Review of Sequence-Based Materials Flow Procedure for Designing & Manufacturing Cell

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INTRODUCTION

Research methodology is applied under real conditions in company, which is manufacturing bicycle components. In generally, companies' reason for radical changes of manufacturing process structures are mainly motivated by recognition that so called process type layout do not suit just-in-time philosophy. That kind of planningoriented production system ends up being a system that requires pushing for sales.

THEORETICAL EXAMPLE OF P-Q DIAGRAM

R1: If value X2 is greater than or equal 70%, then it is strongly recommended to establish wide-variety small-lot production layout in factory thus implementing one-piece flow conception.

R2: If value X2 is smaller than 70% and X2 is greater than 65 % or □X3 is greater then □X2, then it is more or less appropriate to built up wide-variety small-lot production system.

R3: If value X2 is smaller then 70% but □X2 is greater then □X3 then conditions for implementing one-piece flow are not satisfied so the production equipment layout should be organized in technological pattern.

Open interval 65<X2<70 was chosen due to mathematical conditions for application of decision making algorithm.

Presented theoretical hypothesis will be applied and tested on concrete example of real manufacturing company. Further a PFA analysis method will be applied and it will be aimed on optimization of material flows in scope of logistic goals.

INTERVAL OF THE INTEREST

Decision-making algorithm

B. Initial data for conducting P-Q Analysis Initial production values needed for conducting P-Q analysis are given table 1. They serve for drawing of P-Q diagram and Lorenz Curve showed in table below

TABLE I INITIAL PRODUCTION DATA

No.	Quantity (pcs/yr)	Cumul. Quantity (pcs/yr)	Cumul. share (%)
1	405870	405	870
2	270580	676	450
3	266966	943	416
4	256311	199	727
5	101700 1	301	427
6	889901	390	417
7	762761	621	776
8	69404 1	536	097
9	53704	589	801
10	39176	628	977
11	34702	663	679
12	29382	693	061

Table; Actual P-Q diagram (P- product type, Q-quantity) According to previously determined preconditions, the

30:70 ratio (line X2) is greater then 70% what does it mean that condition R1 of a source thesis was completed for implementing of one-piece conception.

In the table are presented only decisive parts of company production program that have a relevance to the manufacturing process design. The semi-products are divided into three assembled groups. First group of components is represented by frames of bikes. Second group consist from different types of back forks and in third group are clustered different types of front forks.

C. Decomposition of technological operations and Layout redesign Broad set of working activities done in a manufacturing department for a given assortment of parts to be processed can be disintegrated into groups according to the group technology concepts. Multi-product process chart based on original process layout is showed in Based on multi-product process chart further steps of Production flow analysis can be applied. Each stage in PFA seeks to eliminate delays in production flows and operational wastes in a progressively smaller area of the factory. PFA can be defined as comprehensive method for material flow analysis, part family formation, design of manufacturing cells, and facility layout design that was developed in the early 70.s [10]. By PFA related groups of parts are identified and rearranged into a new pattern that brings together packs with similar machine sequences. A mathematical formulation of the production flow analysis optimization problem was developed for instance by Villa and Bandera [11]. By applying the results of PFA (also called as cluster analysis), a production equipment layout with optimized lines can be modeled.

After gradual transformation of incident matrix “A” that was derived from table 2, it was created a model of production equipment layout with optimized 6 lines that is shown in figure 8. In real conditions, the cells are often organized into a U-shaped layout, which is considered appropriate when there is a variation in the workflow among the parts made in the cell. Because it is also actual for the case in mentioned company, redesigned layout (figure 9) of production processes consists of lines using U shaped cells. It also allows the multifunctional workers in the cell to move easily in between machines.

IV. CONCLUSION

Presented transformation of production process can be viewed as perspective way of optimization of material flows by changing production equipment layout and achieving the goals of company logistics. In generally, material flow optimization belongs among complex engineering and managerial problems, which have not been satisfactorily solved yet. Obviously, this complexity could not be presented in above research in a full scale. Conducting this study from one side helped to verify the effectiveness of decision-making based on criteria of P-Q analysis. On the other hand, transforming of current production equipment layout to 6 lines led to improvement of more important economical aspects in a company.

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