SOME METHODOLOGICAL QUESTIONS
OF THE PREPARATION OF FORECASTS

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SUMMARY

The direct reason of the development and the increase of the demand for prediction is to look for in the acceleration of social-economic development. At the end of the 19th century, and at the beginning of the 20th century have appeared those processes in the United States of America which changed basically the former, relatively calm market situation.
The primary condition of making the future processes probable and possible is the connecting mode of the past-present-future, the existence or lack of balance, the continuous or balk nature of processes.
If the given phenomena has precedents and those are living further in the past in any form, the mathematical-statistical so called hard methods get wide possibilities. But in those cases, when in lack of precedents a totally new developing period begins, the intuitive, professional so called soft methods come to the fore.
The lecture analyses the theoretical and methodical questions connected to the above with the purpose to improve the quality and goodness of the practical applications of predictions.

1. EMERGENCE OF THE PRACTICAL NEEDS FOR FORECASTS

A demand for forecasting (foreseeing) business processes appeared at the end of the 19th century as a result of an accelerated scientific and economic development. It is no accident that the birthplace of this phenomenon is the United States, where the results of the ever strengthening, and later exponentially rising, acceleration processes manifested themselves in the most evident and dominant way. A proof of this, for instance, is given in the book by Garfield V. Cox, professor at the University of Chicago, in 1929 (1), which says:

"The interest of American businessmen and economists in the problems of business forecasts has intensified by leaps and bounds in the past 15 years."

"More than half a dozen organisations of nation-wide recognition have specialised in preparing forecasts and in examining and analysing business cycles."

"A number of financial and business enterprises (banks, newspapers, etc.) have specialised in examining and publishing prosperity cycles."

"There has been a sudden rise in the number of larger firms, which start to employ economists and statisticians for the examination and forecasting of business processes."

The abrupt strengthening of the future-oriented attitude of American businessmen shows that a long, relatively peaceful, development period is over. From the point of view of our examination, it was characterized by the following factors:

➢ **the market was sharply divided** into clear sections; the manufacturers and merchants laid down the written and unwritten rules of living side by side and of the sovereignty of domains;

➢ **the tendencies of technical development were well predictable;** the pace of development was slow; there were only occasional and individual breaking points and qualitative leaps. The life cycle of products was long; there was no surprise made by the appearance of a new substitute product;

➢ **the factors influencing the demands of the market, the actions of the actors in the market competition were clear-cut; the relations between cause and effect were easily recognisable; the action strategies of competitors were foreseeable;**

➢ drawing the consequences from the above mentioned, it is obvious that **the conditions for forecasting were favourable;** for businessmen (managers) with suitable business-professional practice and good flair for economy the business future was safely predictable; good forecasts based on the opinion of specialists and qualitative judgement could be made.

During the long period prior to the end of the 19th century, no **subjective** demand for effective methods of forecasting was formulated; successful management and

business activity did not call for the conscientious scientific investigation into the future.

At the same time, the **objective** conditions were also missing, because it was not until the beginning of the 20th century that a scientific methodological apparatus, i.e. mathematical statistics based on probability theory which could handle stochastic processes, appeared.

It stands to reason, that the scientific methods of forecasting **deterministic** processes date back to ancient times, closely related to the development of natural sciences (mathematics, physics, astrology). The evolution of these processes is foreseeable with complete certainty, with no unexpected elements. (The sun rises in the East, and sets in the West; the length of the covered distance depends on speed and time; the different stars and zodiacs always appear at the same time and in the same place, thus giving a firm basis for orientation and creating the prerequisites for navigation. A lot more examples could be listed in the above mentioned fields.)

Scientific forecasting based on natural sciences boasts a long history; methodological bases were created in a relatively early phase of development.

The scientific methodological apparatus capable of handling deterministic processes does not meet the requirements set by probability theory processes, though this demand, only in some elements, of course, emerged quite early. E.g. **Aristotle (384–322 B.C.)** was aware of processes of stochastic character and spoke about worlds "above the Moon" and "under the Moon". In the former case, there is a completely regulated and foreseeable system: the orbital movements of planets were defined by foreseeable and pre-calculable rules. Yet, in the latter case, there is uncertainty and incalculableness: the fine, sunny weather unexpectedly changes for rainy and windy. The possible changes of weather can only be described by **prognoses,** which, ab ovo, carry some kind of uncertainty. Weather prognoses made Aristotle formulate a fundamental principle, which, when interpreting forecasts, should be noted even today.

