THE TIME AS A RESOURCE

Corina – Ionela DUMITRESCU[1], Sorin IONESCU[2]

Lucrarea îşi propune să abordeze timpul ca o importantă resursă care generează avantaje competitive pentru o firmă. Sunt de asemenea trecute în reviste câteva aspecte importante ale managementului timpului deoarece din punctul nostru de vedere aceste aspecte sunt decisive pentru înţelegerea rolului timpului în management. Originalitatea lucrării constă într-o analiză empirică a curbelor de experienţă din învăţământul superior.

We propose in this paper an approach of time as an important resource that generates competitive advantages for a company. There are also important aspects reviewed of the time management because, from our point of view, these aspects are decisive for the understanding of the role of time in management. The originality of this paper consists in an empirical analysis of the experience curves in the higher teaching system.

Key words: time management, forecasts, competitive engineering, actualization of costs, experience curves.

1. Introduction

The available time affects the quality and the result of any business. In order to analyse the role of this resource it is important to see the concepts about **time**. The actual conception about time in management comes from the religious, philosophical and economic concepts outlined along history.[1]

The religious conception

- For the Christians, time has a linear evolution on the trend past – present – future;
- For the Moslems the future is predestined; it depends on a transcendent will which cannot be known and influenced;
- For the Buddhists the present is important which reflects both the past and the future.

The philosophical conception

- Heisenberg's opinion is materialized in the principle of uncertainty which says that the future cannot be known for sure but with a certain probability and we make some choices when we try to know it. It is known that if one

[1] Lecturer, Chair of Economics, University POLITEHNICA of Bucharest, Romania.
[2] Professor, Chair of Industrial Management, University POLITEHNICA of Bucharest, Romania.

discloses a forecast, the normal course of the phenomena is disturbed, because people are guided by them. Many irresolute people follow the conception of the majority and the monetary forecasts create immediately an increase of the foreseen values for the different currencies.

- E. Jantsch's conception starts with the linear evolution past – present – future but introduces two notions which explain these stages:
  a) *The temporal link*. Every state (past, present, future) has itself a past, a present and a future. Therefore, there is a past of the past, a present of the past and a future of the past. [2]
  b) *The spatial link*. The transition between the stages described by the temporal link is not unique, the connections between variables are alike a "spiritual matrix" which belongs to a certain space.

The economic conception

The modern economists realized (after 1800) time was included in the entities made by man. For example:

- Time is included in products – time necessary for its production is sold / bought with the product;
- Time is included in the processes – some processes are more rapid, others are slower. This is reflected through the rhythm of the fabrication, the length of the process, productivity, the speed of the amortization of the equipments.
- Time is included in information – getting some information saves assiduous searching.
- Unused time is a loss – products that can be sold are not produced, the revenues do not increase, the experience does not grow. Maybe for this reason Benjamin Franklin said "time is money".

Managers are interested in time because they will get the results of their present efforts only in the future. For this reason they operate with a lot of concepts depending on time. Therefore:

- A *vision* of the organization is defined, in other words an ideal state which the organization tends to. This vision has the role to motivate al the employees.
- Certain *previsions* are effected in order to understand the environment in which the organization will work. Managers do not act like "seeing and doing". They opt for a certain future that they want to achieve, and at the same time there is a certain uncertainty that they are aware of.
- Firstly, managers try to accomplish a *survival* in time of their organization and after that they are concerned about the profit. The organization is seen as a being that develops in time whose value has to increase. Managers do not apply in any case Ludovic the XVth's saying: "the flood after us".

