

1TH INTERNATIONAL WORKSHOP "ADVANCED METHODS AND TRENDS IN PRODUCTION ENGINEERING"

CA-SYSTEMS AND TECHNOLOGIES – ECONOMIC EFFECTIVENESS OF THEIR IMPLEMENTATION

Felicita CHROMJAKOVÁ

*Assoc.Prof.Ing. Felicita Chromjaková,PhD., Department of Industrial Engineering
University of Žilina, Slovakia*

***Abstract:** The main problem, presented in this paper, is oriented on the problem of economic decision processes by the implementation of new CA-systems and technologies into the existing production systems. First will be discussed the phenomena of their economic using and next the phenomena of technological calendar, as an important tool for the decision process about their implementation.*

***Key words:** effectiveness, costs, capital, allocation.*

1. INTRODUCTION

New production technologies presents very important tool of competence strategies by each industrial enterprise. They can be allocated effective only in such enterprise, in which they are supporting the production strategy and on such way they contribute to the success potentials building. In the strategic area there is the main assumption the radical decision: to define the positive and negative incomes of such type of investment.

2. FUNDAMENTAL PROBLEMS OF DECISION PROCESS

From the practical point of view it can be defined the following problem areas in according to the implementation of CA-systems and technologies:

- **Problem of directly definition by relevant changes of credit flows.** New production conceptions are planned as a tool for an active market influencement, f.E. they must to restrain the market position and the market share. Each enterprise planner can very difficult define the long-time returns and costs, to elaborate the strategic plans on the operative level and to obtain the actual cost calculation. If there exists the different understanding of information state in the strategic and operative area, then we can't make any finding and already neither can be here to expected some results.
- **Problem of calculated interest destination.** Questionable is the definition of the lowest possible valuation by respect of risk and inflation. If we integrate both of these criteria into the calculating model, it exists the danger of double suggestibility of investment decision, special in the case, when we interpret the results. If we wont to integrate the

inflation into the model, we can it recover also by payment flows definition. Special situation: lowest interests lead to the favoritisation of smaller projects with short success.

- **Problem of effects summarization by investment on the payment flows in other enterprise areas.** The calculation of the investment is the information about the directly monetary effects of the investment. By small projects it is to expensive, to summarize the effects. It means, by elimination this kind of problem we prefer the strong orientation only on the important characteristics of investment projects, which are through the decision directly supple. Example: for the complexly production system judgment it is important in the first line to determine the system frontiers and in the second line to decide.
- **Problem of the effects summarization by investment on the projects in the future.** This problem can be marked as a neuralgic point of decision process, at this time we haven't some useful methodology for detailed solution.
- **Problem of capital allocation management and investment budget.** It exists the danger, that each enterprise unit give to the multiple investment only small separate improvements, which will be independent themselves. That means, that the original investment is in the real time "used" for elimination of constraint place in the production or rationalization of clear determined areas. Outcome is in the birth of isolated automatisations islands, which separately obtain the effectiveness, but in the framework of integrated whole there are impossible to spend the rationalistic potential.

3. MODIFICATION OF KNOWLEDGE ABOUT THE DYNAMIC INVESTMENT CALCULATION

The flexibility of new production concepts shall to enable the quickest and cost most optimal reaction on the market changes. The creation of the possibility, today prognoses and unpredictable market changes to use as a chance, assumes the existence of redundant capacity and higher investment sums. That means, that these capacities will be used in the case of satisfaction of additional requirements. Under the idea "higher investment sums" we understand the need to take into account the possibility, to create in the investment project such additional requirements. Serious problem there is the frontier determination for the high of investment sums. Two important question must be answered at this time:

- How pay back period can the enterprise obtained in the future, if it will use the contemporary technology and structure, that is it wont be invested?
- How back effect bring it, if it will be used the whole production technology through the whole life-cycle period?

In the endeavor to obtain the optimal judgment of investment need we can use the following steps sequence, which allows us direct to calculate the relative efficiency of new technology through the phenomena "market evoked capital value definition" and this compares with the providing of external production (outsourcing), that means, with the alternative technology. The mentioned advance can be illustrated on the figure 1.