A definite need for business forecasts can be detected in the case of **Solon (640/30–559 B.C.)**, who threw light upon the relationship between scientific observation and business success, and, on the basis of the examination of prosperity cycles, sold the orange groves cheaply bought up in times of poor harvest at a good price in times of rich harvest.

These are just occasional examples; it was not until the end of the 19th century that practical and methodological needs emerged and the idyllic period described above was stirred by new, disturbing events, e.g.:

➢ Unexpectedly, **new actors appeared in the market**, the rivalling producers and vendors showed no respect for the former market borders.

➢ Suddenly, **new, more up-to-date and cheaper products** gained ground; the more expensive, obsolete products became impossible to sell; masses of producers and merchants went bankrupt.

➢ The **scientific-technical development** went off at a gallop never seen before. Revolutionary changes took place; the life-cycle of products drastically shortened, research accelerated.

CONSEQUENTLY:

● the tranquillity of the market was over once and for all; the number of actors gradually grew, business processes, the relations between cause and effect became more confused;

● the needs for foreseeing the probable business future and expected events spread like wild fire; their manifestation and well-founded character both methodologically and scientifically became more competent;

● in addition to the investigation into and forecasting the processes of macro-economy (prosperity cycles), more and more importance was assigned to the micro-sphere and the needs for forecasts related to direct business achievements and profit.

From the point of view of the methodology of business (economic) forecasts, Oscar Morgenstern's book published in 1928 (2) is a milestone. It describes and sets the basic categories and interpretation philosophy of economic forecasting still in force in our days.

The development which started in the field of mathematical statistics in the first third of the 20th century intensified in the following decades, reaching the present level by the appearance of computers. Among the basic methodological works, I would mention the specialist book (3) written by the triad of authors Makridakis-Wheelwright-McGee as the most prominent.

Eric Jantsh, commissioned by OECD, was the first to summarize and classify forecasting methods (4).

Achievements of the scientific research with methodological purpose at international level are demonstrated by the publications; the data of the following breakdown are provided by the U.S. Library of Congress:

Publications on Future Forecasting

Year	Book (piece)	Article (piece)
1969	79	no data
1970	95	no data
1971	109	21
1972	139	119
1973	181	198
1974	215	223
1975	246	619
1976	323	647
1977	292	631
1978	317	989
1979	305	993
1980	319	1.016
1981	334	1.006
1982	348	924
1983	388	1.026
1984	357	1.183
1985	349	no data
1986	370	no data

It is worth giving a brief overview of the situation in Hungary, as there was a considerable break, deviation and backlog in this respect:

1. PHASE 1 (1945 – END OF THE 1960S)

This phase is characterised by complete indifference to business forecasts both in objective and subjective terms. (This was also deepened by political principles and ideology: the controlled economy of socialism definitely ruled out all other sciences concerned with the future, and having roots in the bourgeois society.)

The economy was controlled by issuing orders to carry out the centralised plan; the major factor for the units of micro-economy was not the market, but to fulfil (or even overfulfil) the plans, which, consequently, determined the different forms of recognition and paying premium, etc.

Business forecasting would have automatically been impossible and unreal in this situation, as it would have thrown a shadow on, and interfered in, the activities of controlled economy, i.e. the guiding star of the economic management of companies. (For the sake of the historical truth it should be noted that even in other types of economy, business forecasting remained in the background during the time of shortage economy.)

2. PHASE 2 (END OF THE 1960S – END OF THE 1980S)

The beginning of this phase is usually marked by a particular year, 1968, in Hungary. It is related to the introduction of a new mechanism of controlling the economy. (As it is known, it was an attempt fundamentally doomed to failure to adapt the basis and some elements of market economy to socialist conditions.)

This phase is characterised by economic development and an ever-strengthening market economy, which more and more often, and in more and more aspects, demanded place and role; exclusion and disregard led to growing tension and more problems. The system of plan orders was replaced by the concept and methodology of plan-building, thus companies were given the chance to make their annual plans on their own, to estimate market tendencies, i.e. to prepare plans based on business forecasts.

Unfortunately, this promising attempt failed very soon as a result of the secondary distribution of incomes: companies which were successful in the market and produced surplus above the average were deprived of their profit in favour of unsuccessful companies. The expansion of business forecasts in practical terms remained an illusion.

3. PHASE 3 (END OF 1980S ONWARDS)

This phase is evidently related to the social and economic changes of the system in East European countries. It is plain to see that the objective possibility for the wide-scale expansion of business forecasting has been created, the social and economic conditions are given. The market conditions taking shape, the peculiarities of the transitional period (i.e. there is no pure market economy, there is still a maturing-purifying process going on) are an obstacle to the wide-scale expansion in several aspects. (Suffice it to say that in the first half of the 1990s the flow of productive capital into the country was not significant, whereas servicing, counselling and trading companies played a dominant role. Moreover, the so-called stray capital also gained ground in the early period.)

