >=0; Y1929 >=0;
Y2029 >=0; Y2129 >=0; Y2229 >=0; Y2329 >=0; Y2429 >=0; Y2529 >=0; Y2629 >=0; Y2729 >=0; Y2829 >=0;
Y2929 >=0;

```

### SOLUTION OF BCC MODEL

Global optimal solution found.		
Variable	Value	Reduced Cost
X29	1.000000	-0.1110223E-15
Y129	0.000000	11.88014
Y229	0.000000	0.000000
Y329	0.000000	0.3552164
Y429	0.000000	2.092223
Y529	0.000000	0.5838846
Y629	0.000000	0.6727290
Y729	0.000000	1.478275
Y829	0.000000	0.5802412
Y929	0.000000	0.5487488
Y1029	0.000000	1.134197
Y1129	0.000000	5.221842
Y1229	0.000000	6.773129

Y1329	0.000000	4.903786
Y1429	0.000000	0.5627495
Y1529	0.000000	0.000000
Y1629	0.000000	18.63772
Y1729	0.000000	0.5853375E-01
Y1829	0.000000	1.958011
Y1929	0.000000	-0.8326673E-16
Y2029	0.000000	9.334180
Y2129	0.000000	16.70603
Y2229	0.000000	11.50210
Y2329	0.000000	0.3775430
Y2429	0.000000	25.27742
Y2529	0.000000	8.631643
Y2629	0.000000	0.9239469
Y2729	0.000000	0.7231705
Y2829	0.000000	1.495199
Y2929	1.000000	0.5551115E-16

## SUMMARY

Efficiency of Warehouse 29 (Varanasi) = 1

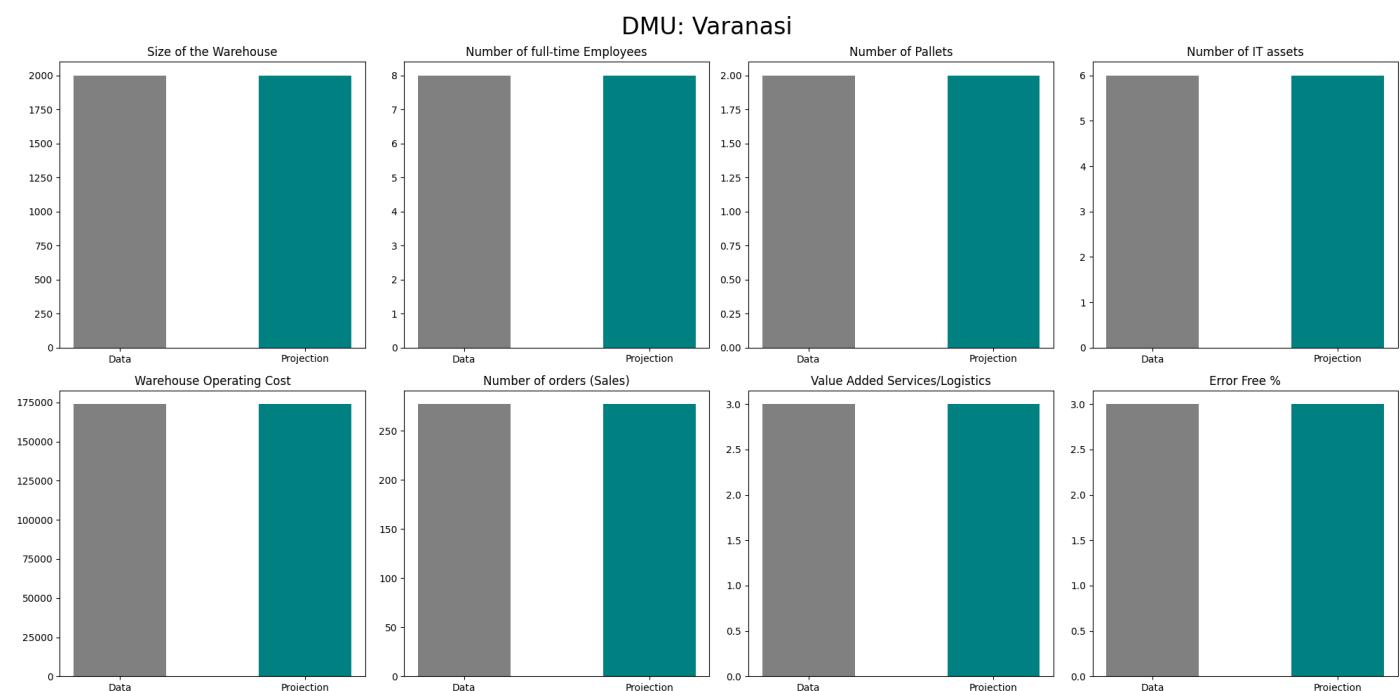
Warehouse 29 (Varanasi) is an efficient warehouse.

## PROJECTION SUMMARY

Variable	Original Value	Projected Value	Slack
Size of the warehouse	2000	2000	0
No. of Full-time Employees	8	8	0
No. of Pallets	2	2	0
No. of IT assets	6	6	0
Warehouse Operating Cost	173934	173934	0
No. of Orders (Sales)	277	277	0
Level of Value-Added Services	3	3	0
Error Free (%)	3	3	0

## LISTING OF PEERS

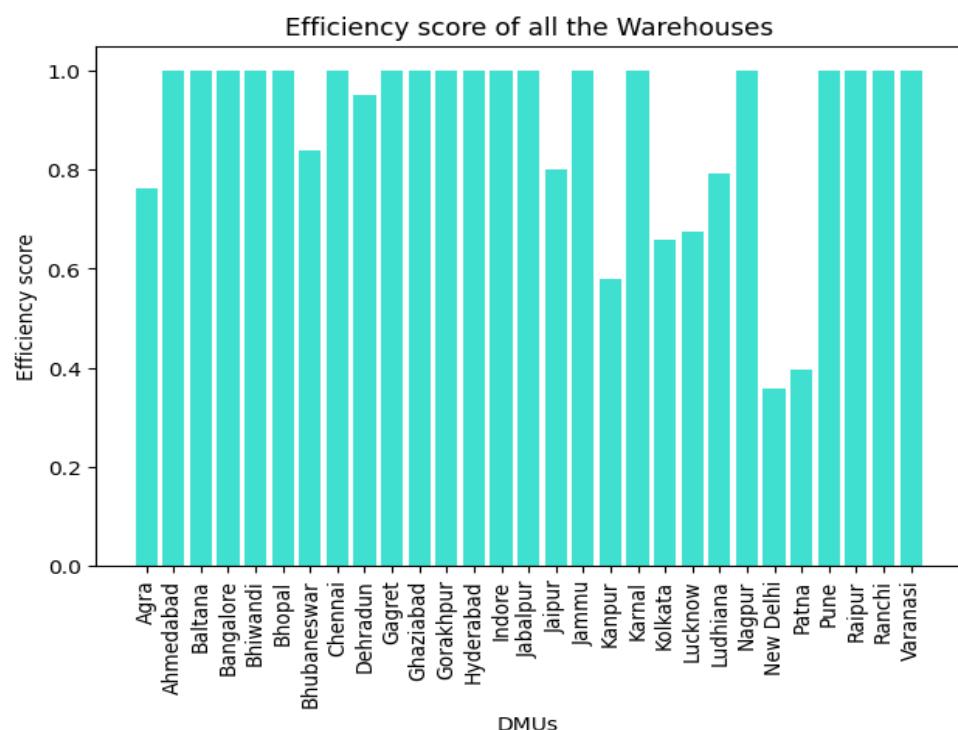
Peers	Lambda Weight
Warehouse 29 (Varanasi)	1



## SUMMARY OF BCC MODEL

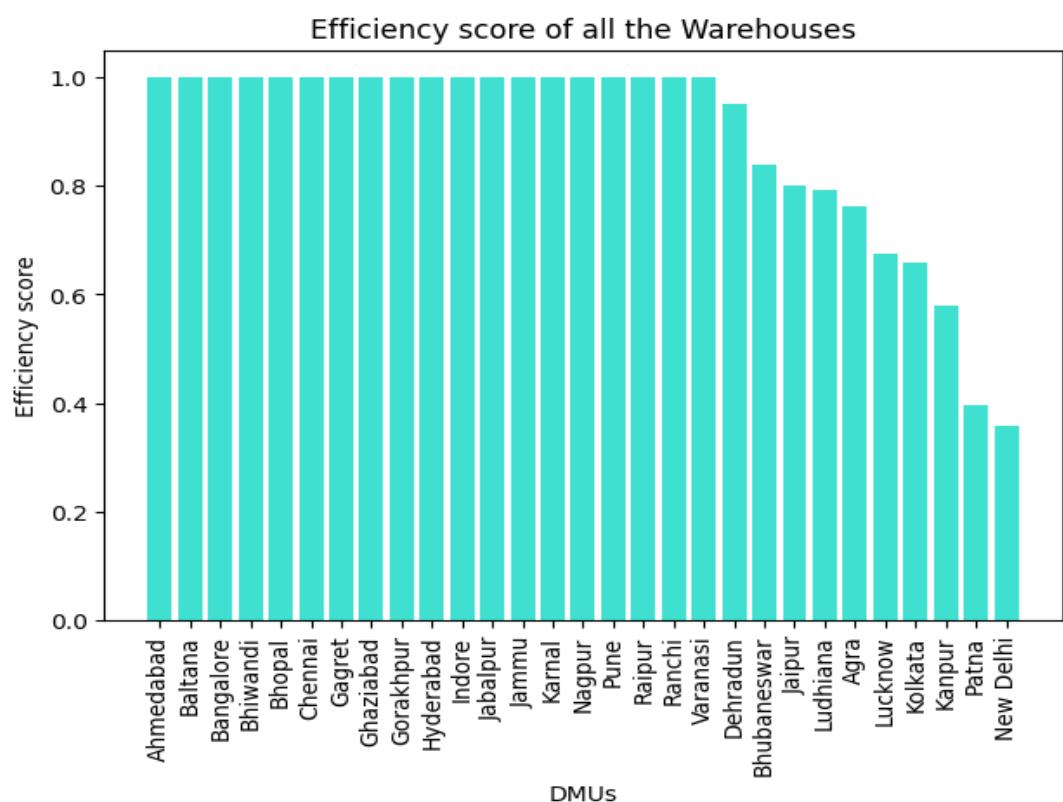
Here we have 19 efficient DMUs and 10 Inefficient DMUs

No.	DMU	Score
1	Agra	0.7613
2	Ahmedabad	1
3	Baltana	1
4	Bangalore	1
5	Bhiwandi	1
6	Bhopal	1
7	Bhubaneswar	0.8387
8	Chennai	1
9	Dehradun	0.9515
10	Gagret	1
11	Ghaziabad	1
12	Gorakhpur	1
13	Hyderabad	1
14	Indore	1
15	Jabalpur	1
16	Jaipur	0.8
17	Jammu	1
18	Kanpur	0.5801
19	Karnal	1
20	Kolkata	0.6588
21	Lucknow	0.6734
22	Ludhiana	0.7922
23	Nagpur	1
24	New Delhi	0.3588
25	Patna	0.3972
26	Pune	1
27	Raipur	1
28	Ranchi	1
29	Varanasi	1



### Ranking of warehouses under BCC model

No.	DMU	Score	Rank
2	Ahmedabad	1	1
3	Baltana	1	1
4	Bangalore	1	1
5	Bhiwandi	1	1
6	Bhopal	1	1
8	Chennai	1	1
10	Gagret	1	1
11	Ghaziabad	1	1
12	Gorakhpur	1	1
13	Hyderabad	1	1
14	Indore	1	1
15	Jabalpur	1	1
17	Jammu	1	1
19	Karnal	1	1
23	Nagpur	1	1
26	Pune	1	1
27	Raipur	1	1
28	Ranchi	1	1
29	Varanasi	1	1
9	Dehradun	0.9515	20
7	Bhubaneswar	0.8387	21
16	Jaipur	0.8	22
22	Ludhiana	0.7922	23
1	Agra	0.7613	24
21	Lucknow	0.6734	25
20	Kolkata	0.6588	26
18	Kanpur	0.5801	27
25	Patna	0.3972	28
24	New Delhi	0.3588	29



## USE OF SUPER-EFFICIENCY TO RANK EFFICIENT FIRM

In CCR model, there are 15 efficient firms and in order to rank those 15 firms, we will use Anderson-Peterson model to rank those. Following is the list of all the efficient firms in CCR model.

No.	DMU	Score
2	Ahmedabad	1
3	Baltana	1
5	Bhiwandi	1
6	Bhopal	1
10	Gagret	1
12	Gorakhpur	1
13	Hyderabad	1
14	Indore	1
15	Jabalpur	1
17	Jammu	1
19	Karnal	1
23	Nagpur	1
27	Raipur	1
28	Ranchi	1
29	Varanasi	1

## WAREHOUSE 2 (AHMEDABAD)

Anderson-Peterson Model LPP formulation

```

!Dual Objective Function;
MIN = X2;

!Subject to;
13100*Y12 + 550*Y32 + 9800*Y42 + 7500*Y52 + 550*Y62 + 4800*Y72 + 10250*Y82 + 2300*Y92 + 1000*Y102 +
20700*Y112 + 1200*Y122 + 11000*Y132 + 4100*Y142 + 2000*Y152 + 21000*Y162 + 500*Y172 + 2152*Y182 +
9700*Y192 + 15000*Y202 + 9000*Y212 + 4600*Y222 + 2000*Y232 + 37324*Y242 + 11000*Y252 + 10000*Y262 +
4000*Y272 + 5500*Y282 + 2000*Y292 - 2000*X2 <=0;

7*Y12 + 2*Y32 + 14*Y42 + 4*Y52 + 2*Y62 + 3*Y72 + 5*Y82 + 2*Y92 + 1*Y102 + 21*Y112 + 6*Y122 + 13*Y132 +
2*Y142 + 2*Y152 + 5*Y162 + 2*Y172 + 4*Y182 + 5*Y192 + 15*Y202 + 6*Y212 + 5*Y222 + 2*Y232 + 48*Y242 +
9*Y252 + 4*Y262 + 2*Y272 + 2*Y282 + 8*Y292 - 2*X2 <=0;

