OPTIMIZATION OF PACKING COMBINATION FOR PRODUCTION OF SILICONE EMULSION

CASE STUDY FOR A COMPANY

Ukwatte Liyanage Pushpakumara
(178135V)

Degree of Master of Science

Department of Mathematics

University of Moratuwa

Sri Lanka

May 2023

OPTIMIZATION OF PACKING COMBINATION FOR PRODUCTION OF SILICONE EMULSION

CASE STUDY FOR A COMPANY

Ukwatte Liyanage Pushpakumara
(178135V)

Thesis/Dissertation submitted in partial fulfilment of requirements for the degree of Master of Science in Operation of Research

Department of Mathematics

University of Moratuwa

Sri Lanka

May 2023

DECLARATION

I hereby declare that the research work submitted, entitled Optimization of Packing Combination for Production of Silicon Emulsion Case Study for Company is a record of an original work done by me under the supervision of Dr. Pasan Manuranga Edirisinghe, senior lecturer of the department of mathematics at the university of Moratuwa. This research work is submitted for the fulfillment of the requirements of the Master Degree in Operation Research.
The results documented in this report have not been submitted by anybody to any other university or institute for the award of any degree or diploma.

Name of Student: U.L Pushpakumara (178135V)

Signature:

Date: 3rd August 2023

“I assure that out of the best of my knowledge, the information given above is true and correct”

Name of supervisor: Dr. Pasan Manuranga Edirisinghe (PhD in Mathematics)

Signature:

Date:

ACKNOWLEDGEMENT

The success of this research depends largely on the encouragement and guidelines of many others apart from me. I take this opportunity to express my wholehearted gratitude to the people who have been involved in giving information and thoughts to complete this research successfully.

My greatest appreciation goes to Dr. Pasan Manuranga Edirisinghe, senior lecture of the Department of Mathematics, University of Moratuwa, for providing guidance and support. Without his encouragement and guidance this research would be a nightmare. I wish to express my sincere thanks to Mr. Gamini Gunasekera Managing director of Union Chemicals Lanka PLC, for providing the opportunity to obtain real world information to work on this project and the guidance extended. I cannot forget Mr. T. M. J. A. Cooray, former course coordinate for Masters of Operation Research, the help and guidance extended to me. I express my sincere thanks to him.

The silicone emulsion operation team lead by Mr. Nihal Jayaweera who provided information and their inputs to make this project a success, should also be appreciated without a doubt. The silicone emulsion marketing team lead by Mr. Amith Weerakkody's contribution should also be appreciated, I thank the finance operations team lead by Ms. Purnima Rajini for providing financial information and analysis to make this project a success. I am grateful for their support and help.

I thank my parents always for giving me the wisdom, knowledge, guidance, assurance and blessings whenever I needed it beyond any doubt. I express my special thanks to my wife Ms. Andrea Anne Fay Adams for encouraging me to do this research project. Without her blessings I would not be able to complete this research project successfully. I thank last, but not least Mr. Hasitha Premasiri who was with me like a brother, and the long-lasting friendship I found at the university.

DEDICATION

I whole heartedly dedicate this thesis to my beloved parents, late Mr. U. L Tuder and late Ms. D. G. D. Gimara Yapa, who have been my source of inspiration.

Last but not least I am dedicating this to my teacher Mr. Mal Wijarthna who coached me to climb the ladder of education in the right direction.

ABSTRACT

Company strategy is patented by the efficient use of resources at every production stage. The analysis and efficient utilization of resources are made sustainable by effective management decisions making techniques employed by the Company. A quantitative decision-making tool called linear programming can be used to the optimize problems of product combination. Chemical manufacturing firms are especially concern about silicone base profit mainly depends on the proper allocation and usage of available, material, and production time.

With limited resources such as capital, production capacity and sales demand, production planning can be challenged in terms of determining which product to manufacture in each month of the financial period. The production planner needs to offer a minimum number of appropriate products by examining the product demand sequences and the purchased order received of every customer in each month. The proposed problem formulated for an optimization with conditional constraints based on integer linear programming establishes an approach for efficient product planning.

The research out come advising process assisted by this optimization allows production planning to engage in an appropriate procurement requirement in every month. In this paper, optimum product combination determined by the mathematical model is validate considering the increase in profitability, and the justification of revision of packing size from customer point of view. The study also considers the revenue retention plan of the company by forecasting sales in scientifically in bootstrapping and simulation techniques.

Finally, the model considers 64 combinations of productions mix in each month. Model quantitatively demonstrate that the optimum product combination can achieved in spite of several resource constraints.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

Autocorrelation function (ACF)
Central Bank of Srilanka (CBSL)
Confidance Interval (CI)
Coronavirus Disease (COVID)
Critical Path Method (CPM)
Document Against Acceptance (DA)
Documents Against Payment (DP)
Euro (EUR)
Federal Express (Fedex)
Government of Sri Lanka (GOSL)
Graphical User Interface (GUI)
Integer linear programming (ILP)
International Standard of Operation (ISO)
Key Performance Indicators (KPI)
Letter of Credit (LC)
Linear Programming (LP)
Management Information System (MIS)
Material Requirement Planning (MRP)
Material Safety Data Sheets (MSDS)
Metric Tonnes (Mt.)
Mixed Integer Linear Programming (MILP)
Miocro Meter ($\mu\, m$)
Non Preforming Assets (NPA)
Pay as You Earn" (PAYE)
Partial Autocorrelation Function (PACF)
Potential of Hydrogen (pH)
Program Rvaluation and Review Technique (PERT)
Qubic Meter (m^3)
Research and Development (R&D)
Simulation and Modelling (SM)
Stocks Keeping Units (SKU)
The Sri Lankan Rupees (Rs.)
United Sate of America (USA)
Unites State of Dollar (USD)

Value Added Tax (VAT)
Standard Deviation (DS)