Is it possible to make scientific forecasts in social sciences?*

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Abstract

This article attempts to answer the question, whether and how it is possible to make scientific forecasts in social sciences through the investigation of the actual scientific-philosophical problems and methodological aspects of futures studies. Following a critical analysis it describes the scientific-philosophical features of uncovering and forecasting the possible futures from the classic predictions to the latest approaches. In the methodological chapter it turns its attention to the impossibility of making scientific predictions and demonstrates the methods with the help of which—reacting to the challenges of uncertainty, instability and various changes—futures studies can perform its original function, i.e. supports present decisions providing information about the future.

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1. Introduction

The problem with the ability to forecast has served as a basis for many scientific debates for a long time. Until the end of 1950s scientific theories were judged on the basis of their abilities to make predictions. However, heuristic power of theories widely prevailed over predictive power in the 1970s. In the 1990s deterministic approaches were relieved by novel treatment of instability and uncertainty. As a consequence, building qualitatively different futures alternatives, evolutionary self-organizing and studying chaotic behaviour have come into

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1 The plural case of future is used because many kinds of futures exist in the present, i.e. many kinds of futures might unfold. It is true that only one alternative/variant will be realized but after realization we speak about the present and not the future.
focus instead of making predictions. Futures studies has turned its attention from reality’s monolithic cognition to cognitive interpretation.

Meanwhile, in practice, a dual tendency can be noticed in the field of forecasts. First, businesses have noticeably begun to dissolve their departments and staffs dealing with forecasting. Second, the cost of forecasting has skyrocketed while their reliability has shown a stagnating/declining tendency.

Due to the change of demands in the fields of theory and practice towards forecasting, it is essential to rethink the theoretical and methodological aspects of futures studies and forecasting at the beginning of the 21st century. This article takes the reader along the theoretical and methodological problems of futures studies from the positivist philosophy of science’s prediction approach to the impact of diversity induced by the paradigm shift in science towards forecasting. This article attempts to find the answer to the question: how is it possible to make scientific forecasts in social sciences, accepting the incommensurability of theories and following a specific methodological synthesis?

2. Current theoretical issues of futures studies

Futures studies examines and forecasts non-existing phenomena. During forecasting it judges future events, processes, interrelationships and states, however, as future phenomena do not exist in the present (at most in seeds), direct cognition is not possible.

2.1. Limitations of classic prediction

Scientific theories were originally constructed to make predictions. According to the classic science determinism and rigorous causal relationships do exist in reality. Newer and newer states emerging from motions might be known and foreseen due to determinism. Limitations of cognition and prediction are only subjective; they depend on our knowledge and cognitive capabilities. This conception was incorporated by static dynamics, which can be characterized by reversibility, equilibrium direction of motions, stability and exploration of equilibrium trajectories [14].

According to the positivist scientific teachings the final goal of scientific theories is to make predictions [7]. The Popperian critique rejects, however, that theories are machines designed for predicting [36]. The falsification theory reveals that the main function of scientific theories is not prediction but explanation. Moreover, predictions—in a theoretical sense—do not serve certain practical-technological objectives, but they control the theories. As theories, in a sense, they really describe the world: that is why it is possible to empirically test or falsify them, which enables us to confront them with experience.

Lakatos [23] conceptualized science as different research programmes, in which heuristic rules are valid. Negative heuristic approaches show ways on which it is not worth going, and positive heuristic approaches inform us about the ways to follow. The heuristic power of theories depends on the magnitude, how novel facts they construct. Earlier it was believed, it can immediately be decided, whether a new theory predicts novel facts. In reality the novelty of factual statements often occurs over a long time. Practical experience has shown that forecasts should contain novelty and confirmation as well. Forecast information is most efficient if it contains approximately 50—50% of confirmation and novelty [4].

Making scientific predictions does not equal with futures studies [27]. Based on scientific predictions we might explore only the future of one sub-field. However, these kinds of
knowledge cannot be built together—either mechanically, or following the attitudes of certain disciplines—into a consistent, whole system providing possible solutions to current future problems. Furthermore, scientific predictions are consequence-futures, which are in themselves insufficient to explore future’s possibilities.