320*Y12 + 2*Y32 + 10*Y42 + 7*Y52 + 2*Y62 + 7*Y72 + 20*Y82 + 7*Y92 + 30*Y102 + 200*Y112 + 7*Y122 +
200*Y132 + 7*Y142 + 2*Y152 + 338*Y162 + 2*Y172 + 48*Y182 + 7*Y192 + 200*Y202 + 7*Y212 + 7*Y222 + 7*Y232 +
550*Y242 + 200*Y252 + 7*Y262 + 2*Y272 + 50*Y282 + 2*Y292 - 7*X2 <=0;

9*Y12 + 2*Y32 + 9*Y42 + 4*Y52 + 3*Y62 + 6*Y72 + 7*Y82 + 4*Y92 + 4*Y102 + 11*Y112 + 5*Y122 + 12*Y132 +
3*Y142 + 3*Y152 + 10*Y162 + 2*Y172 + 7*Y182 + 5*Y192 +
12*Y202 + 7*Y212 + 5*Y222 + 2*Y232 + 25*Y242 + 9*Y252 + 5*Y262 + 2*Y272 + 5*Y282 + 6*Y292 - 4*X2 <=0;

820931*Y12 + 86404*Y32 + 584300*Y42 + 238265*Y52 + 147473*Y62 + 420908*Y72 + 239046*Y82 +
171183*Y92 + 86967*Y102 + 142521*Y112 + 1372680*Y122 + 119500*Y132 +
247573*Y142 + 93157*Y152 + 1994765*Y162 + 29538*Y172 + 226845*Y182 + 117310*Y192 + 955890*Y202 +
+3333230*Y212 + 2349633*Y222 + 139434*Y232 + 2090879*Y242 + 755723*Y252 +
374615*Y262 + 224382*Y272 + 194903*Y282 + 173934*Y292 - 147596*X2 <=0;

229*Y12 + 115*Y32 + 5827*Y42 + 4776*Y52 + 152*Y62 + 661*Y72 + 1019*Y82 + 278*Y92 + 60*Y102 + 2155*Y112 +
+ 908*Y122 + 2593*Y132 + 272*Y142 + 64*Y152 + 1053*Y162 + 137*Y172 + 138*Y182 + 523*Y192 + 1222*Y202 +
1674*Y212 + 554*Y222 + 197*Y232 + 5794*Y242 + 1505*Y252 + 1347*Y262 + 310*Y272 + 259*Y282 + 277*Y292
>= 354;

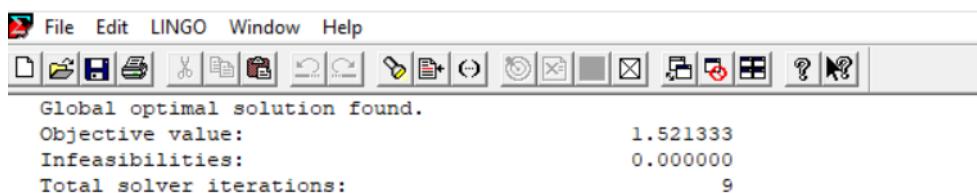
3*Y12 + 3*Y32 + 3*Y42 + 3*Y52 + 3*Y62 + 3*Y72 + 3*Y82 + 3*Y92 + 3*Y102 + 3*Y112 + 3*Y122 + 3*Y132 +
3*Y142 + 3*Y152 + 3*Y162 + 3*Y172 + 3*Y182 + 3*Y192 + 3*Y202 + 3*Y212 + 3*Y222 + 3*Y232 + 3*Y242 +
3*Y252 + 3*Y262 + 3*Y272 + 3*Y282 + 3*Y292 >= 3;

4*Y12 + 1*Y32 + 4*Y42 + 3*Y52 + 1*Y62 + 3*Y72 + 4*Y82 + 2*Y92 + 1*Y102 + 4*Y112 + 2*Y122 + 4*Y132 +
3*Y142 + 2*Y152 + 4*Y162 + 1*Y172 + 2*Y182 + 3*Y192 + 4*Y202 + 3*Y212 + 3*Y222 + 2*Y232 + 4*Y242 +
3*Y252 + 4*Y262 + 2*Y272 + 3*Y282 + 3*Y292 >= 3;

@Free(X2);
Y12 >=0; Y32 >=0; Y42 >=0; Y52 >=0; Y62 >=0; Y72 >=0; Y82 >=0; Y92 >=0; Y102 >=0; Y112 >=0; Y122 >=0;
Y132 >=0; Y142 >=0; Y152 >=0; Y162 >=0; Y172 >=0; Y182 >=0; Y192 >=0; Y202 >=0; Y212 >=0; Y222 >=0;
Y232 >=0; Y242 >=0; Y252 >=0; Y262 >=0; Y272 >=0; Y282 >=0; Y292 >=0;

```

Solution of AP Model



Hence, the super-efficiency score of Warehouse 2 (Ahmedabad) is 1.521333 or 152.1333%.

## WAREHOUSE 3 (Baltana)

Anderson-Peterson LPP model formulation

```

!Dual Objective Function;
MIN = X3;

!Subject to;
13100*Y13 + 2000*Y23 + 9800*Y43 + 7500*Y53 + 550*Y63 + 4800*Y73 + 10250*Y83 + 2300*Y93 + 1000*Y103 +
20700*Y113 + 1200*Y123 + 11000*Y133 + 4100*Y143 + 2000*Y153 +
21000*Y163 + 500*Y173 + 2152*Y183 + 9700*Y193 + 15000*Y203 + 9000*Y213 + 4600*Y223 + 2000*Y233 +
37324*Y243 + 11000*Y253 + 10000*Y263 + 4000*Y273 + 5500*Y283 + 2000*Y293 - 550*X3 <=0;

7*Y13 + 2*Y23 + 14*Y43 + 4*Y53 + 2*Y63 + 3*Y73 + 5*Y83 + 2*Y93 + 1*Y103 + 21*Y113 + 6*Y123 + 13*Y133 +
2*Y143 + 2*Y153 + 5*Y163 + 2*Y173 + 4*Y183 + 5*Y193 + 15*Y203
+ 6*Y213 + 5*Y223 + 2*Y233 + 48*Y243 + 9*Y253 + 4*Y263 + 2*Y273 + 2*Y283 + 8*Y293 - 2*X3 <=0;

320*Y13 + 7*Y23 + 10*Y43 + 7*Y53 + 2*Y63 + 7*Y73 + 20*Y83 + 7*Y93 + 30*Y103 + 200*Y113 + 7*Y123 +
200*Y133 + 7*Y143 + 2*Y153 + 338*Y163 + 2*Y173 + 48*Y183 + 7*Y193 + 200*Y203 + 7*Y213 + 7*Y223 + 7*Y233 +
550*Y243 + 200*Y253 + 7*Y263 + 2*Y273 + 50*Y283 + 2*Y293 - 2*X3 <= 0;

9*Y13 + 4*Y23 + 9*Y43 + 4*Y53 + 3*Y63 + 6*Y73 + 7*Y83 + 4*Y93 + 4*Y103 + 11*Y113 + 5*Y123 + 12*Y133 +
3*Y143 + 3*Y153 + 10*Y163 + 2*Y173 + 7*Y183 + 5*Y193 +
12*Y203 + 7*Y213 + 5*Y223 + 2*Y233 + 25*Y243 + 9*Y253 + 5*Y263 + 2*Y273 + 5*Y283 + 6*Y293 - 2*X3 <= 0;

820931*Y13 + 147596*Y23 + 584300*Y43 + 238265*Y53 + 147473*Y63 + 420908*Y73 + 239046*Y83 +
171183*Y93 + 86967*Y103 + 142521*Y113 + 1372680*Y123 + 119500*Y133 +
247573*Y143 + 93157*Y153 + 1994765*Y163 + 29538*Y173 + 226845*Y183 + 117310*Y193 + 955890*Y203 +
3333230*Y213 + 2349633*Y223 + 139434*Y233 + 2090879*Y243 + 755723*Y253 +
374615*Y263 + 224382*Y273 + 194903*Y283 + 173934*Y293 - 86404*X3 <= 0;

229*Y13 + 354*Y23 + 5827*Y43 + 4776*Y53 + 152*Y63 + 661*Y73 + 1019*Y83 + 278*Y93 + 60*Y103 + 2155*Y113 +
908*Y123 + 2593*Y133 + 272*Y143 + 64*Y153 + 1053*Y163 + 137*Y173 + 138*Y183 + 523*Y193 + 1222*Y203 +
1674*Y213 + 554*Y223 + 197*Y233 + 5794*Y243 + 1505*Y253 + 1347*Y263 + 310*Y273 + 259*Y283 + 277*Y293
>= 115;

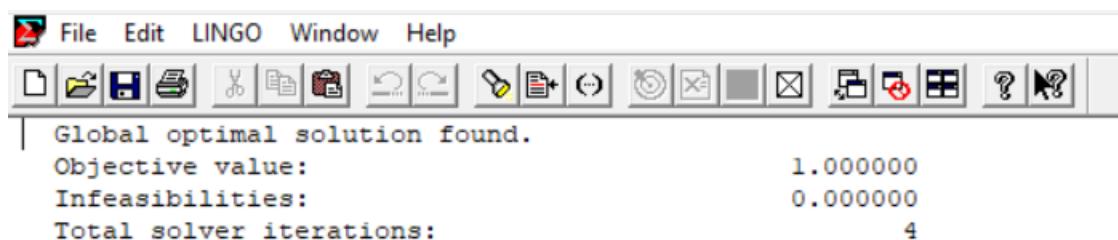
3*Y13 + 3*Y23 + 3*Y43 + 3*Y53 + 3*Y63 + 3*Y73 + 3*Y83 + 3*Y93 + 3*Y103 + 3*Y113 + 3*Y123 + 3*Y133 +
3*Y143 + 3*Y153 + 3*Y163 + 3*Y173 + 3*Y183 + 3*Y193 + 3*Y203 + 3*Y213 + 3*Y223 + 3*Y233 + 3*Y243 +
3*Y253 + 3*Y263 + 3*Y273 + 3*Y283 + 3*Y293 >= 3;

4*Y13 + 3*Y23 + 4*Y43 + 3*Y53 + 1*Y63 + 3*Y73 + 4*Y83 + 2*Y93 + 1*Y103 + 4*Y113 + 2*Y123 + 4*Y133 +
3*Y143 + 2*Y153 + 4*Y163 + 1*Y173 + 2*Y183 + 3*Y193 + 4*Y203 + 3*Y213 + 3*Y223 + 2*Y233 + 4*Y243 +
3*Y253 + 4*Y263 + 2*Y273 + 3*Y283 + 3*Y293 >= 1;

@Free(X3);
Y13 >=0; Y23 >=0; Y43 >=0; Y53 >=0; Y63 >=0; Y73 >=0; Y83 >=0; Y93 >=0; Y103 >=0; Y113 >=0; Y123 >=0;
Y133 >=0; Y143 >=0; Y153 >=0; Y163 >=0; Y173 >=0; Y183 >=0; Y193 >=0; Y203 >=0; Y213 >=0; Y223 >=0;
Y233 >=0; Y243 >=0; Y253 >=0; Y263 >=0; Y273 >=0; Y283 >=0; Y293 >=0;

```

Solution of AP Model



Hence, the super-efficiency score of warehouse 3 (Baltana) is 1.00000 or 100%.

## Warehouse 5 (Bhiwandi)

Anderson-Peterson LPP model formulation

```

!Dual Objective Function;

MIN = X5;

!Subject to;
13100*Y15 + 2000*Y25 + 550*Y35 + 9800*Y45 + 550*Y65 + 4800*Y75 + 10250*Y85 + 2300*Y95 + 1000*Y105 +
20700*Y115 + 1200*Y125 + 11000*Y135 + 4100*Y145 + 2000*Y155 + 21000*Y165 + 500*Y175 + 2152*Y185 +
9700*Y195 + 15000*Y205 + 9000*Y215 + 4600*Y225 + 2000*Y235 + 37324*Y245 + 11000*Y255 + 10000*Y265 +
4000*Y275 + 5500*Y285 + 2000*Y295 - 7500*X5 <= 0;

7*Y15 + 2*Y25 + 2*Y35 + 14*Y45 + 2*Y65 + 3*Y75 + 5*Y85 + 2*Y95 + 1*Y105 + 21*Y115 + 6*Y125 + 13*Y135 +
2*Y145 + 2*Y155 + 5*Y165 + 2*Y175 + 4*Y185 + 5*Y195 + 15*Y205 + 6*Y215 + 5*Y225 + 2*Y235 + 48*Y245 +
9*Y255 + 4*Y265 + 2*Y275 + 2*Y285 + 8*Y295 - 4*X5 <= 0;

320*Y15 + 7*Y25 + 2*Y35 + 10*Y45 + 2*Y65 + 7*Y75 + 20*Y85 + 7*Y95 + 30*Y105 + 200*Y115 + 7*Y125 +
200*Y135 + 7*Y145 + 2*Y155 + 338*Y165 + 2*Y175 + 48*Y185 + 7*Y195 + 200*Y205 + 7*Y215 + 7*Y225 + 7*Y235 +
550*Y245 + 200*Y255 + 7*Y265 + 2*Y275 + 50*Y285 + 2*Y295 - 7*X5 <= 0;

9*Y15 + 4*Y25 + 2*Y35 + 9*Y45 + 3*Y65 + 6*Y75 + 7*Y85 + 4*Y95 + 4*Y105 + 11*Y115 + 5*Y125 + 12*Y135 +
3*Y145 + 3*Y155 + 10*Y165 + 2*Y175 + 7*Y185 + 5*Y195 +
12*Y205 + 7*Y215 + 5*Y225 + 2*Y235 + 25*Y245 + 9*Y255 + 5*Y265 + 2*Y275 + 5*Y285 + 6*Y295 - 4*X5 <= 0;

820931*Y15 + 147596*Y25 + 86404*Y35 + 584300*Y45 + 147473*Y65 + 420908*Y75 + 239046*Y85 +
171183*Y95 + 86967*Y105 + 142521*Y115 + 1372680*Y125 + 119500*Y135 +
247573*Y145 + 93157*Y155 + 1994765*Y165 + 29538*Y175 + 226845*Y185 + 117310*Y195 + 955890*Y205 +
3333230*Y215 + 2349633*Y225 + 139434*Y235 + 2090879*Y245 + 755723*Y255 +
374615*Y265 + 224382*Y275 + 194903*Y285 + 173934*Y295 - 238265*X5 <= 0;

