ECONOMIC PERFORMANCE ASSESSMENT REGARDING AN FLEXIBLE MANUFACTURING SYSTEM INVESTMENT

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Abstract: *Economic efficiency of a manufacturing system variants are assessed annually by the additional benefit achieved by operating the system in question in relation to the reference system. Technical problems generally have many possible solutions. The choice between them is made on economic considerations.In the synthesis of a flexible manufacturing system is usually develop several variants of different solutions from a technical standpoint. The additional benefit is calculated annually taking into account on the one hand favorable economic effects are obtained by introducing relevant, increasing labor productivity, improve product quality, increase competitive ability of the enterprise, shortening travel times of a product, reducing capital asset , reduced labor costs, materials, overhead, on the other additional expenses related to the implementation and operation of the system.The economic evaluation of variations of flexible manufacturing system is usually done by comparing the economic efficiency of an embodiment an another or all versions of each core, which is usually have the „clasic" manufacturing system. Among them will be chosen to achieve that which is most economically advantageous.The article will present as a solution method amortization period of the investment. The basic idea is to follow the principle that the net profit generated by the investment in a flexible manufacturing system must ensure the depreciation in a given time period called for cushioning.*

Key words: *Flexible manufacturing system, net annual income, payback time, annual production, volume, total annual costs.*

1. INTRODUCTION

Flexible manufacturing system is a set of integrated computer controlled automated material handling equipments and numerical controlled machine tools capable of processing a variety of part types.

Due to the competitive advantages like flexibility, speed of response, quality, reduction of lead-time, reduction of labour, flexible manufacturing system are gaining popularity in industries.

The better the choice, more will be the productivity as well as the profit maintaining quality of product and responsiveness to customers.

Though FMS is an outgrowth of existing manufacturing technologies, its selection is not oft studied. It has been a focal point in manufacturing related research since early 1970s.

Flexible manufacturing system provides a low inventory environment with unbalanced operations unique to the conventional production environment.

Process design of flexible manufacturing system consists of a set of crucial decisions that are to be made carefully. if the operations are balanced, the environment becomes that of the transfer line. The changes in production are related to both inventory changes as well as changes in flow time. [1]

The selection of a flexible manufacturing system thus requires trading-off among the various parameters of the flexible manufacturing system alternatives.

The selection parameters are conflicting in nature.

Due to material and financial values that are involved, design, investment and subsequent exploitation of a manufacturing system must be based on rigorous economic criteria.

The fundamental problem you have always had in mind is finding optimal solutions, designed to ensure return on investment deadline and getting the benefits. [2].

Technical problems generally have many possible solutions. The choice between them is made on economic considerations. In the synthesis of a flexible manufacturing system is usually develop several variants of different solutions from a technical standpoint.

Among them will be chosen to achieve that which is most economically advantageous. As a comparison result for variants of the solutions should be valued in terms of economy considerations. The economic evaluation of variations of flexible manufacturing systems is usually done by comparing the economic efficiency of an embodiment of another variant in one or all of the core, which is usually have the manufacturing system "classic"[3,4].

Mustafa and Robert have also developed a knowledgebased decision support system suitable for short-term scheduling in flexible manufacturing systems and strongly influenced by the tool management concept to provide a significant operational control tool for a wide range of machining cells, where a high level of flexibility is demanded [5].

Economic efficiency of a manufacturing system variants are assessed annually by the additional benefit achieved by operating the system in question in relation to the reference system.

The additional benefit is calculated annually taking into account on the one hand favorable economic effects are obtained by introducing relevant, increasing labor productivity, improve product quality, increase competitive ability of the enterprise, shortening travel times of a product, reducing capital asset , reduced labor costs, materials, overhead, on the other additional expenses related to the implementation and operation of the system.

In the synthesis of a flexible manufacturing system is usually develop several variants of different solutions from a technical standpoint.

Among them will be chosen to achieve that which is most economically advantageous.

As a comparison result for variants of the solutions should be valued in terms of economy. Payback period method should be chosen solution.

2. METHOD

It talks about the net annual income of the investment made (V^n) which is the difference between revenues and expenses by selling finished products made of flexible manufacturing system to produce them [2].

We will consider three alternatives:

- (V^n <0). In this variant flexible manufacturing system is a "consumer money". It is not possible depreciation fincare investment and operating time, and we produce additional losses recoverable.

- (V^n = 0), where flexible manufacturing system does not allow recovery of the initial investment.

- (V^n > 0), representing the optimum desired.

If the additional annual amount of benefit obtained by running all versions of flexible manufacturing system will be negative, so it sees profit by implementing systems solutions proposed will be dropped - from economically - the implementation of flexible manufacturing system community.

Zero profit manufacturing system indicates the minimum annual production volume and minimal costs to economic performance for flexible manufacturing systems.

If $V^n > 0$ and is constant each year payback time in a flexible manufacturing.

$$T_a = \frac{90.000 Euro}{30.000 Euro / year} = 3 \text{ years for amortization} \quad (1)$$