Scientific predictions are single-line forecasts (in just one variant) and reliable statements about specific things. The fundamental objective of historicists (one of the most significant representatives of positivist social science) was to predict history. They believed this objective could be performed, if they managed to explore the rhythms, patterns, laws and trends in the depth of historical evolution.\(^2\) The impossibility of social forecasting in historical prediction sense was exposed in the falsification of historicism [28].\(^3\)

1. Human history is strongly influenced by the increase in human knowledge.
2. We cannot predict the future growth of our scientific knowledge with rational or scientific methods.
3. As a consequence we cannot predict the way of human history.
4. It equals that we have to refuse the possibility of theoretic historical science, so a philosophical social science—similar to natural sciences—could not exist. Historical development does not have a scientific theory that could establish historical predictions.
5. Since the fundamental efforts of historical methods are wrong, historicism is considered to fail.

Of course this does not exclude all the opportunities of social forecasting. Furthermore, social theories could be undertaken to test, predicting that if some assumptions exist, some things will happen. We falsify only the possibility to predict historical developments that might be influenced by the growth of our knowledge.

If increasing human knowledge exists, then today we cannot foresee what we will know only tomorrow. There is not a scientific prediction—it does not matter whether it is made by a scientist or a computer—that could be able to predict its own future results using scientific methods. Experiments towards them may bring results only by the time it is too late to predict them. So results will be born, as soon as predictions become posterior reports (i.e. in the present).

Hence our hope to find the society’s laws of motion, like Newton discovered the physical objects’ laws of motion, is based on a series of misunderstandings. Comparison of the motion of society to the motion of physical objects makes no sense, so these kinds of laws could not exist. Popper proved that applying the method of induction and seeking physical laws of motion in social sciences is not viable. The existence of trends or tendencies in social changes is certain: every statistician can count these kinds of trends. But these trends are not similar to Newton’s law of gravity. Trends do exits, but they are not laws. Arguing the existence of trends is existential, but not universal. But universal laws do not argue existence; furthermore they argue the impossibility of things. We may establish scientific predictions on laws, but not on the pure existence of trends (as it is known by the cautious statisticians), as every secular or long run trend may change in a short time.

\(^2\) It is interesting to note here that the exploration of rhythms and patterns was “discovered” much earlier than the emergence of post-modern streams.

\(^3\) Since Popper’s work it has been proven several times that philosophical social science exists. The citation is to underpin the irrelevance of social scientific predictions.
2.2. Uncertainty of the future and the problem of unpredictability

Based on the above mentioned notions we may confirm that we can never know the future accurately and completely, because it is formed by many complex interrelated forces going in different directions. Surprises may arise, because events and future directions might develop that we have not expected, and events and developments will not realize that we have expected. Thus we should refrain from the approach of mechanical determination.

In every historical era many efforts have been made to individually dream the unbelievable future.\(^4\) From them almost only fulfilled predictions have endured. They have attempted to keep the obviously dominant unfulfilled predictions in secret, like today. Forecasting the future individually has several limitations. It might be more successful if we managed to involve, besides experts, every non-professional person into the forecasting process, whose futures the forecast object represents.

The future cannot be predicted or foretold by anybody. Forecasts have frequently become false since unexpected things have realized. Unfortunately forecasts often fail in those cases when they are most expected to work properly: in the case of forecasting greater changes, deviations and turning points. Based on our experiences in recent years the solution to these problems is not to prepare even “better”, more sophisticated and more mathematical forecasts, but to accept the existence of uncertainty and attempt to understand and deal with it.

In futures studies uncertainty appears both in ontological and gnoseological sense \([33]\). Ontological uncertainty expresses the chance of existence, emergence or decline of a phenomenon. In this case emphasis is made on the uncertainty in accordance with the forecast object. Gnoseological uncertainty refers to announcements relating to knowledge, i.e. it expresses the uncertainty (indeterminacy) of knowledge concerning a forecast object. Nowadays it is extremely difficult to reduce gnoseological uncertainty, because there is a huge uncertainty in the cognition of various futures alternatives.