229*Y15 + 354*Y25 + 115*Y35 + 5827*Y45 + 152*Y65 + 661*Y75 + 1019*Y85 + 278*Y95 + 60*Y105 + 2155*Y115 +
908*Y125 + 2593*Y135 + 272*Y145 + 64*Y155 +
1053*Y165 + 137*Y175 + 138*Y185 + 523*Y195 + 1222*Y205 + 1674*Y215 + 554*Y225 + 197*Y235 + 5794*Y245 +
1505*Y255 + 1347*Y265 + 310*Y275 + 259*Y285 + 277*Y295 >= 4776;

3*Y15 + 3*Y25 + 3*Y35 + 3*Y45 + 3*Y65 + 3*Y75 + 3*Y85 + 3*Y95 + 3*Y105 + 3*Y115 + 3*Y125 + 3*Y135 +
3*Y145 + 3*Y155 + 3*Y165 + 3*Y175 + 3*Y185 + 3*Y195 + 3*Y205 + 3*Y215 + 3*Y225 + 3*Y235 + 3*Y245 +
3*Y255 + 3*Y265 + 3*Y275 + 3*Y285 + 3*Y295 >= 3 ;

4*Y15 + 3*Y25 + 1*Y35 + 4*Y45 + 1*Y65 + 3*Y75 + 4*Y85 + 2*Y95 + 1*Y105 + 4*Y115 + 2*Y125 + 4*Y135 +
3*Y145 + 2*Y155 + 4*Y165 + 1*Y175 + 2*Y185 + 3*Y195 + 4*Y205 + 3*Y215 + 3*Y225 + 2*Y235 + 4*Y245 +
3*Y255 + 4*Y265 + 2*Y275 + 3*Y285 + 3*Y295 >= 3 ;

@Free(X5);
Y15 >=0; Y25 >=0; Y35 >=0; Y45 >=0; Y65 >=0; Y75 >=0; Y85 >=0; Y95 >=0; Y105 >=0; Y115 >=0; Y125 >=0;
Y135 >=0; Y145 >=0; Y155 >=0; Y165 >=0; Y175 >=0; Y185 >=0; Y195 >=0; Y205 >=0; Y215 >=0; Y225 >=0;
Y235 >=0; Y245 >=0; Y255 >=0; Y265 >=0; Y275 >=0; Y285 >=0; Y295 >=0;

```

Solution of AP Model

```

Global optimal solution found.
Objective value: 2.907708
Infeasibilities: 0.000000
Total solver iterations: 5

```

Hence, the super-efficiency score of warehouse 5 (Bhiwandi) is 2.907708 or 290.7708%.

## Warehouse 6 (Bhopal)

Anderson-Peterson LPP model formulation

```

!Dual Objective Function;

MIN = X6;

!Subject to;
13100*Y16 + 2000*Y26 + 550*Y36 + 9800*Y46 + 7500*Y56 + 4800*Y76 + 10250*Y86 + 2300*Y96 + 1000*Y106 +
20700*Y116 + 1200*Y126 + 11000*Y136 + 4100*Y146 + 2000*Y156 + 21000*Y166 + 500*Y176 + 2152*Y186 +
9700*Y196 + 15000*Y206 + 9000*Y216 + 4600*Y226 + 2000*Y236 + 37324*Y246 + 11000*Y256 + 10000*Y266 +
4000*Y276 + 5500*Y286 + 2000*Y296 - 550*X6 <=0;

7*Y16 + 2*Y26 + 2*Y36 + 14*Y46 + 4*Y56 + 3*Y76 + 5*Y86 + 2*Y96 + 1*Y106 + 21*Y116 + 6*Y126 + 13*Y136 +
2*Y146 + 2*Y156 + 5*Y166 + 2*Y176 + 4*Y186 + 5*Y196 + 15*Y206 + 6*Y216 + 5*Y226 + 2*Y236 + 48*Y246 +
9*Y256 + 4*Y266 + 2*Y276 + 2*Y286 + 8*Y296 - 2*X6 <=0;

320*Y16 + 7*Y26 + 2*Y36 + 10*Y46 + 7*Y56 + 7*Y76 + 20*Y86 + 7*Y96 + 30*Y106 + 200*Y116 + 7*Y126 +
200*Y136 + 7*Y146 + 2*Y156 + 338*Y166 + 2*Y176 + 48*Y186 + 7*Y196 + 200*Y206 + 7*Y216 + 7*Y226 + 7*Y236 +
550*Y246 + 200*Y256 + 7*Y266 + 2*Y276 + 50*Y286 + 2*Y296 - 2*X6 <= 0;

9*Y16 + 4*Y26 + 2*Y36 + 9*Y46 + 4*Y56 + 6*Y76 + 7*Y86 + 4*Y96 + 4*Y106 + 11*Y116 + 5*Y126 + 12*Y136 +
3*Y146 + 3*Y156 + 10*Y166 + 2*Y176 + 7*Y186 + 5*Y196 + 12*Y206 + 7*Y216 + 5*Y226 + 2*Y236 + 25*Y246 +
9*Y256 + 5*Y266 + 2*Y276 + 5*Y286 + 6*Y296 - 3*X6 <= 0;

820931*Y16 + 147596*Y26 + 86404*Y36 + 584300*Y46 + 238265*Y56 + 420908*Y76 + 239046*Y86 +
171183*Y96 + 86967*Y106 + 142521*Y116 + 1372680*Y126 + 119500*Y136 +
247573*Y146 + 93157*Y156 + 1994765*Y166 + 29538*Y176 + 226845*Y186 + 117310*Y196 + 955890*Y206 +
3333230*Y216 + 2349633*Y226 + 139434*Y236 + 2090879*Y246 + 755723*Y256 +
374615*Y266 + 224382*Y276 + 194903*Y286 + 173934*Y296 - 147473*X6 <= 0;

229*Y16 + 354*Y26 + 115*Y36 + 5827*Y46 + 4776*Y56 + 661*Y76 + 1019*Y86 + 278*Y96 + 60*Y106 + 2155*Y116 +
908*Y126 + 2593*Y136 + 272*Y146 + 64*Y156 + 1053*Y166 + 137*Y176 + 138*Y186 + 523*Y196 + 1222*Y206 +
1674*Y216 + 554*Y226 + 197*Y236 + 5794*Y246 + 1505*Y256 + 1347*Y266 + 310*Y276 + 259*Y286 + 277*Y296
>= 152;

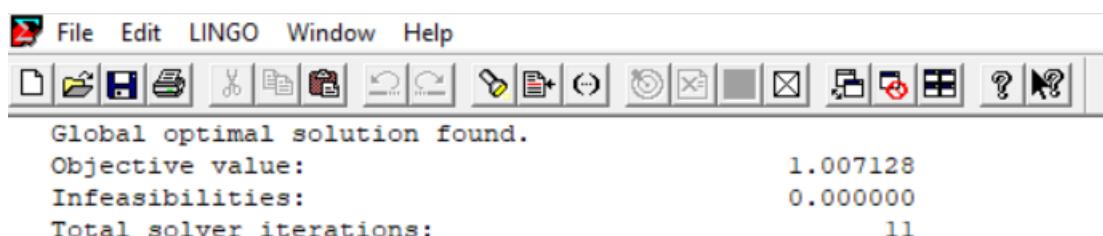
3*Y16 + 3*Y26 + 3*Y36 + 3*Y46 + 3*Y56 + 3*Y76 + 3*Y86 + 3*Y96 + 3*Y106 + 3*Y116 + 3*Y126 + 3*Y136 +
3*Y146 + 3*Y156 + 3*Y166 + 3*Y176 + 3*Y186 + 3*Y196 + 3*Y206 + 3*Y216 + 3*Y226 + 3*Y236 + 3*Y246 +
3*Y256 + 3*Y266 + 3*Y276 + 3*Y286 + 3*Y296 >= 3;

4*Y16 + 3*Y26 + 1*Y36 + 4*Y46 + 3*Y56 + 3*Y76 + 4*Y86 + 2*Y96 + 1*Y106 + 4*Y116 + 2*Y126 + 4*Y136 +
3*Y146 + 2*Y156 + 4*Y166 + 1*Y176 + 2*Y186 + 3*Y196 + 4*Y206 + 3*Y216 + 3*Y226 + 2*Y236 + 4*Y246 +
3*Y256 + 4*Y266 + 2*Y276 + 3*Y286 + 3*Y296 >= 1;

@Free(X6);
Y16 >=0; Y26 >=0; Y36 >=0; Y46 >=0; Y56 >=0; Y76 >=0; Y86 >=0; Y96 >=0; Y106 >=0; Y116 >=0; Y126 >=0;
Y136 >=0; Y146 >=0; Y156 >=0; Y166 >=0; Y176 >=0; Y186 >=0; Y196 >=0; Y206 >=0; Y216 >=0; Y226 >=0;
Y236 >=0; Y246 >=0; Y256 >=0; Y276 >=0; Y286 >=0; Y296 >=0;

```

Solution of AP model



Hence, the super-efficiency score of warehouse 6 (Bhopal) is 1.007128 or 100.7128%.

## Warehouse 10 (Gagret)

### Anderson-Peterson LPP Model Formulation

```

!Dual Objective Function;

MIN = X10;

!Subject to;
13100*Y110 + 2000*Y210 + 550*Y310 + 9800*Y410 + 7500*Y510 + 550*Y610 + 4800*Y710 + 10250*Y810 +
2300*Y910 + 20700*Y1110 + 1200*Y1210 + 11000*Y1310 + 4100*Y1410 + 2000*Y1510 + 21000*Y1610 + 500*Y1710 +
+ 2152*Y1810 + 9700*Y1910 + 15000*Y2010 + 9000*Y2110 + 4600*Y2210 + 2000*Y2310 + 37324*Y2410 +
11000*Y2510 + 10000*Y2610 + 4000*Y2710 + 5500*Y2810 + 2000*Y2910
- 1000*X10 <= 0;

7*Y110 + 2*Y210 + 2*Y310 + 14*Y410 + 4*Y510 + 2*Y610 + 3*Y710 + 5*Y810 + 2*Y910 + 21*Y1110 + 6*Y1210 +
13*Y1310 + 2*Y1410 + 2*Y1510 + 5*Y1610 + 2*Y1710 + 4*Y1810 + 5*Y1910 + 15*Y2010 + 6*Y2110 + 5*Y2210 +
2*Y2310 + 48*Y2410 + 9*Y2510 + 4*Y2610 + 2*Y2710 + 2*Y2810 + 8*Y2910 - 1*X10 <= 0;

320*Y110 + 7*Y210 + 2*Y310 + 10*Y410 + 7*Y510 + 2*Y610 + 7*Y710 + 20*Y810 + 7*Y910 + 200*Y1110 +
7*Y1210 + 200*Y1310 + 7*Y1410 + 2*Y1510 + 338*Y1610 + 2*Y1710 + 48*Y1810 + 7*Y1910 + 200*Y2010 +
7*Y2110 + 7*Y2210 + 7*Y2310 + 550*Y2410 + 200*Y2510 + 7*Y2610 + 2*Y2710 + 50*Y2810 + 2*Y2910 - 30*X10
<= 0;

9*Y110 + 4*Y210 + 2*Y310 + 9*Y410 + 4*Y510 + 3*Y610 + 6*Y710 + 7*Y810 + 4*Y910 + 11*Y1110 + 5*Y1210 +
12*Y1310 + 3*Y1410 + 3*Y1510 + 10*Y1610 + 2*Y1710 + 7*Y1810 + 5*Y1910 + 12*Y2010 + 7*Y2110 + 5*Y2210 +
2*Y2310 + 25*Y2410 + 9*Y2510 + 5*Y2610 + 2*Y2710 + 5*Y2810 + 6*Y2910 - 4*X10 <= 0;

820931*Y110 + 147596*Y210 + 86404*Y310 + 584300*Y410 + 238265*Y510 + 147473*Y610 + 420908*Y710 +
239046*Y810 + 171183*Y910 + 142521*Y1110 + 1372680*Y1210 + 119500*Y1310 + 247573*Y1410 +
93157*Y1510 + 1994765*Y1610 + 29538*Y1710 + 226845*Y1810 + 117310*Y1910 + 955890*Y2010 +
3333230*Y2110 + 2349633*Y2210 + 139434*Y2310 + 2090879*Y2410 + 755723*Y2510 + 374615*Y2610 +
224382*Y2710 + 194903*Y2810 + 173934*Y2910 - 86967*X10 <= 0;

229*Y110 + 354*Y210 + 115*Y310 + 5827*Y410 + 4776*Y510 + 152*Y610 + 661*Y710 + 1019*Y810 + 278*Y910+
2155*Y1110 + 908*Y1210 + 2593*Y1310 + 272*Y1410 + 64*Y1510 + 1053*Y1610 + 137*Y1710 + 138*Y1810 +
523*Y1910 + 1222*Y2010 + 1674*Y2110 + 554*Y2210 + 197*Y2310 + 5794*Y2410 + 1505*Y2510 + 1347*Y2610 +
310*Y2710 + 259*Y2810 + 277*Y2910 >= 60;

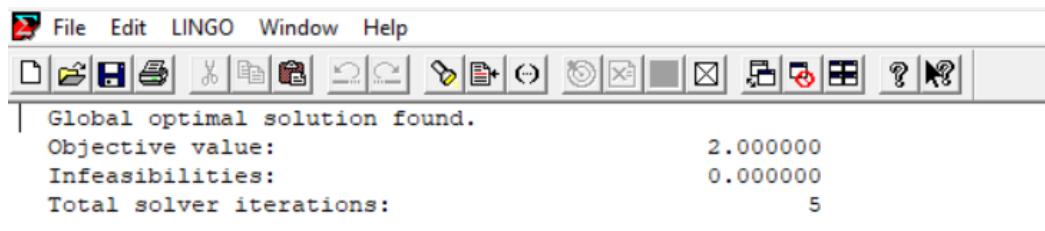
3*Y110 + 3*Y210 + 3*Y310 + 3*Y410 + 3*Y510 + 3*Y610 + 3*Y710 + 3*Y810 + 3*Y910 + 3*Y1110 + 3*Y1210 +
3*Y1310 + 3*Y1410 + 3*Y1510 + 3*Y1610 + 3*Y1710 + 3*Y1810 + 3*Y1910 + 3*Y2010 + 3*Y2110 + 3*Y2210 +
3*Y2310 + 3*Y2410 + 3*Y2510 + 3*Y2610 + 3*Y2710 + 3*Y2810 + 3*Y2910 >= 3;