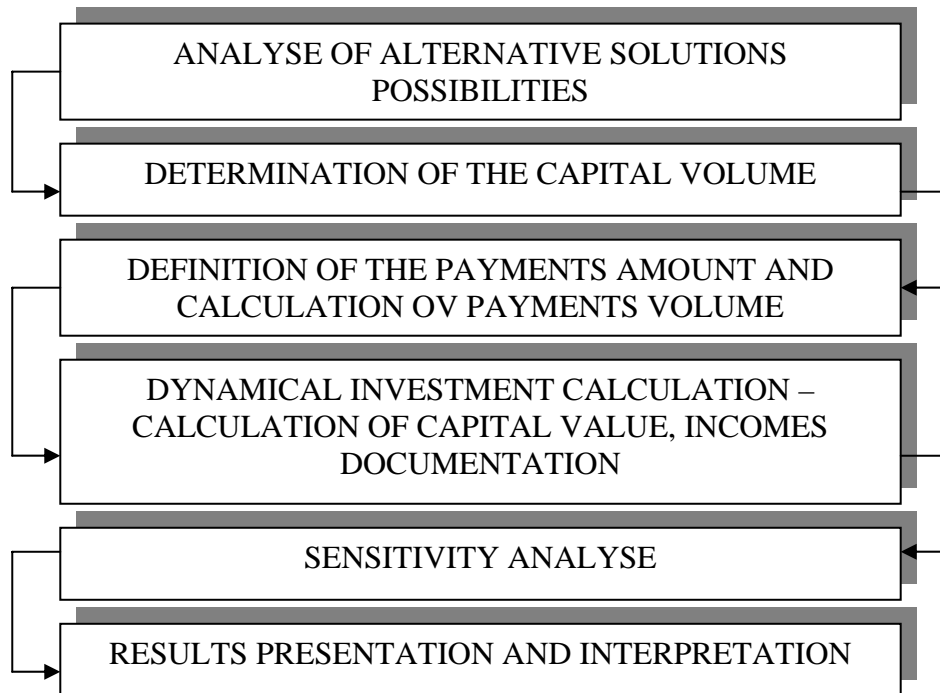


Fig. 1. Market evoked capital definition

1.STEP: Analyse of alternative solutions possibilities

Hereby we detect the quantitative, qualitative and timely capacity and flexibility requirements. In this step we are oriented not only on the alternative technological conceptions, but on the change of the contemporary production system or outsourcing too. Partial alternatives can be described in the special forms (see table 1) together with the technological effects.

ATTRIBUTES of alternatives	ALTERNATIVE 1 (in euro, ...)	ALTERNATIVE 2 (in euro, ...)	ALTERNATIVE 3 (in euro, ...)
Dependability from the order structure			
Sequential effects in the case of machine failure			
Failure time in the test time			
Time recovery			
Technical using			
High performance			
Expansion ability			
Maintenance costs			
Investment			

Only the important alternative define !!!

Table 1. Alternatives of investment solutions

2.STEP: Definition of the capital volume

This step is the basic assumption for the right solution finding. There must be affected all payments for the whole complexly system. If will by the new technology implemented steeply, must be calculated the whole costs per step and per whole investment (incl. trainings, software, other planned costs) – we must map the whole investment chain. The performances, which responds to this costs can by particularly used for all investment steps. The payments for the yet realized activities can't be added to the first investment step, because they influence not the investment effectiveness. The payments, which can be divided into the several projects are marked separately. As illustration see the table 2.

	PAYMENTS TERM	UNIT PRICE	PAYMENT	SUM
PROCESSING SYSTEM				
processing centres measured and test machines cleaning stations				
Sum of processing system				
MATERIAL FLOW SYSTEM				
material transport system surprising places supplies production change system products stock product change system				
Sum of material flow system				
PROGRAMMING SYSTEM				
HARDWARE initial calculation NC-management BDE-system other components SOFTWARE management system machine control service system control NC-programming CAD/CAM-switch over				
Sum of programming system				
INSTALLATION				
fundaments delivery work energetic connection				
Sum of installation				
APPLICATION				
engineering trainings/workshops connection with information system				
Sum of application				
SUMMARY PAYMENT BY PAYMENT TERM				

Table 2. Summarization schema for capital volume definition

3.STEP: Definition of the payment amounts and calculation of payment volume

It is possible to allocate to the investment the payments ? The important answer there is, that we must today make investment, and in the future we can produce without other next investment. The level of the investment for the required adaptation is dependent from the change frequency, rate of task changes (product modification, new variants, production modification,...) and from the grade of production system flexibility for and after the change. The illustrated schema is in the table 3.

