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# SOCIO-TECHNICAL ASPECTS AND BUSINESS-ECONOMICAL ASPECTS OF THE DESIGN FOR ASSEMBLY PROCESS

*This paper described socio-technical aspects and business-economical aspects of the design for assembly process. The implementation of continuous flow production may not lead to production systems being set up that differ little if at all from the assembly line of some twenty years ago. For that will not lead to the required smoothly running factory of the future. To avoid making the same mistakes as made in the past, it is useful to review once again the history and circumstances of the traditional assembly line.*

## 1. INTRODUCTION

The assembly line, which typified factories in the eighties and nineties, was the product of an industrial evolution spread over many decades. This mode of production in the assembly sector contributed in no small measure to the industrial growth of that area. The assembly line utilises two well-established efficiency principles of work organisation:

- Separation of operative, regulative and preparatory tasks,
- Splitting of operative tasks into simple individual operations.

This made it possible to use unskilled personnel for mass production of complex products. The simple, easily learnt operations could soon be routinely carried out at a high rate. The virtues of the moving assembly line systems are thus the high output and low price of large-batch and mass production. Together with mechanisation and vertical integration this method of production enabled companies to contribute to and profit from the growth of the economy and of general prosperity.

## 2. SOCIO-TECHNICAL ASPECTS

In the course of the eighties and at the beginning of the nineties the assembly line came under increasing criticism, both within companies and outside, in connection with delivery problems and motivation problems. Delivery problems arose from the rigidity and the susceptibility of the assembly line to disturbances, (e.g. long waiting times due to hold-ups in the supply of material, to upsets in utilisation and to variations in working rate, poor quality due to high-paced work, sluggish information feedback and demotivation. The increased product diversity also caused many problems, for instance with respect to constantly having to rebalance the line.

Motivatin problems arose from dissatisfaction among the operators about the quality of the work (giving rise to high labour turnover, absenteeism, under-utilisation, alienation). The seriousness of these problems was for a long time obscured by the strong economic growth. The tight labour market, which made it difficult to recruit labour and to keep it, was for a long time the main reason for tackling the problems.

The pressure on the assembly line system gradually increased by a number of developments:

- New mechanisation projects, because of their large-scale character (very high output per unit time) were not compatible with the much slower assembly line with manual work,
- The increasing significance of quality as a factor of competition,
- The increasing diversity of products and technologies made the rigidity of the production systém even more evident,
- Society, in the context of the welfare state, raised the issues of quality of life and wellbeing (participation, humanisation).

In short, the assembly line was seen to be no longer so efficient and failed to meet the new requirements of quality and flexibility.

Gradually, as a consequence of various measures, the assembly line began to give way in many factories to new production systems and production organisations.

Table 1 gives a survey of the differences between a classical factory, employing a moving assembly line and a contemporary organisation with continous flow production.

Comparison of classical organisation with assembly lines and contemporary organisation with continous flow production. **Table 1**

| CLASSICAL ORGANISATION WITH ASSEMBLY LINE | CONTEMPORARY ORGANISATION WITH CONTINOUS FLOW PRODUCTION |
|---|---|
| **Where are the people situated** | |
| • In the line<br>• Serially<br>• Individually and (in some cases) isolated<br>• Directly linked to each other | • Beside the line<br>• Parallel<br>• In groups o max. 15-20 persons<br>• Via buffers |
| **Work content** | |
| • Short cycle times<br>• Tied to the workplace and fixed task<br>• Only the operation<br>• No regulating activities | • Cycle time not under 2 minutes<br>• Job rotation and variable work allocation<br>• Inspection, operation,testing<br>• Also checking, remedy of malfunctions, small maintenance |
| **Working conditions** | |
| • Generally untidy departments<br>• Uniform workplaces, desk designed<br>• Inconveniences (noise, draughts, etc.)<br>• Unvarying physical load | • Orderly, and with space for consultation<br>• Room for personal belongings, participation in design<br>• No nuisance from noise or draughts<br>• Variation in posture and movement |
| **Working relationships** | |
| • The best craftsman is the boss<br>• Boss above the group<br>• Sometimes very long lines and hence very large groups<br>• Individual responsibility only<br>• High paced work<br>• Very irregular feedback and no information about the department | • The best craftsman is not always the boss<br>• Boss part of the group<br>• Groups between 4-2 people, lines not too long<br>• Group responsibility and appropriate authority<br>• Quality awareness<br>• Regular feedback of results and information about the department |

## 3. BUSINESS-ECONOMICAL ASPECTS

The factory of the future, with all its facets, is not of course an end in itself, but a means of improving the competitive position of a company. In terms of business economics it is a question of improving the financial position. In this context the following aspects may be discerned:

- Profit margin
- Rate of capital turnover
- Financing

The most conspicuous characteristics of the factory of the future are greatly increased flexibility and quality. This is achieved through the implementation of a production systém with very short throughput times and low factory stocks, leading to the possibilities of lower stock levels in distribution (pipe-line-stocks).
This can have a positive effect on profit margins in two ways. Firstly, the speed increases, with which new products can be introduced on the market, provided the development throughput times are sufficiently short and Design for Assembly is applied. Secondly, lower stocks lead to lower costs. Moreover, increased flexibility improves the chances of gaining market share.
The rate of capital turnover is increased when throughput times are shortened: less capital is needed for stocks and everything bound up with them. Finally ,financing. The excessively high stock levels which are to be found everywhere in Western industries involve serious financial bunders. For many a company, the growth of sales in recent years has led to an equally fast increase in total capital employed, in which stocks account for about one third.

Continuous flow production is a completely different production system from the present-day batch production and has the following characteristics:

- Balanced process times
- Transport size 1
- Minimum resetting times
- Very fast information feedback
- Very short resetting times
- High quality levels

Technical choices should be integrated with socio-technical ones, other wise the extremely vulnerable systém will not function. This implicity states that, certainly for the nearby future, many people will still directlky be involved in manufacturing.

Continuous flow pproduction is only successful as part of a flexible organisation, with:

- Short development lead times both for productdevelopment as well as processdevelopment
- Design for assembly
- Co-makership with suppliers
- Staff as far possible integrated in line operations
- Very close cooperation between development, Plant Engineering and Production

The total product realisation process changes in terms of product designs, transport systems, machines and organisations to arrive at the required characteristics.

To appreciate the consequences for a company it is also necessary to examine the aspects related to flexibility in the commercial sector.

## Literature

[1] JURKO,J.-MONKA,P.: The Importance of Design for Assembly in Automatized Manufacturing. In: "DAAAM Symposium". Vieden, TU Vieden, 1996, s.195 - 196