4*Y110 + 3*Y210 + 1*Y310 + 4*Y410 + 3*Y510 + 1*Y610 + 3*Y710 + 4*Y810 + 2*Y910 + 4*Y1110 + 2*Y1210 +
4*Y1310 + 3*Y1410 + 2*Y1510 + 4*Y1610 + 1*Y1710 + 2*Y1810 + 3*Y1910 + 4*Y2010 + 3*Y2110 + 3*Y2210 +
2*Y2310 + 4*Y2410 + 3*Y2510 + 4*Y2610 + 2*Y2710 + 3*Y2810 + 3*Y2910 >= 1;

@Free(X10);
Y110 >=0; Y210 >=0; Y310 >=0; Y410 >=0; Y510 >=0; Y610 >=0; Y710 >=0; Y810 >=0; Y910 >=0; Y1110 >=0;
Y1210 >=0; Y1310 >=0; Y1410 >=0; Y1510 >=0; Y1610 >=0; Y1710 >=0; Y1810 >=0; Y1910 >=0; Y2010 >=0;
Y2110 >=0; Y2210 >=0; Y2310 >=0; Y2410 >=0; Y2510 >=0; Y2610 >=0; Y2710 >=0; Y2810 >=0; Y2910 >=0;

```

### Solution of AP Model



Hence, the super-efficiency score of Warehouse 10 (Gagret) is 2.000 or 200%

## Warehouse 12 (Gorakhpur)

### Anderson-Peterson LPP Model Formulation

```

!Dual Objective Function;

MIN = X12;

!Subject to;
13100*Y112 + 2000*Y212 + 550*Y312 + 9800*Y412 + 7500*Y512 + 550*Y612 + 4800*Y712 + 10250*Y812 +
2300*Y912 + 1000*Y1012 + 20700*Y1112 + 11000*Y1312 + 4100*Y1412 + 2000*Y1512 + 21000*Y1612 + 500*Y1712 +
2152*Y1812 + 9700*Y1912 + 15000*Y2012 + 9000*Y2112 + 4600*Y2212 + 2000*Y2312 + 37324*Y2412 +
11000*Y2512 + 10000*Y2612 + 4000*Y2712 + 5500*Y2812 + 2000*Y2912 - 1200*X12 <=0;

7*Y112 + 2*Y212 + 2*Y312 + 14*Y412 + 4*Y512 + 2*Y612 + 3*Y712 + 5*Y812 + 2*Y912 + 1*Y1012 + 21*Y1112 +
13*Y1312 + 2*Y1412 + 2*Y1512 + 5*Y1612 + 2*Y1712 + 4*Y1812 + 5*Y1912 + 15*Y2012 + 6*Y2112 + 5*Y2212 +
2*Y2312 + 48*Y2412 + 9*Y2512 + 4*Y2612 + 2*Y2712 + 2*Y2812 + 8*Y2912 - 6*X12 <=0;

320*Y112 + 7*Y212 + 2*Y312 + 10*Y412 + 7*Y512 + 2*Y612 + 7*Y712 + 20*Y812 + 7*Y912 + 30*Y1012 +
200*Y1112 + 200*Y1312 + 7*Y1412 + 2*Y1512 + 338*Y1612 + 2*Y1712 + 48*Y1812 + 7*Y1912 + 200*Y2012 +
7*Y2112 + 7*Y2212 + 7*Y2312 + 550*Y2412 + 200*Y2512 + 7*Y2612 + 2*Y2712 + 50*Y2812 + 2*Y2912 - 7*X12
<=0;

9*Y112 + 4*Y212 + 2*Y312 + 9*Y412 + 4*Y512 + 3*Y612 + 6*Y712 + 7*Y812 + 4*Y912 + 4*Y1012 + 11*Y1112 +
12*Y1312 + 3*Y1412 + 3*Y1512 + 10*Y1612 + 2*Y1712 + 7*Y1812 + 5*Y1912 + 12*Y2012 + 7*Y2112 + 5*Y2212 +
2*Y2312 + 25*Y2412 + 9*Y2512 + 5*Y2612 + 2*Y2712 + 5*Y2812 + 6*Y2912 - 5*X12 <= 0;

820931*Y112 + 147596*Y212 + 86404*Y312 + 584300*Y412 + 238265*Y512 + 147473*Y612 + 420908*Y712 +
239046*Y812 + 171183*Y912 + 86967*Y1012 + 142521*Y1112 + 119500*Y1312 + 247573*Y1412 +
93157*Y1512 + 1994765*Y1612 + 29538*Y1712 + 226845*Y1812 + 117310*Y1912 + 955890*Y2012 +
3333230*Y2112 + 2349633*Y2212 + 139434*Y2312 + 2090879*Y2412 + 755723*Y2512 + 374615*Y2612 +
224382*Y2712 + 194903*Y2812 + 173934*Y2912 - 1372680*X12 <=0;

229*Y112 + 354*Y212 + 115*Y312 + 5827*Y412 + 4776*Y512 + 152*Y612 + 661*Y712 + 1019*Y812 + 278*Y912 +
60*Y1012 + 2155*Y1112 + 2593*Y1312 + 272*Y1412 + 64*Y1512 + 1053*Y1612 + 137*Y1712 + 138*Y1812 +
523*Y1912 + 1222*Y2012 + 1674*Y2112 + 554*Y2212 + 197*Y2312 + 5794*Y2412 + 1505*Y2512 + 1347*Y2612 +
310*Y2712 + 259*Y2812 + 277*Y2912 >=908;

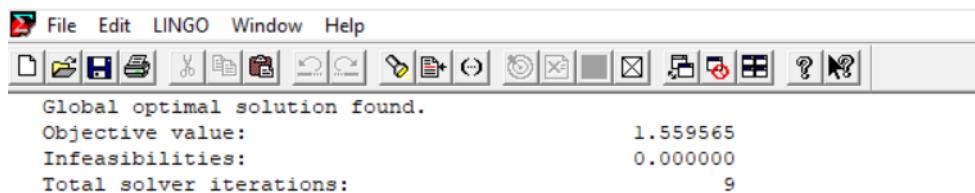
3*Y112 + 3*Y212 + 3*Y312 + 3*Y412 + 3*Y512 + 3*Y612 + 3*Y712 + 3*Y812 + 3*Y912 + 3*Y1012 + 3*Y1112 +
3*Y1312 + 3*Y1412 + 3*Y1512 + 3*Y1612 + 3*Y1712 + 3*Y1812 + 3*Y1912 + 3*Y2012 + 3*Y2112 + 3*Y2212 +
3*Y2312 + 3*Y2412 + 3*Y2512 + 3*Y2612 + 3*Y2712 + 3*Y2812 + 3*Y2912 >=3;

4*Y112 + 3*Y212 + 1*Y312 + 4*Y412 + 3*Y512 + 1*Y612 + 3*Y712 + 4*Y812 + 2*Y912 + 1*Y1012 + 4*Y1112 +
4*Y1312 + 3*Y1412 + 2*Y1512 + 4*Y1612 + 1*Y1712 + 2*Y1812 + 3*Y1912 + 4*Y2012 + 3*Y2112 + 3*Y2212 +
2*Y2312 + 4*Y2412 + 3*Y2512 + 4*Y2612 + 2*Y2712 + 3*Y2812 + 3*Y2912 >=2;

```

@Free(X12);  
Y112 >=0; Y212 >=0; Y312 >=0; Y412 >=0; Y512 >=0; Y612 >=0; Y712 >=0; Y812 >=0; Y912 >=0; Y1012 >=0;  
Y1112 >=0; Y1312 >=0; Y1412 >=0; Y1512 >=0; Y1612 >=0; Y1712 >=0; Y1812 >=0; Y1912 >=0; Y2012 >=0;  
Y2112 >=0; Y2212 >=0; Y2312 >=0; Y2412 >=0; Y2512 >=0; Y2612 >=0; Y2712 >=0; Y2812 >=0; Y2912 >=0;

### Solution of AP Model



The screenshot shows the LINGO software interface with the following output:

```

Global optimal solution found.
Objective value: 1.559565
Infeasibilities: 0.000000
Total solver iterations: 9

```

Hence, the super-efficiency score of Warehouse 12 (Gorakhpur) is 1.559565 or 155.9565%.

## Warehouse 13 (Hyderabad)

### Anderson-Peterson LPP Model Formulation

```

!Dual Objective Function;

MIN = X13;

!Subject to;
13100*Y113 + 2000*Y213 + 550*Y313 + 9800*Y413 + 7500*Y513 + 550*Y613 + 4800*Y713 + 10250*Y813 +
2300*Y913 + 1000*Y1013 + 20700*Y1113 + 1200*Y1213 + 4100*Y1413 + 2000*Y1513 + 21000*Y1613 + 500*Y1713 +
2152*Y1813 + 9700*Y1913 + 15000*Y2013 + 9000*Y2113 + 4600*Y2213 + 2000*Y2313 + 37324*Y2413 +
11000*Y2513 + 10000*Y2613 + 4000*Y2713 + 5500*Y2813 + 2000*Y2913 - 11000*X13 <=0;

7*Y113 + 2*Y213 + 2*Y313 + 14*Y413 + 4*Y513 + 2*Y613 + 3*Y713 + 5*Y813 + 2*Y913 + 1*Y1013 + 21*Y1113 +
6*Y1213 + 2*Y1413 + 2*Y1513 + 5*Y1613 + 2*Y1713 + 4*Y1813 + 5*Y1913 + 15*Y2013 + 6*Y2113 + 5*Y2213 +
2*Y2313 + 48*Y2413 + 9*Y2513 + 4*Y2613 + 2*Y2713 + 2*Y2813 + 8*Y2913 - 13*X13 <=0;

320*Y113 + 7*Y213 + 2*Y313 + 10*Y413 + 7*Y513 + 2*Y613 + 7*Y713 + 20*Y813 + 7*Y913 + 30*Y1013 +
200*Y1113 + 7*Y1213 + 7*Y1413 + 2*Y1513 + 338*Y1613 + 2*Y1713 + 48*Y1813 + 7*Y1913 + 200*Y2013 +
7*Y2113 + 7*Y2213 + 7*Y2313 + 550*Y2413 + 200*Y2513 + 7*Y2613 + 2*Y2713 + 50*Y2813 + 2*Y2913 - 200*X13
<=0;

9*Y113 + 4*Y213 + 2*Y313 + 9*Y413 + 4*Y513 + 3*Y613 + 6*Y713 + 7*Y813 + 4*Y913 + 4*Y1013 + 11*Y1113 +
5*Y1213 + 3*Y1413 + 3*Y1513 + 10*Y1613 + 2*Y1713 + 7*Y1813 + 5*Y1913 + 12*Y2013 + 7*Y2113 + 5*Y2213 +
2*Y2313 + 25*Y2413 + 9*Y2513 + 5*Y2613 + 2*Y2713 + 5*Y2813 + 6*Y2913 - 12*X13 <=0;

820931*Y113 + 147596*Y213 + 86404*Y313 + 584300*Y413 + 238265*Y513 + 147473*Y613 + 420908*Y713 +
239046*Y813 + 171183*Y913 + 86967*Y1013 + 142521*Y1113 + 1372680*Y1213 + 247573*Y1413 +
93157*Y1513 + 1994765*Y1613 + 29538*Y1713 + 226845*Y1813 + 117310*Y1913 + 955890*Y2013 +
3333230*Y2113 + 2349633*Y2213 + 139434*Y2313 + 2090879*Y2413 + 755723*Y2513 + 374615*Y2613 +
224382*Y2713 + 194903*Y2813 + 173934*Y2913 - 119500*X13 <=0;

229*Y113 + 354*Y213 + 115*Y313 + 5827*Y413 + 4776*Y513 + 152*Y613 + 661*Y713 + 1019*Y813 + 278*Y913 +
60*Y1013 + 2155*Y1113 + 908*Y1213 + 272*Y1413 + 64*Y1513 + 1053*Y1613 + 137*Y1713 + 138*Y1813 +
523*Y1913 + 1222*Y2013 + 1674*Y2113 + 554*Y2213 + 197*Y2313 + 5794*Y2413 + 1505*Y2513 + 1347*Y2613 +
310*Y2713 + 259*Y2813 + 277*Y2913 >=2593;

3*Y113 + 3*Y213 + 3*Y313 + 3*Y413 + 3*Y513 + 3*Y613 + 3*Y713 + 3*Y813 + 3*Y913 + 3*Y1013 + 3*Y1113 +
3*Y1213 + 3*Y1413 + 3*Y1513 + 3*Y1613 + 3*Y1713 + 3*Y1813 + 3*Y1913 + 3*Y2013 + 3*Y2113 + 3*Y2213 +
3*Y2313 + 3*Y2413 + 3*Y2513 + 3*Y2613 + 3*Y2713 + 3*Y2813 + 3*Y2913 >=3;

4*Y113 + 3*Y213 + 1*Y313 + 4*Y413 + 3*Y513 + 1*Y613 + 3*Y713 + 4*Y813 + 2*Y913 + 1*Y1013 + 4*Y1113 +
2*Y1213 + 3*Y1413 + 2*Y1513 + 4*Y1613 + 1*Y1713 + 2*Y1813 +
+ 3*Y1913 + 4*Y2013 + 3*Y2113 + 3*Y2213 + 2*Y2313 + 4*Y2413 + 3*Y2513 + 4*Y2613 + 2*Y2713 + 3*Y2813 +
3*Y2913 >=4;

@Free(X13);
Y113 >=0; Y213 >=0; Y313 >=0; Y413 >=0; Y513 >=0; Y613 >=0; Y713 >=0; Y813 >=0; Y913 >=0; Y1013 >=0;
Y1113 >=0; Y1213 >=0; Y1413 >=0; Y1513 >=0; Y1613 >=0; Y1713 >=0; Y1813 >=0; Y1913 >=0; Y2013 >=0;
Y2113 >=0; Y2213 >=0; Y2313 >=0; Y2413 >=0; Y2513 >=0; Y2613 >=0; Y2713 >=0; Y2813 >=0; Y2913 >=0;

```

### Solution of AP Model



Global optimal solution found.  
 Objective value: 1.408816  
 Infeasibilities: 0.000000  
 Total solver iterations: 3

Hence, the super-efficiency score of Warehouse 13 (Hyderabad) is 1.408816 or 140.8816%.

## Warehouse 14 (Indore)

### Anderson-Peterson LPP Model Formulation

```

!Dual Objective Function;