- Managers create *action plans*. These have a certain impact on the evolution of the organization. There is strategic, tactical and operative planning (on the long, medium and short run).
- Managers want the structures to be flexible, in order to adapt themselves to the environment. The theory of contingency says that there is no very good structure itself but very good in a certain situation. Ambidextrous structures appeared, oriented to the future and containing the past experience. But there are ad-hoc structures as well.
- Time is considered a main factor for increasing the competence (education, training, specialization, professional experience). Carrier and job succession plans are prepared for all of these. Competence goes to the reduction of time for the production of goods (learning or experience curves).
- Rapid reaction in the production process provides the selling on the market at the optimum time (time – to - market). The motto of the Benetton company is the "rapid answer to demands" and Milliken company is the "prompt answer". The operational modern methods contributes to the time compression (TCM – time compression management), for example Competitive Engineering or Kanban method (Just – in - Time). It is desirable accounting based on time, not on money (T.B.A. – time based accounting). The quality of the decisions increases if the industrial dynamics is used (J. Forrester) which shapes the effect of the delays and the strategies are adopted taking into account time (T.B.S. – time based strategies). The existing competition is based more and more on time (T.B.C. – time based competition) but not on price.
- The efficiency depends on the grade of the anticipation, too. [3] Short run efficiency is different of long run efficiency.
- Managers know that there are discontinuities in time.

2. Some aspects of time management

In the 80's there was a trend in management and it was called *time management*. But P.Drucker was one of the first researchers who identified the role of time in management. The main activities in which time is determining are:

Forecasts

The management of a business implies the existence of a forecast of the future because the industrial existing system transposes itself in the future and the present decisions must correspond with a future environment. Management is predictable by definition.

The elaboration of a forecast presumes the understanding of the changes, their anticipation and the quantification of the effects.

The forecast is a quantitative and qualitative study about future (future states of the environment and organization). Unlike the forecast, diagnosis describes the existing state.

The forecast must make the difference between the possible futures (with a certain probability) and the impossible ones. And the strategy has to define both the desirable and undesirable futures. [4]

The study about the future has different names:

- Conjecture – tries an intellectual frame of the future (author Bernard de Jouvenel)
- Futurology – tries to determine the evolution of the civilization (author Oscar Flechtheim)
- Prospect – searches the future implications of a decision (author Gustav Berger)
- Forecast – elaborates a scientific study regarding the probable evolution of some events or indicators (defined by CEE – ONU).

There are a lot of types of forecasts: demographic (after 1770), meteorological (after 1860) and even cosmological (funded by H. Hayoshi). At the planetary scale the horizon of the forecast is described as it follows: present (10^o years), present future (10^1), near future (10^2), intermediate future (10^3) and remote future (10 thousands years).

The development of the products

A method which reduces the time for bringing the products on the market is the ***competitive engineering***. Competitive engineering is mainly a method of projection and a method of preparing the production, in particular. The purpose of the competitive engineering is to reduce the time needed for these activities.

The method is well known in literature as: convergent engineering, simultaneous engineering, competitive projection, the competitive development of the products, initial implication in production, total engineering. It proposes the reduction of the time of projection; but it was found that other activities might be included, too, in the system that was created: provisioning, production / fabrication. Therefore, the name of "engineering" is justified.

The competitive engineering method is a technique that contributes to the reduction of the time to bring the products on the market (Time-to-Market). It is usually used together with other methods with the same purpose, such as Kanban which reduces the time of fabrication and M.R.P. II which reduces the time needed for the planning.

Time became the main competitive factor and the way in which the company manages its time is the main tool in order to get the competitive

advantage. The profit depends on the ability of bringing to the market a product before the competitors. In some sectors of activity, a 6 months delay on the market goes to a loss of 1/3 of profit. The projection speed allows personalized products to be made with higher price, purchasing in this case not being determined in a high degree by the price.

The influence of the competitive engineering on the quality consists in the possibility of using the latest solutions in the field. The product may be brought on the market after a long period of preparation (tp) (this period may be about 5 years for the complex products). Even if the best technical solutions are used in the beginning moment of the preparation, there is already a gap in the moment when the selling begins.