In an unstable situation the relationship between past, present and future is not as evident as it was in a stable period. Obvious, well manageable, consecutive past-present-future relationship characterized by causality and determinism is replaced by multiplicity as a consequence of non-linear, interrelated, dynamic and holistic character of natural and scientific systems \([31]\). That is why the future might unfold in various ways: more or less repeated past and present events might occur, but we must also expect the emergence of new events, processes, relationships and states. The variety of futures evolving from the present is increasing. It is also an important factor that more and more members and groups of society want to participate in shaping the future. Individuals, however, expect the contribution of science and the power to recognize and realize desirable futures; they also want to take part in forming the future of the economy and society. Hence the participatory nature of building and forming different futures has been increasing \([35]\). Thus the foresight\(^5\) approach gains more and more importance in futures studies.

The roots of foresight date back to classic science fiction literature. It began to spread in social sciences after the Second World War together with the expansion of systems theory, futurology and strategy formation. Foresight techniques have had a determinant role in elaborating

\(^4\) Individuals, who considered themselves to have peculiar capabilities were called - depending on the idiosyncrasies of their eras - prophets, oracles, clairvoyants or astrologists.

\(^5\) Foresight means the ability to create and maintain a high-quality, coherent, and functional forward view and to use the insights arising in organisationally useful ways \([39]\). Reliable foresight is unimaginable without the participation of non-professionals in the whole forecast process besides asking experts.
qualitatively different futures alternatives and they have contributed to decrease the beliefs in the supremacy of deterministic, causal approaches. Foresight approaches have become popular and acceptable in wider range since the 1990s.

The actual problem of futures studies is whether it is possible to forecast under uncertain and unstable circumstances, and if the answer to this question is positive, then how to make forecasts. Current futures studies methodology does not give a convincing response. Futures studies as a science should answer that under these circumstances we cannot forecast changes, but simply anticipate them. In this case futures studies has to give up being a science. But if futures studies considers that the ability to forecast under these circumstances is still possible, then it has to give up exploring the most probable future. Futures studies should reconceptualize predictability. A slighter but realizable concept would be the exploration of the possible range of futures [11].

If futures studies emphasizes not on the expected, most probable future, but on exploring possible futures, then how can it prevent from regarding every kind of future as possible, through which making the principle of uncontrollable forecasts generally accepted? If every kind of future is possible, then there is no need to forecast, in particular scientific forecast. Ideas and their realization would be enough. On the other hand reality has not become more formable, but the future forming forces have corroborated and differentiated, resulting in the widening of the range of possible futures. As a consequence, the solution is to seek the ability to forecast the possible range of futures.

Scientific predictions meet the requirements of positivist science, even if predictions are often not reliable in reality. However, contemporary forecast and foresight approaches fail in the fulfillment of more criteria of classic science. That is why we must judge the scientific being of contemporary approaches in the environment traced by contemporary scientific-philosophical streams. Knowing the possible streams of the paradigm shift in science we may argue that forecast and foresight approaches are as scientific as predictions.

2.3. Paradigm shift in futures studies

The change of era in science has had a significant impact on futures studies. The essence of paradigm shift in scientific thinking is the transformation of scientific thinking from reality’s monolithic cognition to its multiple cognitive interpretation [13]. This process takes place in the emergence of different competitive streams followed by cutting scientific-philosophical debates. We use the term paradigm according to the sense that it is the aggregation of generally accepted scientific results, which serve in a certain period as a model of problems and problem solving for a community of scientists. Futures studies in Kuhn’s approach [22] is a revolutionary science.6

Competitive streams of futures studies—in the sense of paradigm shift—are organized around chaos theory, evolutionary theory and post-modern streams [15].

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6 A revolutionary science - in comparison to normal science - can be characterized as follows:

- in normal science, the theory is not questioned, in revolutionary science it is;
- in normal science there is cumulative progress, in revolutionary science there is not;
- in normal science there is no meaning to variance, in revolutionary science there is;
- in normal science change is incremental and gradual, in revolutionary science the change is total and relatively sudden.
One of the greatest scientific results in the last two decades was the discovery of chaotic behaviour in simple, non-linear, deterministic systems [29]. Chaos theory considers the examined system to be self-organizing and attempts to describe a system’s dynamics and the relationships among future states expressed in time. The scientific significance of chaos theory demonstrates that accurate foresight (prediction) is impossible even in deterministic systems. It also reveals that chaos theory is in connection with the problem of irreversibility. Moreover, irreversibility is the consequence of chaos.