It is well-known that even in market economies it is mainly the manufacturing and trading companies with vast investment capital and long-term schedules that regularly make and use business forecasts and assign a dominant role to the analysis of the future.

It seems natural that the practical background of the interest in methodological questions was insufficient in Hungary in the past decades. Till the end of the 1980s it was the research units and departments at universities that served as workshops for the methodological improvement of forecast in Hungary. The most significant methodological specialist book of this period was published in 1978 (5).

From the beginning of the 1990s, the change of the economic system, the transition from socialist planned economy to market economy principally created good conditions for the emergence of practical interest in forecasts and for methodological development. However, a big obstacle for this theoretical possibility to come true is the controversial situation deriving from the transitory state of the economy, and also the disturbing factors in the emergence and prevalence of the laws of the market. A special situation was brought about the fact that in the first half of the 1990s, in commerce and service, the country was overflowed by trading capital, the majority of which was meant to get hold of the profit of just a few prosperity areas, but there were no ideas on the long run. Thus, future-orientation reached a rather low level. The appearance of productive capital caused a significant change in this situation, however, future research activities were limited by the big multinational companies to their own parent companies exclusively, which, naturally, did not boost any upturn in Hungary.

We are the witnesses of favourable changes in the first year of the 21st century: with the value of the Hungarian intellectual capital being recognized, there is a gradual shift of certain management, planning and marketing activities to domestic territory, so there is a growing demand for future research, forecasting and planning.

After the short historical overview, let's go on with methodological questions.

2. SELECTION CRITERIA OF FORECASTING METHODS

2.1. STAFF REQUIREMENTS OF SELECTING THE METHOD

When choosing the right method for the examination and forecasting of the given set of problems,
- the professional knowledge and
- the methodological skills

of the given staff member (or team) play a key role, both in positive and negative sense.

It is essential to make a distinction whether the staff participating in the selection process basically belong to
- the end-user circle, or
- the technical staff elaborating the method.

At the end of the 1970s, in close relation to the development of computer science, a method-oriented development process started; as a consequence, the complexity of forecasting methods kept growing. In a decade's time, with a change for the opposite, even the interpretation of outputs called for advanced methodological knowledge and skills.

At the end of the 1980s, "the easier – the better" philosophy led to a halt to the wanton development of forecasting methods, i.e. development for their own sake. With reference to the witty example described in J. Scott Armstrong's book (5), the case is similar to that of the rain-dancer, so traditional in African tribes, who tries to conciliate the rain god with his dance in the time of drought. The rain-dancer can be so much spell-bound by the joys of dancing that, in the end, he forgets about the original purpose of the dance and just dances to please himself. It is also one of the encroachments of the dancer that, at the end of the dance, when drought persists, the good dancer tries to convince his audience that a nice dance is much more important than rain.

The climax of all this is the point when the science of rain-making changes into the science of rain-making dance.

Modern rain-makers and forecasters (prognosis-makers) reached this climax at the end of the 1980s, when a number of forecasters explicitly admitted dealing with certain forms of the Box-Jenkins model as something absolutely unusable as far as practice is concerned, but very interesting and entertaining when coming to theoretical and methodological aspects.

In the addition to the above mentioned, when choosing the right method, we have to take into consideration the following main factors causing distortions or dangers:

a. professional partiality, which is rooted in the "professional blindness" of the given staff. Let's take an example to clearly demonstrate the problem: a complicated case is presented to a homogeneous expert team, but there is no agreement among the different experts, financial, engineering and IT, etc., on what should be considered to be the most important;

b. different methodological training background, which can lead to a special situation: different methods for the forecasting of a certain phenomenon or process are defined by a statistician (e.g. time sequence analysis), an econometrician (e.g. econometric models), and a psychologist (e.g. expert methods);

c. one-sided methodological orientation can be a fault: a certain method is forced and wrongly applied, i.e. an application sphere is looked for to match the method. It can be illustrated by the analogy known as the law of the hammer: if a child is given a hammer, he/she will probably find different objects to be hammered all over the house (table, chair, corners) in a few minutes;

d. lack of innovativeness, a real and timely problem: for solving and forecasting new problems of different qualitative character, the same old solutions and methods are applied.