For this reason, a method that provides the reduction of the preparation time (tp) contributes to the improvement of the quality. Theoretically, the volume of the necessary financial resources is the same but the company has to have the capacity to use them. We can explain this way the fact that the financing contributes to the accomplishment of quality, too. Certain experiences show that the costs of the preparation reduce themselves as well. It is considered that the solutions chosen for the projection influence the cost of the product in a proportion of ¾ and their viability depends on the time available for the technical conception.

Preparation time (tp) is made of a succession of phases; the longer a phase is the better the quality is. Paradoxically, competitive engineering proposes to reduce the preparation time, but increasing the time for each and every phase of this activity.

The principle of the method consists not merely in breaking up the activities into phases and under phases, but in determining their succession rather. In the classical vision, the serial engineering is used (Fig. 1). But the serial projection separates the projection compartment by the other activities and it develops itself "behind a wall".

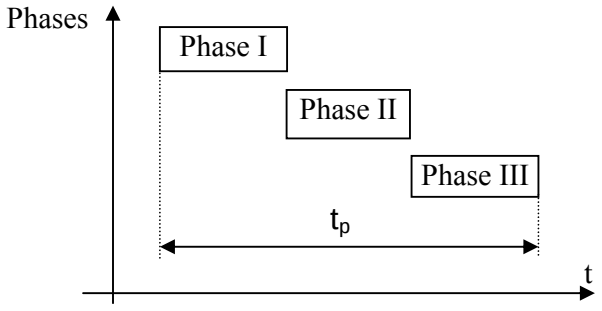

Fig. 1. Serial engineering

The competitive engineering appeals to the principle of the parallelism which has found its practical applications only in fabrication until recently. Through the competitive engineering the use of this principle is extended. The competitive engineering allows many activities to be done in parallel, or begin after a short period of time, when the previous phase has not finished yet. The essence of the competitive engineering is the way in which information is treated.

The principles that have to be adopted are the following:

- The anticipation even in the initial phase of the project structure;
- The distribution of the technical documentation of each and every phase;
- The development of a control system for all the technical changes which appear within the whole development of the project.

The implementation of the method implies the building of a team of planners. The planners work almost independently, and both a project leader who coordinates them and a digital adequate support (for example a Dictionary) exist. The Dictionary of the project provides the asynchronous communication inside the group. Every planner works for a part of the application and produces a lot of elements for the project. The role of the leader of the project is to distribute the duties between the planners, to coordinate the activity of the group and to integrate the schemes in the global scheme of the application. The manager of the Dictionary who can be even the leader of the project has the following tasks to do:

- Sets up the rules for the import / export of the information between the unit of projection and the Dictionary.
- Manages the synonyms and homonyms for the accuracy of the vocabulary;
- Periodically revises the Dictionary. Some temporary elements may become a part of the Dictionary model. For this reason the congruence and the redundancy of the project are studied.

Information changed between the units of projection is:

- data for the project – got by projection;
- reusable modulus – projection elements kept in a library;
- knowledge for projection – the method that guides the planners for the accomplishment of the project.

The actualisation of the costs

The decision of the present creates revenues in the future time. In the same time the expenditures of the future must be planned in present. The expenditures and the revenues must be actualised at the present values in order to be comparable.

The cause of different value of money in time is not the inflation, but the capacity of the financial resources to provide revenues in time. These revenues depend on the way in which money is used.

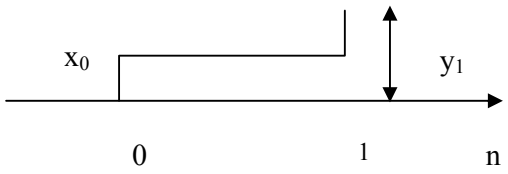

Fig. 2. The value of money

At moment 1:

$$y_1 = x_0 + i \cdot x_0 = x_0 \cdot (1+i) \tag{1}$$

At moment n:

$$y_n = x_0 \cdot (1+i)^n \tag{2}$$

$$V = R\frac{1}{(1+i)^n} = R \cdot F_a \tag{3}$$

where: V – present value of money; R – value after n years; i – actualisation rate
F_a – actualisation factor

Experience curves

It was noticed after 1930 that the reiteration of the actions had an effect on the operational time because of a learning process. The learning process was accepted after 1945 when airplanes companies observed that the assembling time decreased continuously, in a predictable way. Then it was noticed that this process existed in other industries, too.

