

EMPIRICAL MANUFACTURING LINE DESIGNS IN JAPANESE AUTOMOBILE PLANTS

Nguyen, D. M.

Nagoya University, Graduate School of Economics and Business Administration

Furo-cho, Chikusa-ku, Nagoya, Aichi 464-8601, Japan

E-Mail: nguyendangminh@nagoya-u.jp

Abstract

Manufacturing line (ML) designers have understood that simulation studies can help to form a more reliable ML than conventional methods that for the most based upon engineering experiences. However, the use of simulation has not been applied much in designing the ML, and a confident method of designing a new ML or modifying the capacity of a current manufacturing line (CML) has remained a task in Japanese automobile manufacturing plants. The main purpose of this research is to propose a new perspective of a simulation study in Japanese automobile industry from an empirical point of view to implement the framework for designing a ML. The second purpose is to introduce the method and analytical procedures of modifying a CML utilized by a linear programming (LP) model for selecting alternatives for simulation study. The proposed method was applied in an actual design project to confirm the feasibility of the framework.

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Key Words: Manufacturing Line Design, Discrete Event Simulation, LP Model

1. INTRODUCTION

Manufacturing line plays a critical and valuable role in today's manufacturing system. Developing a more efficient ML and bringing it to realization is the main task of ML designers. In present manufacturing activities, there are two main tasks for ML designer; the first is to design a new ML and the second is to modify the CML when the required production volume increases over the line capacity.

After conducting interviews with managers who are responsible for ML design of Japanese automobile manufacturers, it was realized that ML was traditionally designed following conventional methods and for the most were based on engineering experience and simple calculations of worker utilization, machine utilization, and line productivity with constant processing data. However, the experiences of designers are not always the same level and conventional methods of design cannot simulate the actual situation of the ML because of factors such as: unevenness of processing data, machine failures. The application of a simulation study has been lacking in this field. The main reason concerns the fact that no method or procedure setting a practical ML design with application of simulation study has been applied within the manufacturing society. Japanese automobile designers are still hesitant to apply simulation for designing the ML, preferring conventional methods of design.

From an academic aspect, approaches related to manufacturing system design using simulation studies have been briefly reviewed as follows:

Firstly, research discussing the converting of an existing manufacturing system to a new system was presented; for example, in the conversion from a job shop to a cellular manufacturing system [1, 2], and in a US traditional manufacturing system to *just-in-time* system [3]. Simulation of alternatives for simulating an old manufacturing method to a new system has been introduced in those studies; however, these studies failed to provide a method

potential for ML design for the application of simulation models in the Japanese automobile manufacturing plants.

A simulation study not only can help engineers discover better options for developing efficient equipment but also can save time and money from mistakes in redesigning and re-fabricating equipment in comparison with conventional methods that for the most part were based on engineering experience. However, limitations in the application of a simulation study in actual ML design is still exists such as, the company needs to organize training program for engineers to obtain professional knowledge in building simulation model. The concept of the ML design in this research can be extended to other manufacturing areas in future research.

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