The above mentioned facts speak for themselves: when selecting and applying the forecasting methods, it is of utmost importance to provide the right staff. Hereinafter,

let's suppose that there are no distorting factors in this respect, we manage to make the desired decision and can turn all our attention to the objective criteria for the selection of the applicable methods. Two interrelated topics should be touched upon here:

- linkage of *past-present-future*
- *present-future* equilibrium .

2.2. LINKAGE OF PAST-PRESENT-FUTURE

The emergence and examination of this problem is related to the presupposition that the closer the future is to the present, the smoother the transition is from the present to the future, the easier and simpler it is to make forecasts.

Our approach, starting from the basic case, can be demonstrated by a simple figure showing the arrangement of past-present-future points:

past   *present*   *future*
                                          continuing process
                                          starting process

If the past tendencies of change of a given phenomenon live and make a forward roll into the future, we call it a continuing process. On the contrary, when we have to estimate the future evolvement of a phenomenon which has no antecedents in the present, it is called a starting process. It can be put down in a function as follows:

$$Y_{t+z} = f(\alpha y_t; x_{t+z}; u),$$

where
α = transformational coefficient, which expresses the linking manner of the past and the present
$$0 \quad \alpha \le 1$$

Y = value of the examined phenomenon
t = point of time in the present
z = forecasted length of time
X = new factor, which has no sense in the present, but will have in the future
u = random variable factor.

If X ˉ 0, then new elements, imperceptible in the present and the past, will not occur in the future; the future value of the given process can be deduced statistically from the antecedents. More precisely:

$$Y_{t+z} = f(\alpha Y_t; u),$$

If $a \approx 0$, then we see a new phenomenon with no antecedents, the future evolvement of which cannot be deduced from past antecedents:

$$Y_{t+\alpha} = f(X_{t+\alpha}; u),$$

It is plain to see that the statistical chances of making forecasts are favourable in the former case, and unfavourable in the latter.

The same problem, though from a different point of view, is presented by examining the equilibrium state.

2.3. EQUILIBRIUM STATE BETWEEN THE PRESENT AND THE FUTURE

In this respect, within the methodological apparatus of forecasting, we can examine how stable the equilibrium between the present and the future is. If equilibrium prevails, the possibility of using the methods of classical mathematical statistics is wide-ranging.

The chart below proves the above mentioned:

Based on the separate sections, a table showing an interpretation of the equilibrium can be drawn up.

Period of observation	Forecasted period	Equilibrium state
A – B	B – C	Equilibrium
B – D	D – E	Partial conflict
C – E	E – F	Total conflict

Equilibrium means an unhindered process starting from the past through the present into the future. It presupposes the constancy of the given process. (Evidently, this presupposition is only true in principle as far as economic and social processes are concerned; the "constancy of the world" is a fiction from theoretical and practical points of view.)
The practical emergence of the partial conflict can be considered a typical case; it should be taken into account in short-term and long-term forecasts.
Total conflict presupposes nearly the complete lack of the past, or a considerable lack of information related to the past, and is built on the no-antecedents character of the future.
It is clear from the above mentioned that the equilibrium is based on the uniformity and constancy of the qualitative and quantitative parameters of the linkage between the present and the future.
(If, for example, the past is characterized by the $Y = 620 + 15\ t$ linear trend function, the same parameters of the same function type will be valid for the future too.)
In the case of partial conflict, the quantitative link is broken, but the qualitative one still sustains. (The linearity characterizing the past is true for the future too, however, the parameters of the function will be modified numerically, e.g. $Y = 1270 + 180\ t$).
In the case of total conflict, both the quantitative and qualitative links are broken, so a completely new development course will emerge. (Linearity is no longer true in the future; a new type of function, namely, the exponential function will be dominant.)
Forecasting methods to be applied can be classified into 3 main groups according to the above mentioned interpretations of the present and the future:

a. Equilibrium state, or in a similar sense, **continuing processes**

The following scheme can be drawn :

From a statistical point of view, it is an important characteristic that we have information referring to the past at our disposal, we have a statistical database which makes it possible for us to explore and forecast the inherent tendencies and interrelations. This situation offers the possibility of applying the so-called **hard forecasting methods.** The application of the **naïve, mechanical** forecasting methods can be considered typical. The naïvety of applying this method means presupposing constancy, while the mechanical character is expressed by projecting and rolling the parameters of the past into the future without any change. The extrapolation of the main trend of time series and that of the **correlation** links in the past, and also that of the parameters of **regressive functions** describing these links.

b. Total conflict, or in accordance, **starting process**
There is no quantitative information at our disposal, no statistical database. (e.g. the production of a new product is launched, but it is impossible to deduce the turnover in the coming months or years from the past; it stands to reason that no statistical data are available.) In this respect, the application of the so-called **soft methods** are preferred; the application of heuristic and intuitive methods and those ones which are based on expert assessments can serve a good purpose.

c. The existence of **partial conflict** is a continuation of the processes of the past and the present into the future in a modified way; the so-called **modified, emphatic forecasting methods** will play a key role.