The decreasing of both the assembling time and the costs are expressed as a percentage according to the doubled production volume. Therefore, a learning curve of 80% means that if the number of the products is doubled in a period, the average cost diminishes at 80% in comparison with the level before doubling. For example, if 100 airplanes of a kind have been produced until this moment, with an 80% learning curve, the cost of the 200th airplane should be 80% of the cost of the 100th airplane; in its turn, the cost of the 100th airplane is 80% of the 50th airplane (fig. 3).

These curves may be expressed in time units; the influence of the inflation on the costs does not appear in this case. The learning curves become straight lines if we put them in the logarithmic coordinates (Fig. 4).

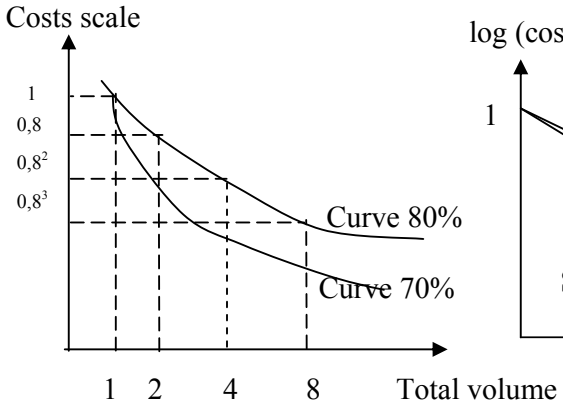

Fig. 3. Learning curve

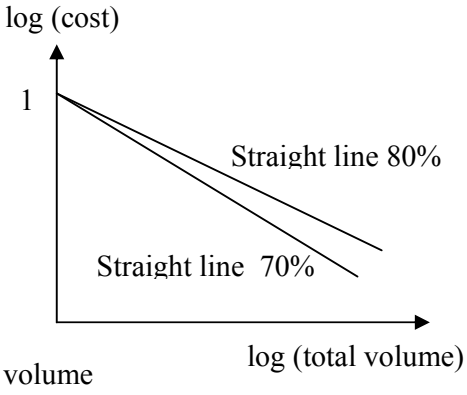

Fig. 4. Learning curve (logarithmic coordinates)

From the qualitative point of view, the learning process may be expressed through the function: [6]

$$\ln y_i = f(S_i, t_i, \frac{1}{t_i^2} Z_i) \tag{4}$$

where: $\ln y_i$ – the level of learning; S_i – education measured in years; t_i – work experience measured in years; Z_i – vector which depends on other variables

The function indicates that learning is directly proportional to experience and inversely proportional to square experience because learning is declining in time.

The consultancy company BCG (after 1965) studied thoroughly this research and described the experience curves. Learning curves referred only to the production costs. These show a reduction of 20-30% of the total costs (capital, research, marketing, administration, production) every time the total production is doubled.

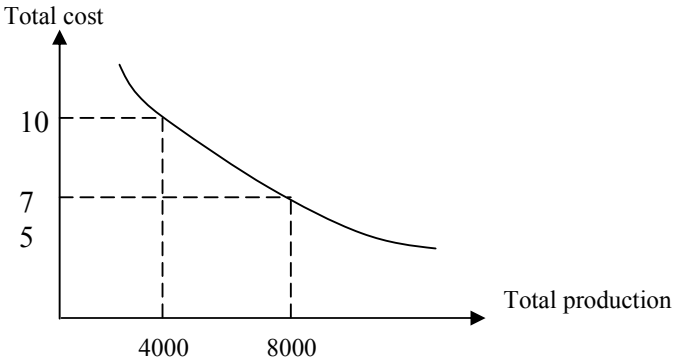

Fig. 5. The experience curve

The experience curve is written as an exponential function.

$$Y = a \cdot x^b \tag{5}$$

where: Y – time for the production of the n^{th} unit; a – time needed for the production of the first product; x – the rate of the learning curve; b – elasticity coefficient (how many times the production was doubled between the first and the n^{th} product).