Damageable payment flows	High of payment flows change pro periode			
	1	2	...	12
Capital sum				
Return payments				
Work costs				
Place costs				
Maintenance				
Energy				
Tools, instruments				
Standards and receipts				
Transports				
Software maintenance				
Quality assurance				
Failures				
Production management				
Bounded capital				
Installation of new products work plans prototypes testing				
Machine rebuilding on new products				
Added netto revenues by changes				
Residual value of machines by finish of planned horizont				
Return payments by period				

Table 3. Summarization schema of relevant payment flows

4.STEP: Dynamic investment calculation

The calculation algorithm for each decision situation are explained in the broad spectrum of resources. In this paper only one important relation:

$$C = \sum_{t=0}^T (R_t - J_t) q^{t-1} + L q^{t-1}$$

- C - capital value
- R_t - return flow in the time point t = reduction of expenses to the time point t
- J_t - capital high in the time point t
- q - (1+i) calculated interest high in per cents : 100
- L - liquidation receipt by end of planned horison
- T - end of planned period

5.STEP: Sensitivity analyze

The sensitivity analyze serves to the obtaining of following goals: ascertaining of uncertainty influence by planning on the capital value, next the determination of critical influence value – the parameters by which the damping influence most the capital value, and the calculation of reliability area of weakness by separate parameters (see figure 2).

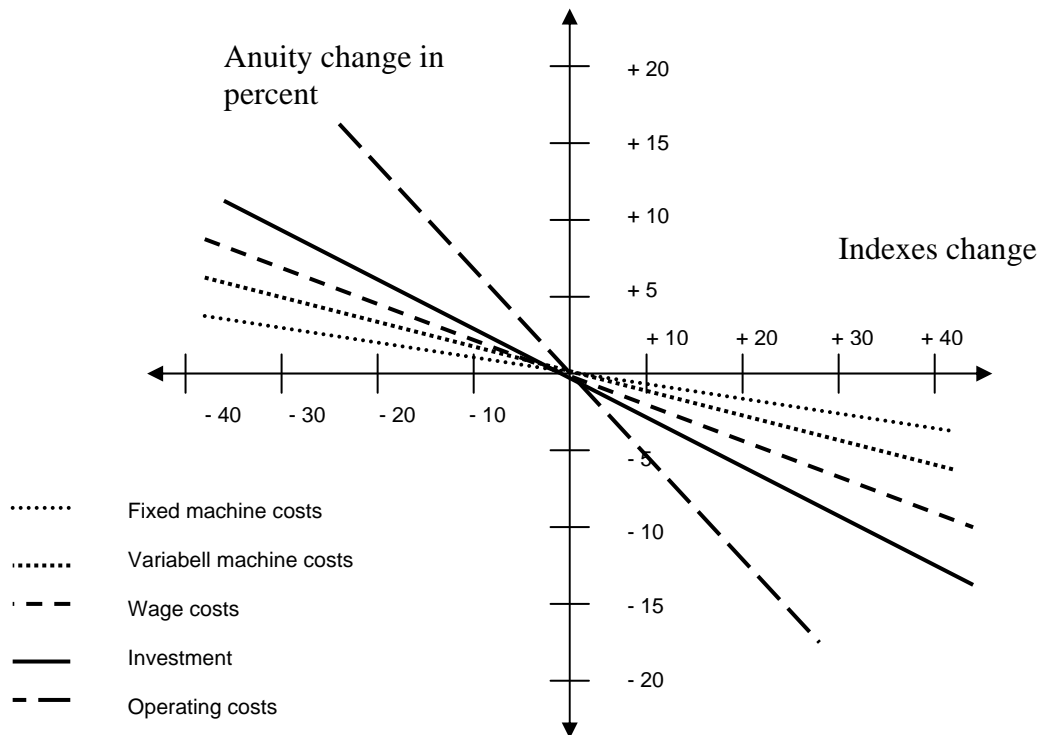


Fig. 2. Sensitivity analyze diagram

6. CONCLUSION

This paper presented the newest knowledge in the area of CA-systems and new technologies economical effectiveness judgment. It is important, how can in this steps to communicate all participants from the enterprise and to take the answerable decision according to the investment.

11. REFERENCES

Štefánik, J.-Chromjaková, F.-Lednár, Š.: *Ekonomika pre technikov*. Žilina, EDIS, 2000, ISBN 80-7100-675-0