Emphatic forecasting is based on the principle that the pieces of information available are of different importance in terms of the future, i.e. they have **different future content**. In general, it can be stated that the closer the information is to the future, the higher the value of forecasting is; or, the farther it is from the future, the smaller its value is. The method of **exponential balancing** worked out especially for this purpose in 1970 is distinguished among all other methods applicable for the same purpose.

Based on the above mentioned, the conceptual and professional decisions to select forecasting methods can be made, though this task seems to be getting more and more complicated with the growing number of methods. The systematisation and classification methods from different points of view help us in orientation. The book by E. Jantsh mentioned before can be considered a basic work. A classification using the results of the 1970s and 1980s can be found in the already quoted books by Makridakis and Armstrong, while in the Hungarian specialist literature a classification by the triad of authors Besenyei-Gidai-Nováky (6) is worth mentioning. In spite of individual deviations, there are common features which are characteristic of nearly all types of the classification of methods.

Subjective methods

No repeatable exact quantitative formula

Source of the output is the expert's brain.

Objective methods

Well-defined methods, repeatable quantitative procedures at any time and in any circumstances

Source of the output is the computer.

Collective expert's assessment	Naïve, mechanical	Emphasized methods
Oral (brainstorming)	extrapolation of time series	harmonious averaging
classical		
anonymous		
didactic		
destructive-constructive	extrapolation of regressive parameters	exponential balancing
Philipps 66		
creative		
synectics		
Written:		
Delphi, SEER, Cross-impact		

After a complete assessment of methods and the examination of their characteristics, practical application can take place.

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Resümee

Man kann die Uhrsache der Stärkung und Entwicklung der Anforderung für die Forblicke in die Beschleunigung der gesell-schaftlichen- wirtschaftlichen Entwicklung suchen. Am Ende des XIX, am Anfang des XX Jahrhundert erscheinten in die USA Vorgänge, die die früheren, relativ ruhigen Zustände grundlegend veränderten.

Die Grundlage des Wahrscheinlichmachens beziehungsweise der Möglichkeit der zukünftigen Prozesse ist die Eingriffsart der Vergandenheit – Gegenwart – Zukunft, das Dasein oder der Mangel des Gleichgewichtes, der fortlaufend oder Ausgangs-charakter der Prozesse.

Wenn die Erscheinung hat einen Vorausgegangenen, welche weiterlebt, dann bekommen die matematische- statistische, sogenannte harte Methoden weite Möglichkeit. Aber wenn eine ganz neue Entwicklungsphase beginnt, ohne Präzedens, treten die intuitiven, sogenannten weichen Methoden in den Vordergrund.

Die Vorlesung prüft die theoretischen und methodischen Fragen mit der Absicht, dass sie die Qualität der praktischen Anstellung des Vorblickes verbessern.

A jövőbeli folyamatok valószínűsítésének illetve lehetőségé-nek alapfeltétele a múlt-jelen-jövő kapcsolódási módja, az egyensúly megléte vagy hiánya, a folyamatok folytatólagos vagy kiindulási jellege.

Amennyiben az adott jelenség előzménnyel rendelkezik, azok valamilyen formában tovább élnek a múltban, akkor tág lehetőséget kapnak a matematikai-statisztikai, ú. n. kemény módszerek. Azokban az esetekben viszont, amikor teljesen új fejlődési szakasz indul, előzmények hiányában az intuitív, szakértői. ú. n. puha módszerek kerülnek előtérbe.

Az előadás a fentiekhez kapcsolódó elméleti és módszertani kérdéseket vizsgálja azzal a céllal, hogy az előrejelzések gyakor-lati alkalmazásának minőségét, jóságát javítsa.

OROSZ ÖSSZEFOGLALÓ

Összefoglaló

Az előrejelzések iránti igény kialakulásának és erősödésének közvetlen oka a társadalmi-gazdasági fejlődés felgyorsulásában keresendő. A XIX. század végén, a XX. század elején az Ameri-kai Egyesült Államokban jelentek meg azok a folyamatok ame-lyek a korábbi, viszonylag nyugodt piaci helyzetet alapvetően megváltoztatták.