Futures studies—like other academic fields—has concentrated on the examination of order and regularity for a long time, because futurists also thought that these characterized the world. Futurists regarded chaos and unstable states as exceptions and clutter, to which scientific statements were not valid. They thought that exceptional states had a short life, and systems would soon get back to equilibrium that is why examining them was negligible. This viewpoint and modeling approach was questioned by chaos theory underpinning at the same time the elaboration of a new future modeling procedure. Chaos theory proved [30] that

- equilibrium is only a special situation of dynamic systems;
- disequilibrium is not only a random oscillation around the equilibrium, but also a frequent situation of dynamic systems;
- chaos is essentially characteristic to dynamic systems;
- chaos emerges in the mathematic structure of laws describing reality, so it cannot be excluded by collecting more information;
- the chaotic element is a real self-organizing factor;
- in chaotic periods structural changes might arise resulting in a qualitative transformation of the whole system, and in generating new situations;
- irregularity, randomness, chaos and disequilibrium might be handled by (mathematical) tools of chaos;
- chaotic states cannot be foreseen in classic sense, but they can be modeled and studied.

Due to the above circumstances the demand for foresights and forecasts—raising from science and becoming a part of science—is greater than in the past. Scientific futures studies, however, often faces problems that refer to the inadequate fulfillment of scientific criteria, and at the same time forecasts often do not satisfy practical needs. Economic forecasts, for instance, can less and less apply economic theories and models for several reasons [17]. First, economic theories and models cannot explain the spatial-time changes of the economy in a realistic way. Second, they do not provide support to see specific forms of human actions in the economy’s future. That is why futures studies has turned its attention to new philosophical and theoretical researches in order to better understand the essence of spatial-time changes and the role of human beings and social institutions in real processes. Hence, evolution and the role of human beings have become a fundamental problem in the theory and methodology of futures studies [12]. Another important focus of futures studies is to examine what kind of role human foresight performs in the occurrence of different processes and how it shapes their futures.

Evolutionary theory draws a general interpretation of irreversible development, which is the substance of every evolutionary motion in the real world. Evolutionary development is considered to be isomorphic, i.e. a kind of motion that takes place everywhere and every time in

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7 Chaos theory proved that predictability is rare and operates only between the limits that science has filtered out from the diversity of our complex world [38].
the same pattern. Furthermore, evolutionary theory is a new scientific ideology and a paradigm as well. It is a new scientific ideology, because it synthesizes the latest scientific results forming a new approach about reality. It is a new scientific paradigm, because it renews not only the approach about reality, but also incorporates new methodological principles, on the basis of which science may raise new questions and answer them. With evolutionary modeling it provides a method, with the help of which its approach can be applied to study reality [2]. Evolutionary theory as a new scientific paradigm means a new, consistent systemization of scientific results, and at the same time a new conceptual pattern, way of thinking, in which reality can be examined more efficiently. It also involves heuristic function, through which—in the framework of new interdisciplinary researches—it allows linking disciplinary sciences.

Post-modern streams—although they also draw strict anti-scientific thoughts—contain plenty of elements that foster the understanding of science as a living reality and the development of scientific approach and methodology as a social action [18]. The common characteristic of post-modern streams is the recognition and appreciation of human rationality in different forms. The base of human rationality’s spatial-time diversity is represented by different life-situations and their cultural embedness. This is expanded by post-modern to science and scientific rationality, so it questions science’s self-position over society and culture.

From this follows that science’s production of knowledge does not differ from the production of other intellectual values, but—and this is the most significant—science works embedded into society and culture as a changing, developing system. In this living science competitive paradigm, changes of examined problems and different approaches are necessary. Consequently the belief to have just one scientific truth is oversimplified and it induces scientific fundamentalism. In a living scientific system many kinds of truths are possible, and they describe, present and interpret reality in various magnitudes. Different theories, knowledge systems are not only falsifiable, but also incommensurable, because reality is extremely complex and diverse. These characteristics make science socially useful and a developing system. Science is a kind of social perception system in which rational factors play a constructive role [16].