MIN = X14;

!Subject to;
13100*Y114 + 2000*Y214 + 550*Y314 + 9800*Y414 + 7500*Y514 + 550*Y614 + 4800*Y714 + 10250*Y814 +
2300*Y914 + 1000*Y1014 + 20700*Y1114 + 1200*Y1214 + 11000*Y1314 + 2000*Y1514 + 21000*Y1614 + 500*Y1714 +
2152*Y1814 + 9700*Y1914 + 15000*Y2014 + 9000*Y2114 + 4600*Y2214 + 2000*Y2314 + 37324*Y2414 +
11000*Y2514 + 10000*Y2614 + 4000*Y2714 + 5500*Y2814 + 2000*Y2914 - 4100*X14 <=0;

7*Y114 + 2*Y214 + 2*Y314 + 14*Y414 + 4*Y514 + 2*Y614 + 3*Y714 + 5*Y814 + 2*Y914 + 1*Y1014 + 21*Y1114 +
6*Y1214 + 13*Y1314 + 2*Y1514 + 5*Y1614 + 2*Y1714 + 4*Y1814 + 5*Y1914 + 15*Y2014 + 6*Y2114 + 5*Y2214 +
2*Y2314 + 48*Y2414 + 9*Y2514 + 4*Y2614 + 2*Y2714 + 2*Y2814 + 8*Y2914 - 2*X14 <=0;

320*Y114 + 7*Y214 + 2*Y314 + 10*Y414 + 7*Y514 + 2*Y614 + 7*Y714 + 20*Y814 + 7*Y914 + 30*Y1014 +
200*Y1114 + 7*Y1214 + 200*Y1314 + 2*Y1514 + 338*Y1614 + 2*Y1714 + 48*Y1814 + 7*Y1914 + 200*Y2014 +
7*Y2114 + 7*Y2214 + 7*Y2314 + 550*Y2414 + 200*Y2514 + 7*Y2614 + 2*Y2714 + 50*Y2814 + 2*Y2914 - 7*X14 <=0;

9*Y114 + 4*Y214 + 2*Y314 + 9*Y414 + 4*Y514 + 3*Y614 + 6*Y714 + 7*Y814 + 4*Y914 + 4*Y1014 + 11*Y1114 +
5*Y1214 + 12*Y1314 + 3*Y1514 + 10*Y1614 + 2*Y1714 + 7*Y1814 + 5*Y1914 + 12*Y2014 + 7*Y2114 + 5*Y2214 +
2*Y2314 + 25*Y2414 + 9*Y2514 + 5*Y2614 + 2*Y2714 + 5*Y2814 + 6*Y2914 - 3*X14 <=0;

820931*Y114 + 147596*Y214 + 86404*Y314 + 584300*Y414 + 238265*Y514 + 147473*Y614 + 420908*Y714 +
239046*Y814 + 171183*Y914 + 86967*Y1014 + 142521*Y1114 + 1372680*Y1214 + 119500*Y1314 +
93157*Y1514 + 1994765*Y1614 + 29538*Y1714 + 226845*Y1814 + 117310*Y1914 + 955890*Y2014 +
3333230*Y2114 + 2349633*Y2214 + 139434*Y2314 + 2090879*Y2414 + 755723*Y2514 + 374615*Y2614 +
224382*Y2714 + 194903*Y2814 + 173934*Y2914 - 247573*X14 <=0;

229*Y114 + 354*Y214 + 115*Y314 + 5827*Y414 + 4776*Y514 + 152*Y614 + 661*Y714 + 1019*Y814 + 278*Y914 +
60*Y1014 + 2155*Y1114 + 908*Y1214 + 2593*Y1314 + 64*Y1514 + 1053*Y1614 + 137*Y1714 + 138*Y1814 +
523*Y1914 + 1222*Y2014 + 1674*Y2114 + 554*Y2214 + 197*Y2314 + 5794*Y2414 + 1505*Y2514 + 1347*Y2614 +
310*Y2714 + 259*Y2814 + 277*Y2914 >=272;

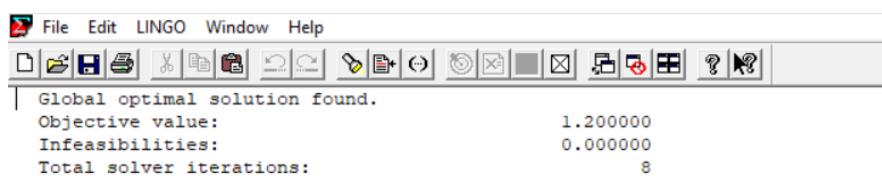
3*Y114 + 3*Y214 + 3*Y314 + 3*Y414 + 3*Y514 + 3*Y614 + 3*Y714 + 3*Y814 + 3*Y914 + 3*Y1014 + 3*Y1114 +
3*Y1214 + 3*Y1314 + 3*Y1514 + 3*Y1614 + 3*Y1714 + 3*Y1814 + 3*Y1914 + 3*Y2014 + 3*Y2114 + 3*Y2214 +
3*Y2314 + 3*Y2414 + 3*Y2514 + 3*Y2614 + 3*Y2714 + 3*Y2814 + 3*Y2914 >=3;

4*Y114 + 3*Y214 + 1*Y314 + 4*Y414 + 3*Y514 + 1*Y614 + 3*Y714 + 4*Y814 + 2*Y914 + 1*Y1014 + 4*Y1114 +
2*Y1214 + 4*Y1314 + 2*Y1514 + 4*Y1614 + 1*Y1714 + 2*Y1814 + 3*Y1914 + 4*Y2014 + 3*Y2114 + 3*Y2214 +
2*Y2314 + 4*Y2414 + 3*Y2514 + 4*Y2614 + 2*Y2714 + 3*Y2814 + 3*Y2914 >=3;

@Free(X14);
Y114 >=0; Y214 >=0; Y314 >=0; Y414 >=0; Y514 >=0; Y614 >=0; Y714 >=0; Y814 >=0; Y914 >=0; Y1014 >=0;
Y1114 >=0; Y1214 >=0; Y1314 >=0; Y1514 >=0; Y1614 >=0; Y1714 >=0; Y1814 >=0; Y1914 >=0; Y2014 >=0;
Y2114 >=0; Y2214 >=0; Y2314 >=0; Y2414 >=0; Y2514 >=0; Y2614 >=0; Y2714 >=0; Y2814 >=0; Y2914 >=0;

```

### Solution of AP Model



Hence, the super-efficiency score of Warehouse 14 (Indore) is 1.2 or 120%.

## Warehouse 15 (Jabalpur)

### Anderson-Peterson LPP Model Formulation

```

!Dual Objective Function;

MIN = X15;

!Subject to;
13100*Y115 + 2000*Y215 + 550*Y315 + 9800*Y415 + 7500*Y515 + 550*Y615 + 4800*Y715 + 10250*Y815 +
2300*Y915 + 1000*Y1015 + 20700*Y1115 + 1200*Y1215 + 11000*Y1315 + 4100*Y1415 + 21000*Y1615 + 500*Y1715 +
2152*Y1815 + 9700*Y1915 + 15000*Y2015 + 9000*Y2115 + 4600*Y2215 + 2000*Y2315 + 37324*Y2415 +
11000*Y2515 + 10000*Y2615 + 4000*Y2715 + 5500*Y2815 + 2000*Y2915 - 2000*X15 <=0;

7*Y115 + 2*Y215 + 2*Y315 + 14*Y415 + 4*Y515 + 2*Y615 + 3*Y715 + 5*Y815 + 2*Y915 + 1*Y1015 + 21*Y1115 +
6*Y1215 + 13*Y1315 + 2*Y1415 + 5*Y1615 + 2*Y1715 + 4*Y1815 + 5*Y1915 + 15*Y2015 + 6*Y2115 + 5*Y2215 +
2*Y2315 + 48*Y2415 + 9*Y2515 + 4*Y2615 + 2*Y2715 + 2*Y2815 + 8*Y2915 - 2*X15 <=0;

320*Y115 + 7*Y215 + 2*Y315 + 10*Y415 + 7*Y515 + 2*Y615 + 7*Y715 + 20*Y815 + 7*Y915 + 30*Y1015 +
200*Y1115 + 7*Y1215 + 200*Y1315 + 7*Y1415 + 338*Y1615 + 2*Y1715 + 48*Y1815 + 7*Y1915 + 200*Y2015 +
7*Y2115 + 7*Y2215 + 7*Y2315 + 550*Y2415 + 200*Y2515 + 7*Y2615 + 2*Y2715 + 50*Y2815 + 2*Y2915 - 2*X15
<=0;

9*Y115 + 4*Y215 + 2*Y315 + 9*Y415 + 4*Y515 + 3*Y615 + 6*Y715 + 7*Y815 + 4*Y915 + 4*Y1015 + 11*Y1115 +
5*Y1215 + 12*Y1315 + 3*Y1415 + 10*Y1615 + 2*Y1715 + 7*Y1815 + 5*Y1915 + 12*Y2015 + 7*Y2115 + 5*Y2215 +
2*Y2315 + 25*Y2415 + 9*Y2515 + 5*Y2615 + 2*Y2715 + 5*Y2815 + 6*Y2915 - 3*X15 <=0;

820931*Y115 + 147596*Y215 + 86404*Y315 + 584300*Y415 + 238265*Y515 + 147473*Y615 + 420908*Y715 +
239046*Y815 + 171183*Y915 + 86967*Y1015 + 142521*Y1115 + 1372680*Y1215 + 119500*Y1315 +
247573*Y1415 + 1994765*Y1615 + 29538*Y1715 + 226845*Y1815 + 117310*Y1915 + 955890*Y2015 +
3333230*Y2115 + 2349633*Y2215 + 139434*Y2315 + 2090879*Y2415 + 755723*Y2515 + 374615*Y2615 +
224382*Y2715 + 194903*Y2815 + 173934*Y2915 - 93157*X15 <=0;

229*Y115 + 354*Y215 + 115*Y315 + 5827*Y415 + 4776*Y515 + 152*Y615 + 661*Y715 + 1019*Y815 + 278*Y915 +
60*Y1015 + 2155*Y1115 + 908*Y1215 + 2593*Y1315 + 272*Y1415 + 1053*Y1615 + 137*Y1715 + 138*Y1815 +
523*Y1915 + 1222*Y2015 + 1674*Y2115 + 554*Y2215 + 197*Y2315 + 5794*Y2415 + 1505*Y2515 + 1347*Y2615 +
310*Y2715 + 259*Y2815 + 277*Y2915 >= 64;

3*Y115 + 3*Y215 + 3*Y315 + 3*Y415 + 3*Y515 + 3*Y615 + 3*Y715 + 3*Y815 + 3*Y915 + 3*Y1015 + 3*Y1115 +
3*Y1215 + 3*Y1315 + 3*Y1415 + 3*Y1615 + 3*Y1715 + 3*Y1815 + 3*Y1915 + 3*Y2015 + 3*Y2115 + 3*Y2215 +
3*Y2315 + 3*Y2415 + 3*Y2515 + 3*Y2615 + 3*Y2715 + 3*Y2815 + 3*Y2915 >=3;

4*Y115 + 3*Y215 + 1*Y315 + 4*Y415 + 3*Y515 + 1*Y615 + 3*Y715 + 4*Y815 + 2*Y915 + 1*Y1015 + 4*Y1115 +
2*Y1215 + 4*Y1315 + 3*Y1415 + 4*Y1615 + 1*Y1715 + 2*Y1815 + 3*Y1915 + 4*Y2015 + 3*Y2115 + 3*Y2215 +
2*Y2315 + 4*Y2415 + 3*Y2515 + 4*Y2615 + 2*Y2715 + 3*Y2815 + 3*Y2915 >=2;

@Free(X15);
Y115 >=0; Y215 >=0; Y315 >=0; Y415 >=0; Y515 >=0; Y615 >=0; Y715 >=0; Y815 >=0; Y915 >=0; Y1015 >=0;
Y1115 >=0; Y1215 >=0; Y1315 >=0; Y1415 >=0; Y1615 >=0; Y1715 >=0; Y1815 >=0; Y1915 >=0; Y2015 >=0;
Y2115 >=0; Y2215 >=0; Y2315 >=0; Y2415 >=0; Y2515 >=0; Y2615 >=0; Y2715 >=0; Y2815 >=0; Y2915 >=0;

```

### Solution of AP Model



```

Global optimal solution found.
Objective value: 1.462756
Infeasibilities: 0.000000
Total solver iterations: 4

```

Hence, the super-efficiency score of Warehouse 15 (Jabalpur) is 1.462756 or 146.2756%.

## Warehouse 17 (Jammu)

### Ander-Peterson Model Formulation

```

!Dual Objective Function;
MIN = X17;

!Subject to;
13100*Y117 + 2000*Y217 + 550*Y317 + 9800*Y417 + 7500*Y517 + 550*Y617 + 4800*Y717 + 10250*Y817 +
2300*Y917 + 1000*Y1017 + 20700*Y1117 + 1200*Y1217 + 11000*Y1317 + 4100*Y1417 + 2000*Y1517 +
21000*Y1617 + 2152*Y1817 + 9700*Y1917 + 15000*Y2017 + 9000*Y2117 + 4600*Y2217 + 2000*Y2317 +
37324*Y2417 + 11000*Y2517 + 10000*Y2617 + 4000*Y2717 + 5500*Y2817 + 2000*Y2917-500*X17 <=0;

7*Y117 + 2*Y217 + 2*Y317 + 14*Y417 + 4*Y517 + 2*Y617 + 3*Y717 + 5*Y817 + 2*Y917 + 1*Y1017 + 21*Y1117 +
6*Y1217 + 13*Y1317 + 2*Y1417 + 2*Y1517 + 5*Y1617 + 4*Y1817 + 5*Y1917 + 15*Y2017 + 6*Y2117 + 5*Y2217 +
2*Y2317 + 48*Y2417 + 9*Y2517 + 4*Y2617 + 2*Y2717 + 2*Y2817 + 8*Y2917 -2*X17 <=0;

320*Y117 + 7*Y217 + 2*Y317 + 10*Y417 + 7*Y517 + 2*Y617 + 7*Y717 + 20*Y817 + 7*Y917 + 30*Y1017 +
200*Y1117 + 7*Y1217 + 200*Y1317 + 7*Y1417 + 2*Y1517 + 338*Y1617 + 48*Y1817 + 7*Y1917 + 200*Y2017 +
7*Y2117 + 7*Y2217 + 7*Y2317 + 550*Y2417 + 200*Y2517 + 7*Y2617 + 2*Y2717 + 50*Y2817 + 2*Y2917 -2*X17
<=0;

