# Application of technical analysis in management decision-making in higher education institutions

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**Abstract.** University management should be organized in such a way that it may provide the labor market with specialists needed today. In order to solve the problem, a hypothesis on the possible use of such method of technical analysis as the moving average method is being applied for forecasting in the financial market. The market analysis makes it possible to identify specialties that are currently in greatest demand. At the same time, universities do not immediately respond to the needs of the labor market. An average university training is four years; therefore, university graduates of the highly demanded specialties will similarly appear four years late. The moving average method to predict future labor market demands for specialties enables universities to train the necessary specialists for the market without delay. The results of the market analysis are the basis for the development by the university administration of strategic and tactical solutions necessary for the development. At the same time, special attention should be paid to ensuring the quality of specialists' training, which corresponds to the demand of the labor market.

## 1. Introduction

Improving the management of higher education institutions during this time of growing economic internationalization and globalization is becoming increasingly relevant. The necessity to provide effective management decision-making, which has an influence on an HEI further performance, is urgent due to the following reasons. Girst, high-quality management decisions result in high quality educational services. Second, it is the quality of education that entrant students consider when choosing an HEI. Third, prospective employers pay attention to educational quality as well. All of the above mentioned reasons improve am image of the university and competitiveness in the educational marketplace [15-17].

As a result, management in the higher education sphere is becoming increasingly important. It is predetermined by the fact, that with growing competition, effective management is a means of accomplishing strategic goals of a higher education institution. Indeed, varied offers of educational services provoke interest in the systems of educational quality management, and a great variety of offers in the education market requires improvement in the quality of the provided services. Moreover,

effective management decisions may result in unique educational services which a particular HEI can provide, and entering students would compete to be enrolled, as well as employers fight to hire its graduates. Thus, the university management must monitor and coordinate the performance of a university, thereby ensuring the accomplishment of its goals in tough competition, the main goal being provision of quality educational services [1].

The peculiarity of decision-making in universities is the need to take into account labor market trends when determining the structure of the body of applicants.

## 2. Method

During the research we used a method of the system analysis which founder is von Bertalanffy [2]. Besides, authors were guided by fundamental works by such authoritative researchers in the field of adoption of administrative decisions as McCregor D. [3], Drucker [4], Shvager [5], Simon [6], Ran [7], Rezaei [8], etc.

Of great importance for the HEI management decision-making process are statistical techniques of analysis, including technical ones, which are relevant in decision-making in the financial market.

Statistical methods are the most wide-spread and well-developed forecasting methods. They help extrapolate quantitative variables of big systems, specification of quantity of the economic, scientific, production potential, data evaluating scientific and technical progress, ratio characteristics of separate subsystems, clusters, elements in the system of complex systems metric, etc. [9].

In the decision-making process extrapolation is widely used for anticipatory control as a part of the general curve of development (trend), which is corrected with consideration of the past of the variable development, surpassing the variable to be predicted in its development.

Thus, the specifics of HEI activity enable an education institution to apply the forecasting method based on the technical statistical analysis.

## 3. Results

The products of HIEs are its graduates of different specialties, the demand for which is formed under the influence of different factors of the labor market. If the labor market needs specialists in a certain field, it results in an increase in the number of graduates in this specialty.

However, as there are many offers in the market, the consumers of an product of HEIs, mainly employers, choose quality. In this case, quality means the graduates with knowledge and skills required by the employers. High quality education, in turn, presupposes providing all the necessary conditions for its obtaining and suggests quality of management decisions taken in this organization. It is desirable that effective management decisions eventually result in high quality graduates.

Therefore, one can note a parallel between management decisions taken at an HEI and the performance of this university. One should also note that high quality graduates are a factor promoting an increase in the number of people who want to study at this HEI, and the increasing demand for its services results in growing prices. So, one can state that the basis for the high-quality of an HEI's performance is the process of management decision-making.

And here a question arises: can management decisions in a university be made with the analysis normally applied in the financial market? As the labor market is similar to the financial market [10], and if market laws are observed, a higher education institution can be regarded as its participant and its graduates as its "product" or "goods." All these factors speak to the effect that application of analytical methods, in particular, technical statistical ones suitable for the financial market, may be used in higher education institutions.

At the same time, one should not forget the necessity to define the market need for specialists in particular fields. Each higher education institution should have its own path of research, i.e. the University of Economics will probably be most interested in the analysis of demand for such specialties as Accounting, Finance, International Relations, Management, and Marketing. With the method of the technical statistical analysis one may forecast further trends in the employment of

graduates and decide what specialties should be focused on and given all the necessary resources, and what future management decisions should be taken in a particular higher education institution.