Social sciences and new interdisciplinary fields—to which futures studies also belongs—are most responsive to post-modern thoughts. Critical streams emerged almost in every field of science, and they frankly undertake their linkage to values. They consider the reality-constructing role of social-cultural values and their systematic exploration to be evident. They severely criticize their mainstreams, because the mainstreams escape to formality (pure science), whereas they accept only their approaches to be scientific.

The academic work of Feyerabend has been also determinant in the development of the scientific–philosophical background of futures studies [6]. Feyerabend regards science as an essentially anarchistic enterprise: theoretical anarchism is more humanitarian and more likely to encourage progress than its law-and-order alternatives. The only principle that does not inhibit progress is: anything goes.

3. Actual methodological problems of futures studies

Futures studies—as an interdisciplinary science—mostly deals with forecasting complex systems. Apart from the old prognostic techniques the emergence of futures studies methodology has taken place in the period of economic imperialism [24]. Prognostic methods are at any rate based on mathematical-economic approaches, independent from the era of economic imperialism. In accordance with the expansion of the vanquish process in the field of social
sciences, economic type forecasts dominate futures studies accepting that economics became a universal grammar of social sciences [40].

However, practice has proven that economic theories and models are insufficient to examine and forecast really complex phenomena. Its reasons were presented in the previous chapter. Many factors must be taken into account before making decisions concerning the future of complex phenomena, so the judgment of future development also requires the examination of many elements’ future. This diversity appears in a form that both events, processes, states, interrelationships and technological, economic, ecological, social, political and human factors become the object of analyses and forecasts.

Diversity characteristic to forecast objects is also realized in the diversity of applied methods. Hence in complex futures studies formalized mathematical and verbal approaches are applied in accordance with each other. Many attempts have arisen to create a methodological synthesis, but here we should take into account the fact that the synthesis always depends on the forecast project and the research field. As a consequence, a universal applicable recipe book for forecasting—like in the case of other intellectual academic fields—cannot be prepared in futures studies.

3.1. Formalized, mathematical based methodological approach in futures studies

Throughout several years and decades mathematic–statistical forecasting methods have been dominant in futures studies—like in economics. Moreover until the 1980s only the prognostic stream of futures studies was accepted as a science in Hungary. Futurology dealing with intellectual visioning, scenario building and intuitive judgment was regarded as a bourgeois initiative. Prevailing mathematical modeling have swept from forecasting even those assumptions, qualitative factors and expert opinions, which would have been essential to explore qualitatively different futures alternatives. In futures studies—like in other academic fields—mathematical tools were applied to transform phenomena and problems into numbers and certain symbols.

Mathematical models—however correct they are in describing phenomena—are in themselves unable to express complexity residing in the multiplicity of reality. Hence besides contemporary mathematical techniques it is not possible to get to know reality from its various aspects and reduce uncertainty of theoretic cognition without the application of verbal-heuristic models.

Goldfarb and Leonard [10] raise the question whether mathematics went too far in social sciences and factual modeling might be successful. According to Lipsey [25] overmathematization has the following severe consequences:

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8 It seems that futures studies has taken notice of economic imperialism, but due to its openness it cannot be said that it has also digested this process.

9 Hence the impact of economic streams in methodological development of futures studies - although exists - cannot be regarded as decisive. There were attempts [8] to naturalize new political economics in futures studies, but non-interdisciplinary approaches today cannot take root in the renewing methodology of futures studies.

10 In the literature, the majority of forecasts are still mathematic-statistical types [5]. Verbal information appears almost only in the introduction or in the conclusions.

11 There are methods, which are verbal and formalized at the same time. See e.g. the previously mentioned evolutionary models, where behind the formalised evolutionary models there are always a verbal model or a system of ideas describing and interpreting the breakdown, operation and expected results of the model.
– a tendency for generality to be desired for its own sake, even when it obscures the simplicity of solutions to some problems;
– obscurantism: using mathematics even if it adds nothing to your verbal analysis;
– intellectual crowding out: the high cost of learning advanced mathematics [pushes] more descriptive and factual material out of the curriculum and
– perhaps most dangerous of all, the confusion of validity and truth: the implicit assumption that if some result is derived from a complex model containing all the OK assumptions… it must be true.