The experience curves are used in many cases:

- Predictions about the manual labour, the production planning, the costs, the budgets;
- The purchasing of some goods from outside of the company;
- The evolution of both the company and the industry;

Ignoring the learning process goes to the refusal of some orders because they seem too costly or to wrong planning or to the acceptance of some prices too high for some goods.

The rate of learning was calculated and here are the conclusions about the values:

- Manual labour (airplanes assembling - 80%, petroleum processing - 90%, repairs -76%, steel production - 79%)
- Costs (cars - 86%, integrated circuits - 79%, electronic watches - 74%, memory disks - 76%, lorries - 80%, conditioned air equipments - 80%, cement production - 70%).

Learning process is influenced by a lot of **factors** which reduce the cost of a production cycle: [7]

Factors of labour

- The experience of the worker: this is the initial explanation of learning. The reduction of the cost through the increasing of the efficiency lasts on the short run. These costs reductions may be kept longer only if the labour is stable. High fluctuation of labour may annul both the gains in efficiency and the labour interest in increasing the productivity.
- Managers' implication – tight collaboration may reduce the costs. The importance of the managers' implication is undervalued sometimes, not only in the learning process, but in other purposes, too.
- The organization of labour – a systematic training programme, an intelligent division of labour and a plan for labour mobility and carrier promotion are all factors with a major role in the reduction of the costs.

Changes in the production process

- The improvement of the labour methods. These depend on the understanding of the connections that reduce labour time, the variations in the succession of the operations for a product, the production improvement, stocks control, the use of the mechanisms that facilitate the production.

- The substitution of the labour with the capital. It is a traditional method that allows the reduction of the average costs through the substitution of the manual work with the mechanised work.
- The replacement of the old equipments with other more competitive, more flexible, more rapid, longer lasting.
- Vertical integration. Increasing the scale of the process lower costs may be obtained even if they could not decrease continuously.
- Technological changes – represent reprojections of the productive process on the basis of new concepts from the fundamental research. This goes to a rethinking of the way in which certain products are accomplished. For this reason there are changes in the fabrication ways, workers training, production and stocks control.

Product change

- Reprojection of the product. A product may be often simplified in order to reduce manual labour. For this purpose the analysis of the value may be used. Reprojection of the product goes to the increase of its performances with certain effects on the increase of the market value.
- The replacement of the raw material. The replacement of aluminium with steel, of plastic materials with glass or metal, of metal with wood could go to the reduction of the fabrication costs through small changes of the projects.

Learning curves are used as *strategic instruments* as well. They could indicate, for example, the evolution of the production capacity or the number of the necessary providers as well.

The price strategies could be set up on the basis on the experience curves. The strategy for setting up a limit low price is interesting when the following conditions are met:

- Life expectancy of the product is long;
- The product is standardised and the risk for the desires of the consumers to have an immediate repercussions on the market is low;
- The market is expected to grow rapidly;
- The slope of the learning curve is apparently high because it might be a barrier for the free entrance of other companies on the market;
- The product is not protected by patents;
- The company is not in the course of liquidation.

Setting up the low prices allows the company to gain both important market quotas and profits (Fig. 6)

Experience influences the productivity as well (the experience can be expressed by the total number of realized products) (Fig. 7)

New companies that enter the market have to find isolated segments on the market and turn them into their own advantages. On the other segments of the

market there are old companies with economies of scale, lower costs and higher productivity. It is important that certain niches should be found.

The intensity of the competition on the large markets determines the big international companies to use the resources placed at their disposal by remote countries. Clients take advantage of the low prices and do not orient to the new companies.