Therefore, if the technical analysis is based on the review of graphs of the market movement, particularly, its two components – fluctuation of prices and the trade volume during a certain period of time [7], – then while applying it to higher education one may consider diagrams of demand in specialties and the number of graduates in these specialties [10].

Thus, the technical statistical analysis allows the forecast of fluctuation of prices in the financial market. We shall apply methods of the statistical technical analysis for management decision-making, including forecasting the necessary number of graduates in the specialties in which the HEI provides educational services.

In general, the analysis graphs and algorithm are as follows (Fig.1).

The graph of this type consists of two parts: an upper part shows the number of the HEI graduates in a certain specialty, the lower one shows the demand of the market in specialists of this field.

We should note that the parts of the graph are interconnected, with an upper part being the consequence of the lower part. That is, there is a dependence of the number of graduates in a specialty on the market demand. It should be noted that the market demand for the graduates of a particular specialty influence the number of graduates immediately. It happens after some time and allows one to apply some methods of the technical statistical analysis.

In addition, the indices, shown in the upper and lower parts of the graph, also depend on a number of other factors, e.g., the demographic situation in the country, the image of a particular university, the education programs at a higher education institution, etc. In other words, we can say that the above-mentioned indices are influenced by the macro and micro factors which are analogous to fundamental analysis.
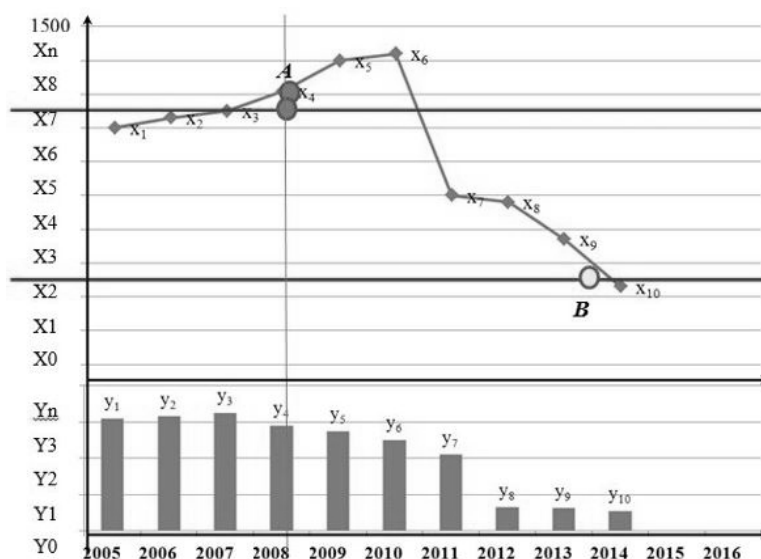


**Figure1.** Technical analysis method in HEI management [11].

The horizontal lines on the graph (XA and XB) are the "envelope," reflecting the maximum and minimum values of university preferences by the number of graduates in a particular specialty.

At Point *A* of Fig. 1 the number of graduates in a specialty goes beyond the upper limit of the "envelope." In the financial market, it would mean that at this point it is reasonable to obtain financial instruments and to sell them at point $x_6$. However, in the education market such short-term maneuvers are nearly impossible. So, point *A* shows that in the given institution the number of graduates of this specialty is increasing. In the graph, which is characteristic of the education market, the time period is given in years, not in days like in the financial market. So, this increase is typical at the beginning of the academic year. Here it is necessary to correlate the index of the upper part of the graph with its

lower part, in which the decrease in the index of the labor market demand in this specialty is shown. What does this indicate? As in the financial market, it shows that this development of the trend is inert and short-term. And, as the demand for the "product" is decreasing, the supply will soon decrease as well.

Nevertheless, we observe a gradual increase in the number of graduates of this specialty for some more years, and only then its rather drastic decrease. Why did this happen? The point is that, as a rule, the education market does not react quickly and adequately enough to the needs of the labor market. In addition, an HEI also graduates those students who were enrolled in this specialty when the labor market demonstrated a rather high demand for specialists in this field.

At Point *B*, on the contrary, we see the intersection of the trend with the minimal value of the "envelope". In much the same way, in financial analysis, the point of intersection would be a signal to sell financial instruments, but in the education market one cannot speak about the sale of its "products", so the intersection on the graph of the number of graduates with its minimal level speaks to the effect that the number of graduates is at a minimum and lower values have not previously been observed.

In both cases, one should pay attention to the lower part of the graph. Normally, its upper part changes in the direction the lower part does, though sometimes with a delay (as mentioned above). If the index of the number of graduates changes in correspondence with the index of the market demand in this specialty, we can be sure that this HEI has an excellent policy in the enrollment of students; the HEI's management monitors changes in the market and adapts its education process to the current requirements of the labor and education markets, thus, making timely and effective management decisions. Such HEIs tend to have high ratings and its graduates are in demand.