9*Y117 + 4*Y217 + 2*Y317 + 9*Y417 + 4*Y517 + 3*Y617 + 6*Y717 + 7*Y817 + 4*Y917 + 4*Y1017 + 11*Y1117 +
5*Y1217 + 12*Y1317 + 3*Y1417 + 3*Y1517 + 10*Y1617 + 7*Y1817 + 5*Y1917 + 12*Y2017 + 7*Y2117 + 5*Y2217 +
2*Y2317 + 25*Y2417 + 9*Y2517 + 5*Y2617 + 2*Y2717 + 5*Y2817 + 6*Y2917 -2*X17 <=0;

820931*Y117 + 147596*Y217 + 86404*Y317 + 584300*Y417 + 238265*Y517 + 147473*Y617 + 420908*Y717 +
239046*Y817 + 171183*Y917 + 86967*Y1017 + 142521*Y1117 + 1372680*Y1217 + 119500*Y1317 +
247573*Y1417 + 93157*Y1517 + 1994765*Y1617 + 226845*Y1817 + 117310*Y1917 + 955890*Y2017 +
3333230*Y2117 + 2349633*Y2217 + 139434*Y2317 + 2090879*Y2417 + 755723*Y2517 + 374615*Y2617 +
224382*Y2717 + 194903*Y2817 + 173934*Y2917 -29538*X17 <=0;

229*Y117 + 354*Y217 + 115*Y317 + 5827*Y417 + 4776*Y517 + 152*Y617 + 661*Y717 + 1019*Y817 + 278*Y917 +
60*Y1017 + 2155*Y1117 + 908*Y1217 + 2593*Y1317 + 272*Y1417 + 64*Y1517 + 1053*Y1617 + 138*Y1817 +
523*Y1917 + 1222*Y2017 + 1674*Y2117 + 554*Y2217 + 197*Y2317 + 5794*Y2417 + 1505*Y2517 + 1347*Y2617 +
310*Y2717 + 259*Y2817 + 277*Y2917 >=137;

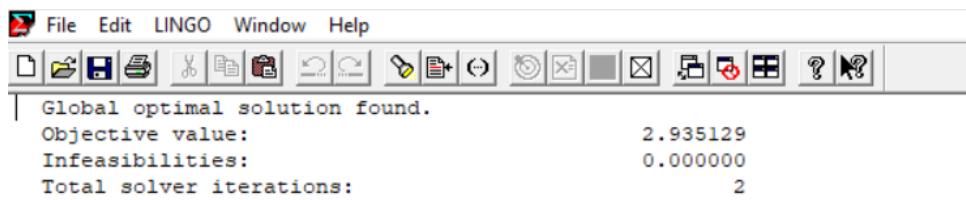
3*Y117 + 3*Y217 + 3*Y317 + 3*Y417 + 3*Y517 + 3*Y617 + 3*Y717 + 3*Y817 + 3*Y917 + 3*Y1017 + 3*Y1117 +
3*Y1217 + 3*Y1317 + 3*Y1417 + 3*Y1517 + 3*Y1617 + 3*Y1817+ 3*Y1917 + 3*Y2017 + 3*Y2117 + 3*Y2217 +
3*Y2317 + 3*Y2417 + 3*Y2517 + 3*Y2617 + 3*Y2717 + 3*Y2817 + 3*Y2917 >=3;

4*Y117 + 3*Y217 + 1*Y317 + 4*Y417 + 3*Y517 + 1*Y617 + 3*Y717 + 4*Y817 + 2*Y917 + 1*Y1017 + 4*Y1117 +
2*Y1217 + 4*Y1317 + 3*Y1417 + 2*Y1517 + 4*Y1617 + 2*Y1817 + 3*Y1917 + 4*Y2017 + 3*Y2117 + 3*Y2217 +
2*Y2317 + 4*Y2417 + 3*Y2517 + 4*Y2617 + 2*Y2717 + 3*Y2817 + 3*Y2917 >=1;

@Free(X17);
Y117 >=0; Y217 >=0; Y317 >=0; Y417 >=0; Y517 >=0; Y617 >=0; Y717 >=0; Y817 >=0; Y917 >=0; Y1017 >=0;
Y1117 >=0; Y1217 >=0; Y1317 >=0; Y1417 >=0; Y1517 >=0; Y1617 >=0; Y1817 >=0; Y1917 >=0; Y2017 >=0;
Y2117 >=0; Y2217 >=0; Y2317 >=0; Y2417 >=0; Y2517 >=0; Y2617 >=0; Y2717 >=0; Y2817 >=0; Y2917 >=0;

```

### Solution of AP Model



Hence, the super-efficiency score of warehouse 17 (Jammu) is 2.935129 or 293.5129%.

## Warehouse 19 (Karnal)

### Anderson-Peterson LPP Model Formulation

```

!Dual Objective Function;
MIN = X19;

!Subject to;
13100*Y119 + 2000*Y219 + 550*Y319 + 9800*Y419 + 7500*Y519 + 550*Y619 + 4800*Y719 + 10250*Y819 +
2300*Y919 + 1000*Y1019 + 20700*Y1119 + 1200*Y1219 + 11000*Y1319 + 4100*Y1419 + 2000*Y1519 +
21000*Y1619 + 500*Y1719 + 2152*Y1819 + 15000*Y2019 + 9000*Y2119 + 4600*Y2219 + 2000*Y2319 +
37324*Y2419 + 11000*Y2519 + 10000*Y2619 + 4000*Y2719 + 5500*Y2819 + 2000*Y2919 - 9700*X19 <=0;

7*Y119 + 2*Y219 + 2*Y319 + 14*Y419 + 4*Y519 + 2*Y619 + 3*Y719 + 5*Y819 + 2*Y919 + 1*Y1019 + 21*Y1119 +
6*Y1219 + 13*Y1319 + 2*Y1419 + 2*Y1519 + 5*Y1619 + 2*Y1719 + 4*Y1819 + 15*Y2019 + 6*Y2119 + 5*Y2219 +
2*Y2319 + 48*Y2419 + 9*Y2519 + 4*Y2619 + 2*Y2719 + 2*Y2819 + 8*Y2919 - 5*X19 <= 0;

320*Y119 + 7*Y219 + 2*Y319 + 10*Y419 + 7*Y519 + 2*Y619 + 7*Y719 + 20*Y819 + 7*Y919 + 30*Y1019 +
200*Y1119 + 7*Y1219 + 200*Y1319 + 7*Y1419 + 2*Y1519 + 338*Y1619 + 2*Y1719 + 48*Y1819 +
200*Y2019 + 7*Y2119 + 7*Y2219 + 7*Y2319 + 550*Y2419 + 200*Y2519 + 7*Y2619 + 2*Y2719 + 50*Y2819 +
2*Y2919 - 7*X19 <=0;

9*Y119 + 4*Y219 + 2*Y319 + 9*Y419 + 4*Y519 + 3*Y619 + 6*Y719 + 7*Y819 + 4*Y919 + 4*Y1019 + 11*Y1119 +
5*Y1219 + 12*Y1319 + 3*Y1419 + 3*Y1519 + 10*Y1619 + 2*Y1719 + 7*Y1819 + 12*Y2019 + 7*Y2119 + 5*Y2219 +
2*Y2319 + 25*Y2419 + 9*Y2519 + 5*Y2619 + 2*Y2719 + 5*Y2819 + 6*Y2919 - 5*X19 <=0;

820931*Y119 + 147596*Y219 + 86404*Y319 + 584300*Y419 + 238265*Y519 + 147473*Y619 + 420908*Y719 +
239046*Y819 + 171183*Y919 + 86967*Y1019 + 142521*Y1119 + 1372680*Y1219 + 119500*Y1319 +
247573*Y1419 + 93157*Y1519 + 1994765*Y1619 + 29538*Y1719 + 226845*Y1819 + 955890*Y2019 +
3333230*Y2119 + 2349633*Y2219 + 139434*Y2319 + 2090879*Y2419 + 755723*Y2519 + 374615*Y2619 +
224382*Y2719 + 194903*Y2819 + 173934*Y2919 - 117310*X19 <=0;

229*Y119 + 354*Y219 + 115*Y319 + 5827*Y419 + 4776*Y519 + 152*Y619 + 661*Y719 + 1019*Y819 + 278*Y919 +
60*Y1019 + 2155*Y1119 + 908*Y1219 + 2593*Y1319 + 272*Y1419 + 64*Y1519 + 1053*Y1619 + 137*Y1719 +
138*Y1819 + 1222*Y2019 + 1674*Y2119 + 554*Y2219 + 197*Y2319 + 5794*Y2419 + 1505*Y2519 + 1347*Y2619 +
310*Y2719 + 259*Y2819 + 277*Y2919 >=523;

3*Y119 + 3*Y219 + 3*Y319 + 3*Y419 + 3*Y519 + 3*Y619 + 3*Y719 + 3*Y819 + 3*Y919 + 3*Y1019 + 3*Y1119 +
3*Y1219 + 3*Y1319 + 3*Y1419 + 3*Y1519 + 3*Y1619 + 3*Y1719 + 3*Y1819 + 3*Y2019 + 3*Y2119 + 3*Y2219 +
3*Y2319 + 3*Y2419 + 3*Y2519 + 3*Y2619 + 3*Y2719 + 3*Y2819 + 3*Y2919 >= 3;

4*Y119 + 3*Y219 + 1*Y319 + 4*Y419 + 3*Y519 + 1*Y619 + 3*Y719 + 4*Y819 + 2*Y919 + 1*Y1019 + 4*Y1119 +
2*Y1219 + 4*Y1319 + 3*Y1419 + 2*Y1519 + 4*Y1619 + 1*Y1719 + 2*Y1819 + 4*Y2019 + 3*Y2119 + 3*Y2219 +
2*Y2319 + 4*Y2419 + 3*Y2519 + 4*Y2619 + 2*Y2719 + 3*Y2819 + 3*Y2919 >= 3;

@Free(X19);
Y119 >=0; Y219 >=0; Y319 >=0; Y419 >=0; Y519 >=0; Y619 >=0; Y719 >=0; Y819 >=0; Y919 >=0; Y1019 >=0;
Y1119 >=0; Y1219 >=0; Y1319 >=0; Y1419 >=0; Y1519 >=0; Y1619 >=0; Y1719 >=0; Y1819 >=0; Y2019 >=0;
Y2119 >=0; Y2219 >=0; Y2319 >=0; Y2419 >=0; Y2519 >=0; Y2619 >=0; Y2719 >=0; Y2819 >=0; Y2919 >=0;

```

### Solution of AP Model

Global optimal solution found.  
 Objective value: 1.013732  
 Infeasibilities: 0.000000  
 Total solver iterations: 4

Hence, the super-efficiency of Warehouse 19 (Karnal) is 1.013732 or 101.3732%.

## Warehouse 23 (Nagpur)

### Anderson-Peterson LPP Model Formulation

```

!Dual Objective Function;

MIN = X23;

!Subject to;
13100*Y123 + 2000*Y223 + 550*Y323 + 9800*Y423 + 7500*Y523 + 550*Y623 + 4800*Y723 + 10250*Y823 +
2300*Y923 + 1000*Y1023 + 20700*Y1123 + 1200*Y1223 + 11000*Y1323 + 4100*Y1423 + 2000*Y1523 +
21000*Y1623 + 500*Y1723 + 2152*Y1823 + 9700*Y1923 + 15000*Y2023 + 9000*Y2123 + 4600*Y2223 +
37324*Y2423 + 11000*Y2523 + 10000*Y2623 + 4000*Y2723 + 5500*Y2823 + 2000*Y2923
-2000*X23 <= 0;

7*Y123 + 2*Y223 + 2*Y323 + 14*Y423 + 4*Y523 + 2*Y623 + 3*Y723 + 5*Y823 + 2*Y923 + 1*Y1023 + 21*Y1123 +
6*Y1223 + 13*Y1323 + 2*Y1423 + 2*Y1523 + 5*Y1623 + 2*Y1723 + 4*Y1823 + 5*Y1923 + 15*Y2023 + 6*Y2123 +
5*Y2223 + 48*Y2423 + 9*Y2523 + 4*Y2623 + 2*Y2723 + 2*Y2823 + 8*Y2923 -2*X23 <=0;

320*Y123 + 7*Y223 + 2*Y323 + 10*Y423 + 7*Y523 + 2*Y623 + 7*Y723 + 20*Y823 + 7*Y923 + 30*Y1023 +
200*Y1123 + 7*Y1223 + 200*Y1323 + 7*Y1423 + 2*Y1523 + 338*Y1623 + 2*Y1723 + 48*Y1823 +
7*Y1923 + 200*Y2023 + 7*Y2123 + 7*Y2223 + 550*Y2423 + 200*Y2523 + 7*Y2623 + 2*Y2723 + 50*Y2823 +
2*Y2923 - 7*X23 <=0;

9*Y123 + 4*Y223 + 2*Y323 + 9*Y423 + 4*Y523 + 3*Y623 + 6*Y723 + 7*Y823 + 4*Y923 + 4*Y1023 + 11*Y1123 +
5*Y1223 + 12*Y1323 + 3*Y1423 + 3*Y1523 + 10*Y1623 + 2*Y1723 + 7*Y1823 + 5*Y1923 + 12*Y2023 + 7*Y2123 +
5*Y2223 + 25*Y2423 + 9*Y2523 + 5*Y2623 + 2*Y2723 + 5*Y2823 + 6*Y2923 - 2*X23 <=0;

820931*Y123 + 147596*Y223 + 86404*Y323 + 584300*Y423 + 238265*Y523 + 147473*Y623 + 420908*Y723 +
239046*Y823 + 171183*Y923 + 86967*Y1023 + 142521*Y1123 + 1372680*Y1223 + 119500*Y1323 +
247573*Y1423 + 93157*Y1523 + 1994765*Y1623 + 29538*Y1723 + 226845*Y1823 + 117310*Y1923 +
955890*Y2023 + 3333230*Y2123 + 2349633*Y2223 + 2090879*Y2423 + 755723*Y2523 + 374615*Y2623 +
224382*Y2723 + 194903*Y2823 + 173934*Y2923 - 139434*X23 <=0;