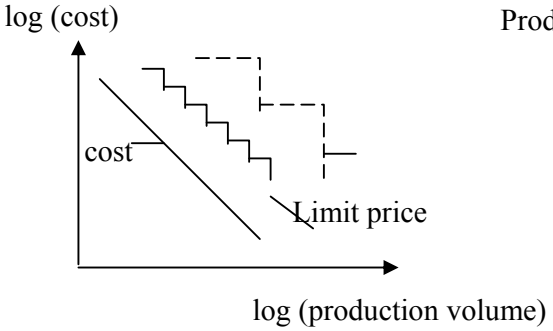

Fig. 6. Strategies for setting up the price

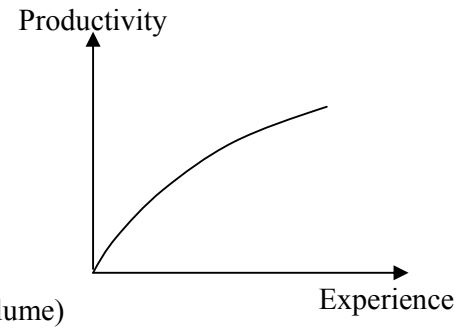

Fig. 7. Change in productivity

Learning curves may be applied where the production depends on the labour quality. They may be used in a lower extent where the rhythm of the labour depends on the performance of the equipments.

Even if the learning process is real, the productivity in the developed countries seems to have been at the same level lately. The explanation could be:

- Low productive investments probably caused by the increase of the economic uncertainty;
- Very big increase of the energetic costs;
- Law constraints (for example, the ecological ones) which need unproductive investments;
- The migration of the labour force to the services sector;
- The increase of the number of unemployed;

The following aspects could be added at those described above:

- The orientation of the companies to the efficiency on the short run;
- A clash between the productivity and the tendency to personalize the products;
- We can not trust thoroughly the data about productivity in the sector of services.

3. An empirical analysis of the experience curves in the higher teaching system

From our point of view, the experience curves may be applied in the teaching system. “The production” in this field of activity depends on the labour

quality so we thought about a survey through which we could analyse the experience curves in the teaching system.

We made a simple questionnaire with questions about the type of course a professor teaches (technical or socio – human), the time needed for the preparation of a lecture (**the same content of information**), time in which a professor teaches effectively a lecture previously prepared. The number of the respondents was 25 for the professors who teach socio – economic courses and 25 for the professors who teach technical courses.

First of all we have to say that the respondents are divided in two categories: either professors who teach socio – human courses or professors who teach technical courses.

Moreover, some professors from both categories are at the beginning of their professional carrier and have been teaching the course for one year. Others have been teaching their courses for more than 5 years.

The results of the survey for the professors who have been teaching a socio – human course for one year only are:

1. the time needed for the preparation of a lecture (the same content of information) decreased by 24.5% on an average; (Fig. 8.)

2. the time in which young professors teach a lecture previously prepared decreased by 9% on an average.

The results of the survey for the professors who have been teaching a socio – human course for more than 5 years are:

1. the time needed for the preparation of a lecture (the same content of information) decreased by 83.66% on an average; the decreasing of the time needed for the preparation of a lecture in the first years of activity is around the average value of 24.5% calculated for the young professors. (Fig. 8.)

2. the time in which these professors teach effectively a lecture previously prepared decreased by 34% on an average.

