OPTIMALISATION METHOD OF MATERIAL FLOW AT MANUFACTURING PROCESS

1,3 SLOVAK UNIVERSITY OF TECHNOLOGY, FACULTY OF MATERIALS SCIENCE AND TECHNOLOGY, INSTITUTE OF PRODUCTION SYSTEMS AND APPLIED MECHANICS, TRNAVA, SLOVAKIA

ABSTRACT: A today trend in manufacturing is characterized by production broadening, innovation cycle shortening, and products having new shape, material and functions. The production strategy focused to time needs change from traditional functional production structure to production by flexible manufacturing cells and lines. Production by automated manufacturing system (AMS) is a most important manufacturing philosophy in last years.

KEYWORDS: production system, manufacturing, material flow, layout optimizing

INTRODUCTION

This paper was created thanks to project Operational program RESEARCH and DEVELOPMENT (OPVaV-2009/2.2/03-SORO) number ITMS 26220220094 named „Manufacture technical level and control effectiveness increase in the field of plastics component production“. Faculty of Material Science and Technology of Slovak University of Technology in Trnava is realized this project in cooperation with HANIL E-HWA AUTOMOTIVE SLOVAKIA s.r.o. in Považská Bystrica in Slovakia.

The main target of project is a manufacturing and control processes effectivity increasing at plastics parts production process. Goal of effectivity increasing is competitiveness increasing at automotive manufacturing market by knowledge and technology transfer and joined research and development activities between industrial and academic sphere.

This project is covered by the category of applied research. It is focused to planed research for new knowledges and skills acquirement for new plastic component development (tools for plastics molding), processes (new processes in manufacturing) and significant quality increasing of existing products (existing tools and processes optimizing).

Rationalization of production system allows elimination of negative influences on production costs and product price. Rationalization projects starts with data acquisition followed by analysis and evaluation of data. Once aims of rationalization are clearly defined a new production system or innovative production process is designed. Designed changes cannot be implemented during production of the factory, because effectiveness of proposed alternatives is not guaranteed. Due to this reason, simulation of proposed alternatives using various simulation computer programs gains on importance. Simulation is a suitable tool for elimination of imperfections in production process. Furthermore, it allows searching for possibilities of increasing effectiveness of production as well as for problems, which may interfere with continuous production cycle of a factory.

Main aim of rationalization projects is an improvement of production processes and prevention from losses and wasting of all possible kinds of production resources (material, energy, production area, production time, production facilities, etc.), this all from material purchase from supplier to dispatch of finalized products to customer at all workstations as in case of production preparation so as during production itself.

LAYOUT OPTIMIZATION

Principe of systematic application of logical thinking during solution of difficult issues and elimination of losses and wasting during production process is aimed predominately at 4 essential areas:
1. Minimization of stock size and supply and release of financial resources and also lowering the logistics expenditures for storage, manipulation, etc.
2. Constant improvement of all activities of logical chain: suppliers - product - customer (lowering the production costs, shortening the production time, improvement of work environment, etc.)

3. Concentrate attention at sites, which are decisive for quality, competitiveness, perspective, productivity, costs, etc.

4. Optimize system of material and information flows - eliminate losses, which may cause irregularity or overload of production, complexity of material flows, downtime caused by organization imperfections, etc. Solving the optimization of production requires detailed information about whole production process. Because technological procedure of production is given, it is possible to adjust material and data flow. Fig. 1 shows former structure of material flow through production. Aim was to provide continuous production process in automotive area of Hanil company.

Wastage is present at each workshop, but it is possible to identify and solve it using 5S method, which is suitable for production and service oriented organizations. Applying the 5S method allows achieving an improvement and simplification of material flow, machine layout and stock. Other benefits are:

- Quality, productivity and safety improvement
- Better company culture, people attitude, less apathy
- Improved work environment.

Method of 5S is under development and nowadays sixth S is also defined, know as safety. Reason is to realize all improvements at workplace in such manner, that employees are not endangered. Apart of this, it put emphasis on availability and unambiguous identification of all safety devices. The aim is to prevent from danger during work and limit occupational accident to a minimum possible.

The aim of material flow projection is solution of:

- Minimization of transport, manipulation and storage
- Simplification of system to minimum - minimum consumption of expenses and time ⇒ solution of important relationships,
- Workplaces and capacities - incorrectly designed capacity causes unevenly distributed material flow, stock accumulation, necessity of inter-stocks and buffers and additional manipulation activities,
- Information flow and control system - correct control of inputs of production tasks, synchronization of purchase, production and dispatch, coordination of system of production control with transportation system,
- All components of the production system have to be designed in mutual relations and it is ideal if all are verified before installation using simulation model.

Solving the given material flow requires specification of the aim of innovation of a given material flow. The proposal of the layout of production lines is solved as a combination of concerned layout (according to a number of products declared in PQ diagram) and technological layout (consideration of a technology of injection and technology of forming). In the frame of detailed design were relocated beginnings MT on production facilities in order to eliminate intersection of MT directly in front of production facilities. In fact this change counts only for location of the product, which undergoes technological operation. Combination of products in the frame of one production facility remains with
respect to the available capacity unchanged. Respecting the MT proposal, the layout of stocks is realized close to dispatch, taking into account space required for expedition trolleys. Distribution of a part of trolleys with finalized products is realized in proposed annex building of dispatch stock with dimension of 10 × 70 meters.

Fig. 2 Innovation of the workshop

Simulation of the proposed change is possible to avoid unavailing loses during ineffective trials related with application of innovations. During simulation is required to fulfill production plan, which is documented in the form of a table.

Fig. 3 shows production plan, which is compared with values of outputs after the simulation is completed.

Fig. 3 Production plan

Figure 4 depicts simulation of SOFT TRIM component production in HANIL company and partial tables with outputs from simulation.

Fig. 4 Simulation of innovation of workshop layout

**CONCLUSION**

Proposal of new layout of production lines is adjusted for current capacity of production with aim to optimize material flows. Application of proposed solution is in fact possible to realize during full production process, because it counts mostly for relocation of dispatch trolleys. Relocation of those trolleys would be effective after finishing the building of dispatch hall at current dispatch site. Building
the dispatch hall would not affect production process, what is benefit of the proposed solution. Expected time required for building up the dispatch hall with dimensions of 10×70 meters is approximately one month. After finalizing the hall, zones required for different types of trolleys would be calculated and subsequently labeled zones for stock areas, service areas and transportation paths. After the trolleys relocation and clear out the spaces, workplaces for assembly would be relocated. This procedure would affect the production process significantly. This change would be implemented during weekends using internal employees of the company, predominately. Implementation of all changes is expected to last approximately two months. From economic point of view, most significant impact would have an investment into the new stock for distribution logistics. Expenses related with relocation of workplaces are negligible and could be realized also during full production. When comparing this investment with shortening transportation time between workplaces, return on investment is expected in few months. From the long term point of view and considering ambitions of the company, which are aimed at increasing volume of production, the investment into dispatch stock is in short term range necessity. Other advantage of building the dispatch stock is simplification of production process and establishment of space for dispatch trolleys with finalized products.

ACKNOWLEDGMENT

REFERENCES