229*Y123 + 354*Y223 + 115*Y323 + 5827*Y423 + 4776*Y523 + 152*Y623 + 661*Y723 + 1019*Y823 + 278*Y923 +
60*Y1023 + 2155*Y1123 + 908*Y1223 + 2593*Y1323 + 272*Y1423 + 64*Y1523 + 1053*Y1623 + 137*Y1723 +
138*Y1823 + 523*Y1923 + 1222*Y2023 + 1674*Y2123 + 554*Y2223 + 5794*Y2423 + 1505*Y2523 + 1347*Y2623 +
310*Y2723 + 259*Y2823 + 277*Y2923 >= 197;

3*Y123 + 3*Y223 + 3*Y323 + 3*Y423 + 3*Y523 + 3*Y623 + 3*Y723 + 3*Y823 + 3*Y923 + 3*Y1023 + 3*Y1123 +
3*Y1223 + 3*Y1323 + 3*Y1423 + 3*Y1523 + 3*Y1623 + 3*Y1723 + 3*Y1823 + 3*Y1923 + 3*Y2023 + 3*Y2123 +
3*Y2223 + 3*Y2423 + 3*Y2523 + 3*Y2623 + 3*Y2723 + 3*Y2823 + 3*Y2923 >= 3;

4*Y123 + 3*Y223 + 1*Y323 + 4*Y423 + 3*Y523 + 1*Y623 + 3*Y723 + 4*Y823 + 2*Y923 + 1*Y1023 + 4*Y1123 +
2*Y1223 + 4*Y1323 + 3*Y1423 + 2*Y1523 + 4*Y1623 + 1*Y1723 + 2*Y1823 + 3*Y1923 + 4*Y2023 + 3*Y2123 +
3*Y2223 + 4*Y2423 + 3*Y2523 + 4*Y2623 + 2*Y2723 + 3*Y2823 + 3*Y2923 >= 2;

@Free(X23);
Y123 >=0; Y223 >=0; Y323 >=0; Y423 >=0; Y523 >=0; Y623 >=0; Y723 >=0; Y823 >=0; Y923 >=0; Y1023 >=0;
Y1123 >=0; Y1223 >=0; Y1323 >=0; Y1423 >=0; Y1523 >=0; Y1623 >=0; Y1723 >=0; Y1823 >=0; Y1923 >=0;
Y2023 >=0; Y2123 >=0; Y2223 >=0; Y2423 >=0; Y2523 >=0; Y2623 >=0; Y2723 >=0; Y2823 >=0; Y2923 >=0;

```

### Solution of AP Model



```

Global optimal solution found.
Objective value: 1.227273
Infeasibilities: 0.000000
Total solver iterations: 7

```

Hence, the super-efficiency score of Warehouse 23 (Nagpur) is 1.227273 or 122.7273%.

## Warehouse 27 (Raipur)

### Anderson-Peterson LPP Model Formulation

```

!Dual Objective Function;
MIN = X27;

!Subject to;
13100*Y127 + 2000*Y227 + 550*Y327 + 9800*Y427 + 7500*Y527 + 550*Y627 + 4800*Y727 + 10250*Y827 +
2300*Y927 + 1000*Y1027 + 20700*Y1127 + 1200*Y1227 + 11000*Y1327 + 4100*Y1427 + 2000*Y1527 +
21000*Y1627 + 500*Y1727 + 2152*Y1827 + 9700*Y1927 + 15000*Y2027 + 9000*Y2127 + 4600*Y2227 +
2000*Y2327 + 37324*Y2427 + 11000*Y2527 + 10000*Y2627 + 5500*Y2827 + 2000*Y2927-4000*X27 <=0;

7*Y127 + 2*Y227 + 2*Y327 + 14*Y427 + 4*Y527 + 2*Y627 + 3*Y727 + 5*Y827 + 2*Y927 + 1*Y1027 + 21*Y1127 +
6*Y1227 + 13*Y1327 + 2*Y1427 + 2*Y1527 + 5*Y1627 + 2*Y1727 + 4*Y1827 + 5*Y1927 + 15*Y2027 + 6*Y2127 +
5*Y2227 + 2*Y2327 + 48*Y2427 + 9*Y2527 + 4*Y2627 + 2*Y2827 + 8*Y2927 -2*X27 <=0;

320*Y127 + 7*Y227 + 2*Y327 + 10*Y427 + 7*Y527 + 2*Y627 + 7*Y727 + 20*Y827 + 7*Y927 + 30*Y1027 +
200*Y1127 + 7*Y1227 + 200*Y1327 + 7*Y1427 + 2*Y1527 + 338*Y1627 + 2*Y1727 + 48*Y1827 + 7*Y1927 +
200*Y2027 + 7*Y2127 + 7*Y2227 + 7*Y2327 + 550*Y2427 + 200*Y2527 + 7*Y2627 + 50*Y2827 + 2*Y2927 - 2*X27
<=0;

9*Y127 + 4*Y227 + 2*Y327 + 9*Y427 + 4*Y527 + 3*Y627 + 6*Y727 + 7*Y827 + 4*Y927 + 4*Y1027 + 11*Y1127 +
5*Y1227 + 12*Y1327 + 3*Y1427 + 3*Y1527 + 10*Y1627 + 2*Y1727 + 7*Y1827 + 5*Y1927 + 12*Y2027 + 7*Y2127 +
5*Y2227 + 2*Y2327 + 25*Y2427 + 9*Y2527 + 5*Y2627 + 5*Y2827 + 6*Y2927 - 2*X27 <=0;

820931*Y127 + 147596*Y227 + 86404*Y327 + 584300*Y427 + 238265*Y527 + 147473*Y627 + 420908*Y727 +
239046*Y827 + 171183*Y927 + 86967*Y1027 + 142521*Y1127 + 1372680*Y1227 + 119500*Y1327 +
247573*Y1427 + 93157*Y1527 + 1994765*Y1627 + 29538*Y1727 + 226845*Y1827 + 117310*Y1927 +
+955890*Y2027 + 3333230*Y2127 + 2349633*Y2227 + 139434*Y2327 + 2090879*Y2427 + 755723*Y2527 +
374615*Y2627 + 194903*Y2827 + 173934*Y2927 - 224382*X27 <=0;

229*Y127 + 354*Y227 + 115*Y327 + 5827*Y427 + 4776*Y527 + 152*Y627 + 661*Y727 + 1019*Y827 + 278*Y927 +
60*Y1027 + 2155*Y1127 + 908*Y1227 + 2593*Y1327 + 272*Y1427 + 64*Y1527 +
1053*Y1627 + 137*Y1727 + 138*Y1827 + 523*Y1927 + 1222*Y2027 + 1674*Y2127 + 554*Y2227 + 197*Y2327 +
5794*Y2427 + 1505*Y2527 + 1347*Y2627 + 259*Y2827 + 277*Y2927 >= 310;

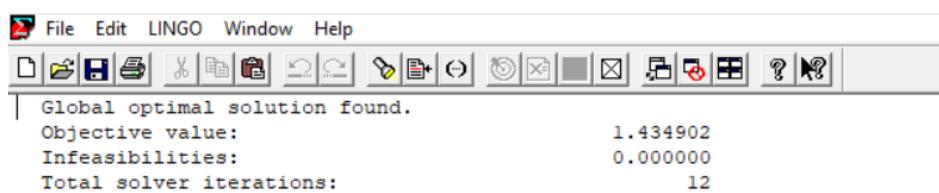
3*Y127 + 3*Y227 + 3*Y327 + 3*Y427 + 3*Y527 + 3*Y627 + 3*Y727 + 3*Y827 + 3*Y927 + 3*Y1027 + 3*Y1127 +
3*Y1227 + 3*Y1327 + 3*Y1427 + 3*Y1527 + 3*Y1627 + 3*Y1727 + 3*Y1827 + 3*Y1927 + 3*Y2027 + 3*Y2127 +
3*Y2227 + 3*Y2327 + 3*Y2427 + 3*Y2527 + 3*Y2627 + 3*Y2827 + 3*Y2927 >= 3;

4*Y127 + 3*Y227 + 1*Y327 + 4*Y427 + 3*Y527 + 1*Y627 + 3*Y727 + 4*Y827 + 2*Y927 + 1*Y1027 + 4*Y1127 +
2*Y1227 + 4*Y1327 + 3*Y1427 + 2*Y1527 + 4*Y1627 + 1*Y1727 + 2*Y1827 + 3*Y1927 + 4*Y2027 + 3*Y2127 +
3*Y2227 + 2*Y2327 + 4*Y2427 + 3*Y2527 + 4*Y2627 + 3*Y2827 + 3*Y2927 >= 2;

@Free(X27);
Y127 >=0; Y227 >=0; Y327 >=0; Y427 >=0; Y527 >=0; Y627 >=0; Y727 >=0; Y827 >=0; Y927 >=0; Y1027 >=0;
Y1127 >=0; Y1227 >=0; Y1327 >=0; Y1427 >=0; Y1527 >=0; Y1627 >=0; Y1727 >=0; Y1827 >=0; Y1927 >=0;
Y2027 >=0; Y2127 >=0; Y2227 >=0; Y2327 >=0; Y2427 >=0; Y2527 >=0; Y2627 >=0; Y2827 >=0; Y2927 >=0;

```

### Solution of AP Model



The screenshot shows the LINGO software interface with the following details:

- Global optimal solution found.**
- Objective value:** 1.434902
- Infeasibilities:** 0.000000
- Total solver iterations:** 12

Hence, the super-efficiency score of Warehouse 27 (Raipur) is 1.434902 or 143.4902%.

## Warehouse 28 (Ranchi)

### Anderson-Peterson LPP Model Formulation

```

!Dual Objective Function;
MIN = X28;

!Subject to;
13100*Y128 + 2000*Y228 + 550*Y328 + 9800*Y428 + 7500*Y528 + 550*Y628 + 4800*Y728 + 10250*Y828 +
2300*Y928 + 1000*Y1028 + 20700*Y1128 + 1200*Y1228 + 11000*Y1328 + 4100*Y1428 + 2000*Y1528 +
21000*Y1628 + 500*Y1728 + 2152*Y1828 + 9700*Y1928 + 15000*Y2028 + 9000*Y2128 + 4600*Y2228 +
2000*Y2328 + 37324*Y2428 + 11000*Y2528 + 10000*Y2628 + 4000*Y2728 + 2000*Y2928 - 5500*X28 <=0;

7*Y128 + 2*Y228 + 2*Y328 + 14*Y428 + 4*Y528 + 2*Y628 + 3*Y728 + 5*Y828 + 2*Y928 + 1*Y1028 + 21*Y1128 +
6*Y1228 + 13*Y1328 + 2*Y1428 + 2*Y1528 + 5*Y1628 + 2*Y1728 + 4*Y1828 + 5*Y1928 + 15*Y2028 + 6*Y2128 +
5*Y2228 + 2*Y2328 + 48*Y2428 + 9*Y2528 + 4*Y2628 + 2*Y2728 + 8*Y2928 - 2*X28 <=0;

320*Y128 + 7*Y228 + 2*Y328 + 10*Y428 + 7*Y528 + 2*Y628 + 7*Y728 + 20*Y828 + 7*Y928 + 30*Y1028 +
200*Y1128 + 7*Y1228 + 200*Y1328 + 7*Y1428 + 2*Y1528 + 338*Y1628 + 2*Y1728 + 48*Y1828 + 7*Y1928 +
200*Y2028 + 7*Y2128 + 7*Y2228 + 7*Y2328 + 550*Y2428 + 200*Y2528 + 7*Y2628 + 2*Y2728 + 2*Y2928 - 50*X28
<=0;

9*Y128 + 4*Y228 + 2*Y328 + 9*Y428 + 4*Y528 + 3*Y628 + 6*Y728 + 7*Y828 + 4*Y928 + 4*Y1028 + 11*Y1128 +
5*Y1228 + 12*Y1328 + 3*Y1428 + 3*Y1528 + 10*Y1628 + 2*Y1728 + 7*Y1828 + 5*Y1928 + 12*Y2028 + 7*Y2128 +
5*Y2228 + 2*Y2328 + 25*Y2428 + 9*Y2528 + 5*Y2628 + 2*Y2728 + 6*Y2928 - 5*X28 <=0;

820931*Y128 + 147596*Y228 + 86404*Y328 + 584300*Y428 + 238265*Y528 + 147473*Y628 + 420908*Y728 +
239046*Y828 + 171183*Y928 + 86967*Y1028 + 142521*Y1128 + 1372680*Y1228 + 119500*Y1328 +
247573*Y1428 + 93157*Y1528 + 1994765*Y1628 + 29538*Y1728 + 226845*Y1828 + 117310*Y1928 +
955890*Y2028 + 3333230*Y2128 + 2349633*Y2228 + 139434*Y2328 + 2090879*Y2428 + 755723*Y2528 +
374615*Y2628 + 224382*Y2728 + 173934*Y2928 - 194903*X28 <=0;

229*Y128 + 354*Y228 + 115*Y328 + 5827*Y428 + 4776*Y528 + 152*Y628 + 661*Y728 + 1019*Y828 + 278*Y928 +
60*Y1028 + 2155*Y1128 + 908*Y1228 + 2593*Y1328 + 272*Y1428 + 64*Y1528 + 1053*Y1628 + 137*Y1728 +
138*Y1828 + 523*Y1928 + 1222*Y2028 + 1674*Y2128 + 554*Y2228 + 197*Y2328 + 5794*Y2428 + 1505*Y2528 +
1347*Y2628 + 310*Y2728 + 277*Y2928 >= 259;

3*Y128 + 3*Y228 + 3*Y328 + 3*Y428 + 3*Y528 + 3*Y628 + 3*Y728 + 3*Y828 + 3*Y928 + 3*Y1028 + 3*Y1128 +
3*Y1228 + 3*Y1328 + 3*Y1428 + 3*Y1528 + 3*Y1628 + 3*Y1728 + 3*Y1828 + 3*Y1928 + 3*Y2028 + 3*Y2128 +
3*Y2228 + 3*Y2328 + 3*Y2428 + 3*Y2528 + 3*Y2628 + 3*Y2728 + 3*Y2928 >= 3;

4*Y128 + 3*Y228 + 1*Y328 + 4*Y428 + 3*Y528 + 1*Y628 + 3*Y728 + 4*Y828 + 2*Y928 + 1*Y1028 + 4*Y1128 +
2*Y1228 + 4*Y1328 + 3*Y1428 + 2*Y1528 + 4*Y1628 + 1*Y1728 + 2*Y1828 + 3*Y1928 + 4*Y2028 + 3*Y2128 +
3*Y2228 + 2*Y2328 + 4*Y2428 + 3*Y2528 + 4*Y2628 + 2*Y2728 + 3*Y2928 >= 3;

