# Some Studies in Lot Sizing for Material Requirements Planning Systems

by

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1986

IN MEMORY OF

MY BELOVED COUSIN BROTHER

**MANNAVA PUSHPA RAJA NAIDU**

# CERTIFICATE

The thesis entitled **Some Studies in Lot Sizing for Material Requirements planning Systems** being submitted by Mr. M. Munirathnam Naidu to the Indian Institute of Technology, Delhi, for the award of the Degree of Doctor of Philosophy, is a record of bona fide research work carried out by him. He has worked under my guidance and supervision and has fulfilled the requirements for the submission of this thesis,which has attained the standard required for a Ph.D. degree of this Institute. This work has not been submitted elsewhere for the award of any degree or diploma.

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## ACKNOWLEDGEMENTS

It is with a deep sense of gratitude that the author records his sincere thanks to Dr. N. Singh of the Department of Mechanical Engineering, Indian Institute of Technology, Delhi, for his able guidance, encouragement and suggestions throughout the period of research work reported in this thesis.

The author wishes to thank the authorities of Sri Venkateswara University, Tirupati, for sponsoring him under Q.I.P. for the Doctoral programme.

Thanks are due to his colleagues and friends, Dr. K. Ravindranath, Major K.R. Seshasayee and Mr. G.Padmanabhan for their help and co-operation.

The author is grateful to his parents, brothers and sister. The author appreciates his wife Mrs. Satyavathi, and children Premchand and Prasanthi, for their patience, understanding and cooperation, but for which this work would not have been completed in time.

Finally, the author wishes to thank Mr.P.M.Padmanabhan Nambiar for his meticulous typing.

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ABSTRACT

The control and maintenance of inventories of physical goods is a problem common to all enterprises in any sector of a given economy. The inventories may broadly be classified into two types - manufacturing inventories and distribution inventories. The purpose of a manufacturing inventory is to satisfy the production requirements, whereas that of a distribution inventory is to meet the customer demand at a prespecified service level.

The nature of demand for an item of a manufacturing inventory is dependent and lumpy, i.e.,inventory depletion occurs at discrete time periods. Because of these two special dimensions of demand for manufacturing inventories, the techniques of statistical inventory control cannot be employed effectively for inventory management. The alternative choice is the material requirements planning, an approach that recognizes the realities of demand existing in a manufacturing environment.

A material requirements planning (MRP) system, narrowly defined, consists of a set of logically related procedures, decision rules and records designed to translate a master production schedule into time-phased net requirements and the planned coverage of such requirements for each component inventory item needed to implement this schedule. Discrete

lot-sizing is one of the important planning factors of MRP. In discrete lot-sizing order quantities generated should equal the net requirements in an integral number of consecutive planning periods. Discrete lot-sizing does not create remnants, i.e., quantities that would be carried for some length of time without being sufficient to cover a future period's requirements in full. The present study is limited to discrete lot-sizing only.

The standard MRP logic facilitates the use of single-product single-level lot-sizing techniques for determining the planned coverage of component item requirements. Though there are many recognized lot-sizing techniques, till to date, only the Wagner and Whitin algorithm based on a dynamic programming approach assures an optimal solution. The complexity of the procedure inhibits its understanding by the layman and acts as an obstacle to its adoption in practice.

Two simple heuristic algorithms based on the incremental cost approach are developed for solving the problem of single-product discrete lot-sizing arising in MRP. The incremental cost approach is extended to solve the problem of multi-product discrete lot-sizing with constraints.

A finite production rate discrete lot-sizing model is formulated incorporating a finite production rate and raw

material inventory holding cost in the case of constant demand occurring at discrete time periods. Two simple algorithms are developed to solve the model. A finite production rate discrete lot-sizing model is formulated incorporating finite production rate and raw material inventory holding cost in the case of time-varying demand occurring at discrete time periods. A simple algorithm based on an incremental cost approach is developed to solve the model. The Wagner and Whitin algorithm is modified to take care of the finite production rate and raw material inventory holding cost. The effects of a finite production rate and raw material inventory holding cost in a single-product discrete lot-sizing have been studied. An attempt is made to develop a heuristic procedure to jointly determine the master production schedule and component lot-sizes.

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