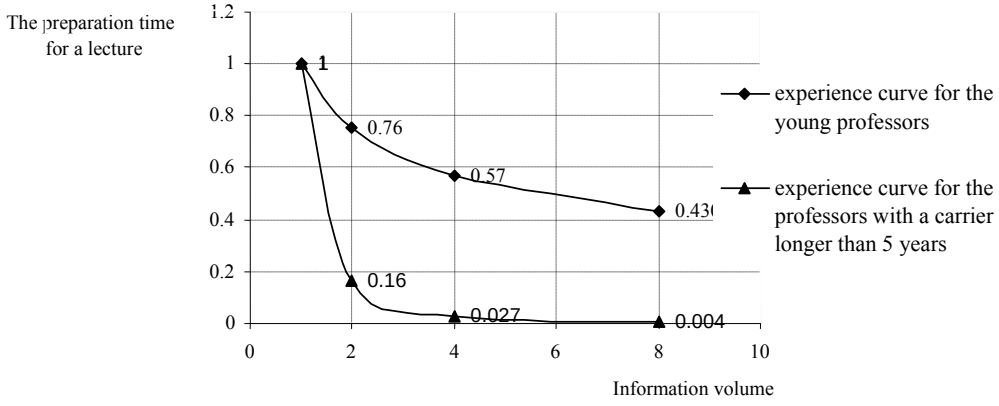

Fig. 8. Experience curve: socio – human courses

The results of the survey for the professors who have been teaching a technical course for only one year are:

1. the time needed for the preparation of a lecture (the same content of information) decreased by 13% on an average; (Fig. 9.)

2. the time in which young professors teach a lecture previously prepared decreased by 18.3% on an average.

The results of the survey for the professors who have been teaching a technical course for more than 5 years are:

1. the time needed for the preparation of a lecture (the same content of information) decreased by 43.73% on an average; the decreasing of the time needed for the preparation of a lecture in the first years of activity is around the average value of 13% calculated for the young professors. (Fig. 9)

2. the time in which these professors teach effectively a lecture previously prepared decreased by 15.66% on an average.

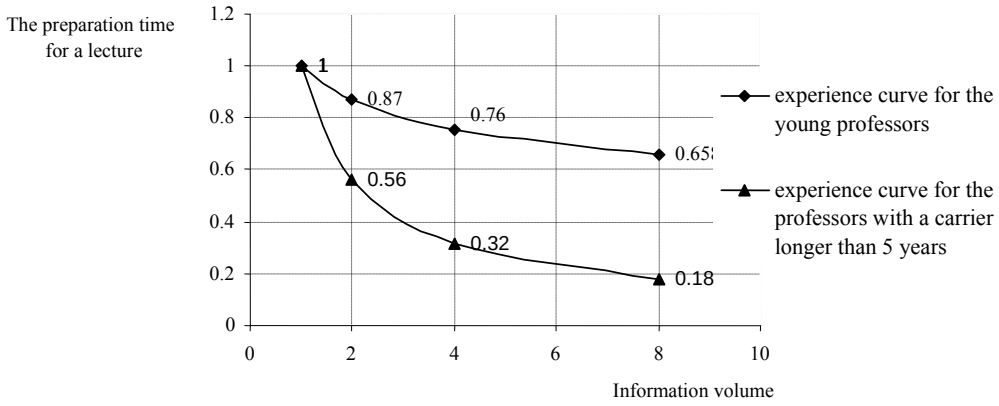

Fig. 9. Experience curves: technical courses

6. Conclusions

Time is included in products, processes or information. Unused time is a loss for a company. The efficient use of time gives a competitive advantage to a certain company.

Forecasts, competitive engineering, the actualisation of costs and experience curves are only few methods in management in which time has a very important role in the process of decision taking.

The originality of this paper consists in the empirical analysis of the experience curves in the higher teaching system. The paper offers both the authors' calculations and their conclusions on the basis of these calculations.

What are the conclusions of these calculations?

1. The time for preparing the same content of information for a lecture decreased both for socio – human and technical courses.
2. The content of the courses have been improved from one year to another;
3. The time needed for teaching the lectures previously prepared (the same content) decreased. From our point of view, the causes of this decrease are: professors master better and better the basic knowledge of their lectures from one year to another, the means of teaching have been continuously improved from one year to another or /and the students are more and more receptive;
4. Professors might use this decrease of both time for preparation a lecture and time for teaching the lectures previously prepared to add new knowledge to the basic content of their lectures.

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