@Free(X28);
Y128 >=0; Y228 >=0; Y328 >=0; Y428 >=0; Y528 >=0; Y628 >=0; Y728 >=0; Y828 >=0; Y928 >=0; Y1028 >=0;
Y1128 >=0; Y1228 >=0; Y1328 >=0; Y1428 >=0; Y1528 >=0; Y1628 >=0; Y1728 >=0; Y1828 >=0; Y1928 >=0;
Y2028 >=0; Y2128 >=0; Y2228 >=0; Y2328 >=0; Y2428 >=0; Y2528 >=0; Y2628 >=0; Y2728 >=0; Y2928 >=0;

```

### Solution of AP Model



```

File Edit LINGO Window Help
[Icons for file operations]
Global optimal solution found.
Objective value: 1.000000
Infeasibilities: 0.000000
Total solver iterations: 3

```

Hence, the super-efficiency score of Warehouse 28 (Ranchi) is 1.00 or 100%.

## Warehouse 27 (Varanasi)

### Anderson-Peterson LPP Model Formulation

```

!Dual Objective Function;
MIN = X29;

!Subject to;
13100*Y129 + 2000*Y229 + 550*Y329 + 9800*Y429 + 7500*Y529 + 550*Y629 + 4800*Y729 + 10250*Y829 +
2300*Y929 + 1000*Y1029 + 20700*Y1129 + 1200*Y1229 + 11000*Y1329 + 4100*Y1429 + 2000*Y1529 +
21000*Y1629 + 500*Y1729 + 2152*Y1829 + 9700*Y1929 + 15000*Y2029 + 9000*Y2129 + 4600*Y2229 +
2000*Y2329 + 37324*Y2429 + 11000*Y2529 + 10000*Y2629 + 4000*Y2729 + 5500*Y2829 -2000*X29 <= 0;

7*Y129 + 2*Y229 + 2*Y329 + 14*Y429 + 4*Y529 + 2*Y629 + 3*Y729 + 5*Y829 + 2*Y929 + 1*Y1029 + 21*Y1129 +
6*Y1229 + 13*Y1329 + 2*Y1429 + 2*Y1529 + 5*Y1629 + 2*Y1729 + 4*Y1829 + 5*Y1929 + 15*Y2029 + 6*Y2129 +
5*Y2229 + 2*Y2329 + 48*Y2429 + 9*Y2529 + 4*Y2629 + 2*Y2729 + 2*Y2829 - 8*X29 <= 0;

320*Y129 + 7*Y229 + 2*Y329 + 10*Y429 + 7*Y529 + 2*Y629 + 7*Y729 + 20*Y829 + 7*Y929 + 30*Y1029 +
200*Y1129 + 7*Y1229 + 200*Y1329 + 7*Y1429 + 2*Y1529 + 338*Y1629 + 2*Y1729 + 48*Y1829 + 7*Y1929 +
200*Y2029 + 7*Y2129 + 7*Y2229 + 7*Y2329 + 550*Y2429 + 200*Y2529 + 7*Y2629 + 2*Y2729 + 50*Y2829 - 2*X29
<=0;

9*Y129 + 4*Y229 + 2*Y329 + 9*Y429 + 4*Y529 + 3*Y629 + 6*Y729 + 7*Y829 + 4*Y929 + 4*Y1029 + 11*Y1129 +
5*Y1229 + 12*Y1329 + 3*Y1429 + 3*Y1529 + 10*Y1629 + 2*Y1729 + 7*Y1829 + 5*Y1929 +
12*Y2029 + 7*Y2129 + 5*Y2229 + 2*Y2329 + 25*Y2429 + 9*Y2529 + 5*Y2629 + 2*Y2729 + 5*Y2829 - 6*X29 <=0;

820931*Y129 + 147596*Y229 + 86404*Y329 + 584300*Y429 + 238265*Y529 + 147473*Y629 + 420908*Y729 +
239046*Y829 + 171183*Y929 + 86967*Y1029 + 142521*Y1129 + 1372680*Y1229 + 119500*Y1329 +
247573*Y1429 + 93157*Y1529 + 1994765*Y1629 + 29538*Y1729 + 226845*Y1829 + 117310*Y1929 +
955890*Y2029 + 3333230*Y2129 + 2349633*Y2229 + 139434*Y2329 + 2090879*Y2429 + 755723*Y2529 +
374615*Y2629 + 224382*Y2729 + 194903*Y2829 - 173934*X29 <=0;

229*Y129 + 354*Y229 + 115*Y329 + 5827*Y429 + 4776*Y529 + 152*Y629 + 661*Y729 + 1019*Y829 + 278*Y929 +
60*Y1029 + 2155*Y1129 + 908*Y1229 + 2593*Y1329 + 272*Y1429 + 64*Y1529 + 1053*Y1629 + 137*Y1729 +
138*Y1829 + 523*Y1929 + 1222*Y2029 + 1674*Y2129 + 554*Y2229 + 197*Y2329 + 5794*Y2429 + 1505*Y2529 +
1347*Y2629 + 310*Y2729 + 259*Y2829 >= 277;

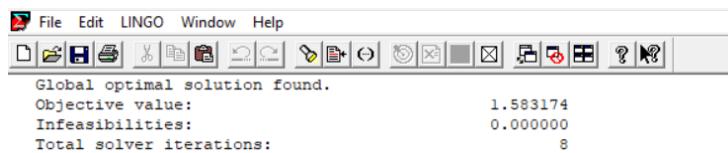
3*Y129 + 3*Y229 + 3*Y329 + 3*Y429 + 3*Y529 + 3*Y629 + 3*Y729 + 3*Y829 + 3*Y929 + 3*Y1029 + 3*Y1129 +
3*Y1229 + 3*Y1329 + 3*Y1429 + 3*Y1529 + 3*Y1629 + 3*Y1729 + 3*Y1829 + 3*Y1929 + 3*Y2029 + 3*Y2129 +
3*Y2229 + 3*Y2329 + 3*Y2429 + 3*Y2529 + 3*Y2629 + 3*Y2729 + 3*Y2829 >= 3;

4*Y129 + 3*Y229 + 1*Y329 + 4*Y429 + 3*Y529 + 1*Y629 + 3*Y729 + 4*Y829 + 2*Y929 + 1*Y1029 + 4*Y1129 +
2*Y1229 + 4*Y1329 + 3*Y1429 + 2*Y1529 + 4*Y1629 + 1*Y1729 + 2*Y1829 + 3*Y1929 + 4*Y2029 + 3*Y2129 +
3*Y2229 + 2*Y2329 + 4*Y2429 + 3*Y2529 + 4*Y2629 + 2*Y2729 + 3*Y2829 >= 3;

@Free(X29);
Y129 >=0; Y229 >=0; Y329 >=0; Y429 >=0; Y529 >=0; Y629 >=0; Y729 >=0; Y829 >=0 Y929 >=0; Y1029 >=0;
Y1129 >=0; Y1229 >=0; Y1329 >=0; Y1429 >=0; Y1529 >=0; Y1629 >=0; Y1729 >=0; Y1829 >=0; Y1929 >=0;
Y2029 >=0; Y2129 >=0; Y2229 >=0; Y2329 >=0; Y2429 >=0; Y2529 >=0; Y2629 >=0; Y2729 >=0; Y2829 >=0;

```

### Solution of AP Model



Hence, the super-efficiency of warehouse 29 (Varanasi) is 1.583174 or 158.3174%.

## SUMMARY

After applying Anderson-Peterson Model, following is the list of super-efficient score of all the efficient warehouse.

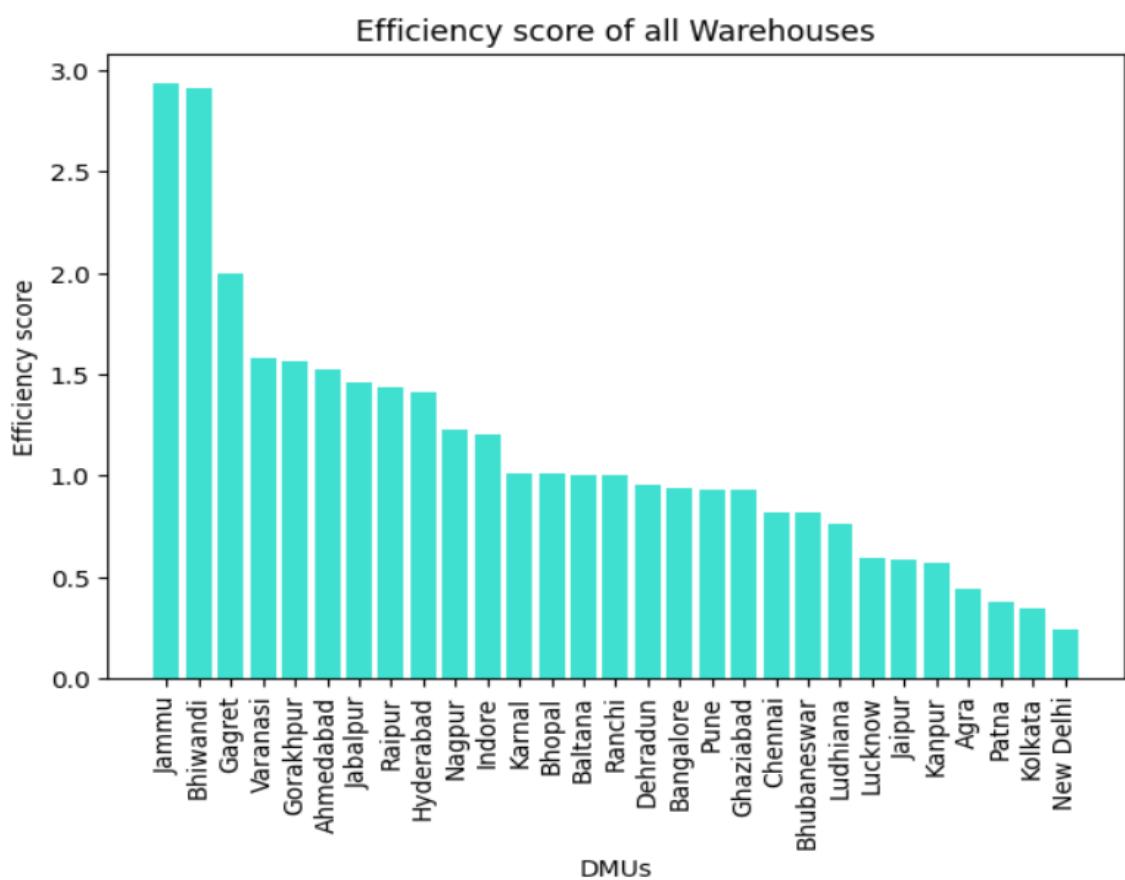
DMU	Super-efficiency Score
Ahmedabad	1.521333
Baltana	1
Bhiwandi	2.907708
Bhopal	1.007128
Gagret	2
Gorakhpur	1.559565
Hyderabad	1.408816
Indore	1.2
Jabalpur	1.462756
Jammu	2.935129
Karnal	1.013732
Nagpur	1.227273
Raipur	1.434902
Ranchi	1
Varanasi	1.583174



So, the final rank of all the warehouses is:

DMU	Efficiency Score	Rank
Warehouse 17 (Jammu)	2.935129	1
Warehouse 5 (Bhiwandi)	2.907708	2
Warehouse 10 (Gagret)	2	3
Warehouse 29 (Varanasi)	1.583174	4
Warehouse 12 (Gorakhpur)	1.559565	5
Warehouse 2 (Ahmedabad)	1.521333	6

Warehouse 15 (Jabalpur)	1.462756	7
Warehouse 27 (Raipur)	1.434902	8
Warehouse 13 (Hyderabad)	1.408816	9
Warehouse 23 (Nagpur)	1.227273	10
Warehouse 14 (Indore)	1.2	11
Warehouse 19 (Karnal)	1.013732	12
Warehouse 6 (Bhopal)	1.007128	13
Warehouse 3 (Baltana)	1	14
Warehouse 28 (Ranchi)	1	14
Warehouse 9 (Dehradun)	0.9515	16
Warehouse 4 (Bangalore)	0.9389	17
Warehouse 26 (Pune)	0.9323	18
Warehouse 11 (Ghaziabad)	0.9279	19
Warehouse 8 (Chennai)	0.8164	20
Warehouse 7 (Bhubaneswar)	0.8153	21
Warehouse 22 (Ludhiana)	0.7601	22
Warehouse 21 (Lucknow)	0.5967	23
Warehouse 16 (Jaipur)	0.5859	24
Warehouse 18 (Kanpur)	0.5656	25
Warehouse 1 (Agra)	0.4444	26
Warehouse 25 (Patna)	0.3739	27
Warehouse 20 (Kolkata)	0.3483	28
Warehouse 24 (New Delhi)	0.2438	29



## CONCLUSION

The DEA approach may be said to be one of the most often utilised to determine the effectiveness of Decision-Making Units (DMUs). The 29 DMUs in this study were evaluated for effectiveness using DEA methodologies.

Additionally, it can be said that the CCR model revealed that 15 warehouses, or more than half of them, were efficient, while just 14 of them were inefficient. And in the BCC model, when there are 19 efficient warehouses and 10 inefficient, the number of efficient warehouses rises. The inefficient warehouses in both models run within a range that calls for substantial adjustments to increase efficiency.

The input variables have to be adjusted in order to get the desired results. All of the DMUs will function effectively once the input variables have been fixed as illustrated above. Let's have a look at DMU 1 in the CCR model. At first glance, it is clear that there has to be a 3.111 and an 8.7778 reduction in the number of full-time employees and pallets, respectively. As can be seen, there are 3.111 full-time employees and 8.7778 pallets respectively. Pallets and staff cannot both be 0.111 and 0.8778 in reality. In such a circumstance, it is advised to hire contract employees who will uphold and meet the output parameters in order to temporarily address the problem..

Last but not least, using the notion of super-efficiency, the warehouse in Jammu was placed best while the warehouse in New Delhi was ranked last.

## REFERENCES

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- Ballesteros, E., & Romero, C. (1998). Multiple criteria decision making and its application to economic problems. New York: Springer.
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