There is another point to consider. It is reasonable to monitor the market during the academic year. In this case, by its end one can get a good idea of the current situation in the labor market. It is of vital importance that the correspondence between the market demand for specialists in a field and the number of graduates in this specialty be observed [11]. In this case, if the HEI graduates "unique" specialists, the market will always give its requirements, and all the graduates of the given HEI will be employed, even if the lower part of the graph is decreasing and the HEI's number of graduates still exceeds the demand of the current labor market.

To apply forecasting to management decision-making in HEI, let us use the moving average method. Moving average is the general name for a group of functions, the values of which at each point are equal to the average value of the assumed function for the previous period. A moving average is normally used with the data of the time axes in order to diminish short-term fluctuations and define the main trends or cycles [12].

The calculation formula for the exponential moving average can be written like this:

$$ES_t = \alpha * P_t + (1 - \alpha) * ES_{t-1} \qquad (1)$$

where α is a weight coefficient with the interval "0-1," reflecting the obsolescence rate of previous data; the higher it is, the more weight new observations of random variables get, and the less important are the old ones; $P_1$ is the value of a random variable during the time period *t;*

$ES_{t-1}$ is the value of the exponential moving average during the previous period of time.

Let us consider the application of a moving average method to the Healthcare specialty.
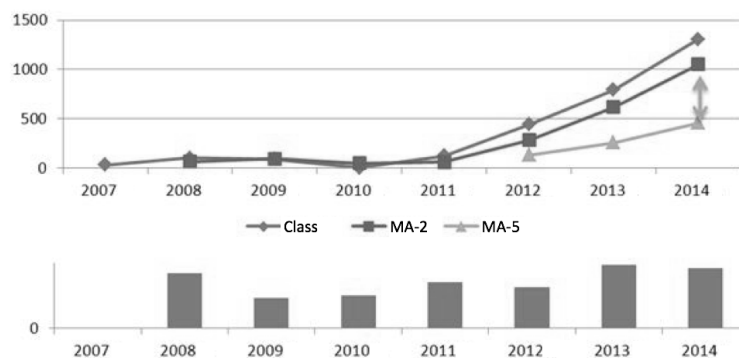
**Figure 2**. A number of graduates and demand for "healthcare" specialty [11].

In Fig. 2, one can see that the moving averages are diverging, and the demand in the specialty is decreasing slightly, though insignificantly. Therefore, the labor market does not have enough specialists in "healthcare," and the demand is still increasing. It should be noted that insignificant decreases in the number of vacancies in the market do not yet indicate the turn of the trend. To obtain precise data, one should study the labor market more in depth.

At present, despite the increase in the number of the "healthcare" specialty graduates, the current state of things is as follows. Statistics indicate that the majority of students study "nursing", "pharmacy", "social medicine," while there is a deficit of physicians in narrow specializations. This speaks to the effect that moving averages indicate the state of things and forecasts future developments correctly.

## 4. Conclusion

Which management policies should the medical universities have with such a state of things and forecasts? If the market has a growing demand for physicians with narrow specializations, many people may now want to study in this specialty, though there are problems connected with the length of the study (7-8 years) and, consequently, with the tuition. In this situation, the HEI management should focus on providing good facilities for education: a proper education environment, reasonable tuition payments, and, mainly, employment, which will be ensured if the graduates are high-quality specialists demanded by the market.

There is another thing to consider: in linear graphs there are always peaks. Generally, the peaks should be considered a local problem: how to correct drawbacks or maintain success [13], contributing to further development. To settle such local tasks, for each peak, a tree of objectives or a tree of challenges in enhancing educational quality are drawn considering the system approach.

One should pay attention to the advance peaks, because if one does not analyze facts resulting in the success in a certain criterion and does not take the necessary steps to maintain the advantage, it would soon be lost.

On the basis of the tree of objectives (challenges) for each advance/delay peak of the zero level, the track of scientific and technical development is defined and proper steps are taken towards achieving (or maintaining) the state-of-the-art level based on all economic calculations and reasoning [13].

Thus, the management approach based on forecasting (in this case, based on moving averages and demand in a specialty) is relevant during a period of increasing tempo of changes, and the opportunity to foresee future trends in a timely manner and develop a proper strategy to respond to them is necessary. Strategic planning is directed not inside, but outside. It is transition from the "closed organization" to the "open organization" model. For this management system, avoidance of assessment extrapolation, consideration of the variability of factors, the strategic analysis of the external and internal environment and alternative solutions are all necessary characteristics.

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