T_a system- the number of years it will be the ratio between the initial investment and annual income:[2]

$$T_a = \frac{C_i}{V_n} \quad (2)$$

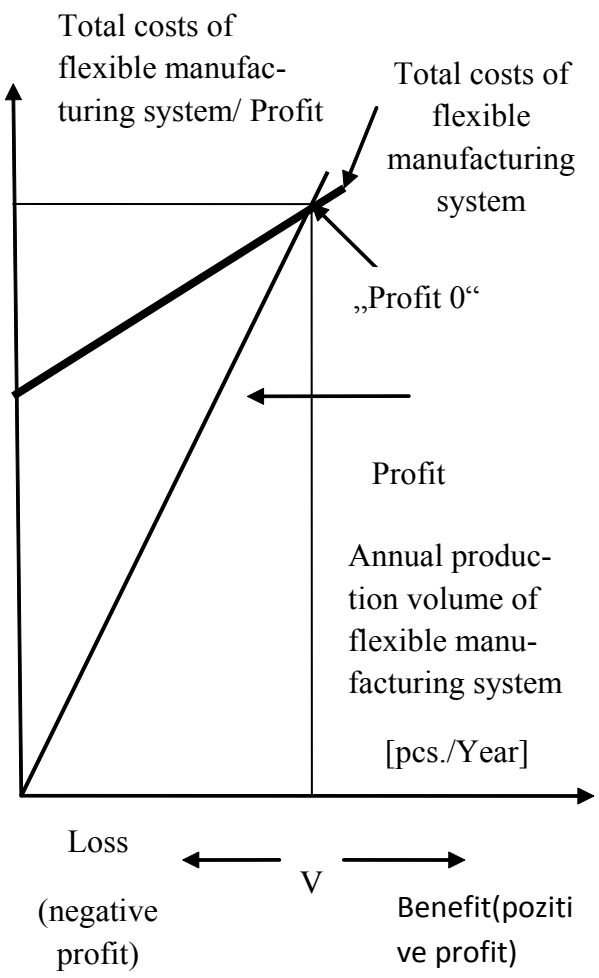

Fig.1. Graph of profitability of a flexible manufacturing system

3. STUDY CASE

An flexible manufacturing system costs 90,000 Euro annually, products worth 60,000 Euro, and the expences are 35,000 Euro.

It analyzes evaluating the investment opportunity of such a mechanism, designed to be kept in operation for 8 years. It will choose the flexible manufacturing system for the expected annual benefit will be maximized.

V^n = 60.000Euro/year - 35.000Euro/year = 30.000 Euro/year

$V^n > 0$, so the investment is amortized

According to Figure 2 the fixed costs are constant and do not depend on the volume of production. It is expressed in annual values.

Variable costs are directly dependent on the volume of production. In addition to the costs described must be considered and maintenance costs due to outdated equipment.

Costs due to wear are more difficult to estimate quantitatively and differ from one machine to another.

They grow linearly with the volume of production achieved, so the total cost of production will total fixed and variable costs. So all production costs for a flexible manufacturing system are divided into fixed costs (C^f) and variable costs (C^v).

Economic situations prefer a different classification of costs:

- personnel costs (wages, social security)
- material costs (raw materials and consumables).
- indirect costs or additional costs of providing business functionality
- indirect costs from factory (ensuring social conditions of labor, labor, transportation of materials, office with customers).
- indirect costs to the company (supporting research, commercial advertising, market research, specific taxes).

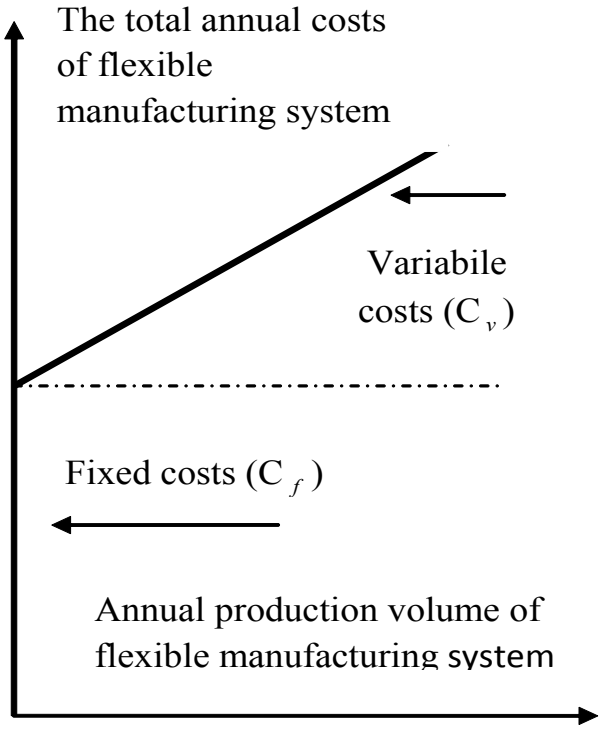

Fig.2. Ideal evolution of total cost

CONCLUSIONS

The economic criterion used in the economic analysis division is the added benefit annually by putting into operation of flexible manufacturing system in relation to manufacture in a classical system.

If the additional annual amount of benefit obtained by running all variants of flexible manufacturing systems will be negative, so it sees profit by implementing systems solutions proposed will be dropped - from economically - to implement the flexible manufacturing system.

The selection problem of flexible manufacturing system is complex due to the high capital costs involved and the presence of multiple profit criteria.

One can reduce investment and maintenance costs, increase equipment utilization, efficiency as well as improve facilities layout by selecting the right system suitable for the operations to be carried out.

For the flexible manufacturing system, performance standards of the systems are not uniform, and expression of capabilities and performance attributes among manufacturers are inconsistent and incommensurable.

Technical problems generally have many possible solutions.

The choice between them is made on economic considerations.

In the synthesis of a flexible manufacturing system is usually develop several variants of different solutions from a technical standpoint.

Among them will be chosen to achieve that which is most economically advantageous.

As a comparition result for variants of the solutions should be valued in terms of economy.

The economic evaluation of variations of flexible manufacturing systems is usually done by comparing the economic efficiency of an embodiment of another variant in one or all of the core, which is usually have the manufacturing system "classic".

The additional benefit is calculated annually taking into account on the one hand favorable economic effects are obtained by introducing relevant, increasing labor productivity, improve product quality, increase competitive ability of the enterprise, shortening travel times of a product, reducing capital asset , reduced labor costs, materials, overhead, on the other additional expenses related to the implementation and operation of the system.

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