*Friedman* thinks that theoretical economists rely on mathematics and econometrics in today’s extent, because it is cheaper to publish theorems than to collect data and make empirical researches. Although the advantages of new economic streams[^12] are obvious, in most empirical researches induction is still dominant and researchers stick to econometric attempts to find law-like regularities in historic data.

### 3.2. Methodological challenges of instability

Since the 1990s the conditions and circumstances of making forecasts have been changing[^9]. Futures studies face a new situation in many areas of society, politics, ecology and economic life. So far a wide range of stability and equilibrium have occurred. However, nowadays *changes, instability and disequilibrium can be noticed almost everywhere.* It is necessary, in accordance with the transformation character and growing complexity of the socio-economic system, to extend the terms and variability of unstable periods and more frequently unexpected changes. *It is more difficult to follow why and how the whole system changes.* Emerging changes in more and more areas increase the probability of emerging catastrophic situations.

Several practical experiences have proven that *one of the most effective ways to deal with uncertainty is to build up and previously rehearse our own futures.* Rejecting the illusion to completely get to know, measure and predict the future, future-building methods (from which scenario building is the most frequently applied method) elaborate alternative scenarios on the basis of the scenario-logic coming from the impact-uncertainty analysis of influencing factors and key driving forces towards different future directions[^19].

Under unstable circumstances the future might unfold in various ways. The chance of emerging qualitatively different futures alternatives is vastly increasing. This variety does not only express that in case of instability the future’s uncertainty expands, but also the chance to draw and realize futures significantly differs from the past.

According to our latest researches[^13] forecasting of unstable, non-equilibrium-type systems and processes might be successfully carried out with the tools of chaos theory, evolutionary modeling and artificial intelligence, together with scenario building and participatory futures studies methods.

### 3.3. Methodological synthesis

*In recent years it was attempted several times to integrate qualitative and quantitative information in forecasting.* Both approaches have their strengths. Qualitative futures alternatives

[^12]: e.g. experimental economics[^37].
[^13]: In the Futures Studies Department, Corvinus University of Budapest.
(scenarios) have a richness that is not bound by quantitative methods. They can explore relationships and tendencies for which there is little or no numerical data available, including shocks and discontinuities; they can more easily incorporate social and individual motivations, values, and behavior; they can create images that capture the imagination of those for whom they are intended. Quantitative futures—when done properly—provide a rigour, precision and consistency that comes from their numerical and mathematical underpinnings. Their assumptions are made explicit and are, therefore, open to critical examination; their conclusions can be traced back to the assumptions and the effects of changes in assumptions can be easily checked, pointing to important uncertainties. It is clear that there is a big gap between the increasing complexity and the analytical tools that try to address this complexity. Furthermore, quantitative and qualitative analysis should be integrated early in the process.

It is expected in the future that—due to the high complexity of socio-economic problems—computer simulations gain an even greater role in science as an alternative of theorems. However, in order to enable simulation methods to spread in the field of social sciences, it must be accepted that, besides induction and deduction, a third way of doing scientific research is to carry out simulation experiments. Axelrod examined the present and the future of simulation methods applied in social sciences. From his thoughts the following three are the most important:

- For publishing simulation models, it is not enough to interpret only the results and the model. They must be made available via Internet and CDs so everybody might personally carry out the experiments, because, due to space limitations, it is impossible to publish the source-code.
- It is important that experts in the field rerun the previously published simulations, because numerical methods are often considered not to be proofs. To find mistakes and real challenges it is necessary to build up research of others from their very beginning.
- To accept simulation methodology it is also necessary to form a company from socio-scientists, who follow simulation methods in their researches.

The following criteria arise towards forecasting models meeting the challenges of the 21st century:

- capability to holistically deal with the whole system;
- interpretation of multi-elemental and multi-central (not hierarchical but network-like) systems;
- expression of processes in the system, interpretation of the term and contents of self-organizing systems;
- ability to describe linear and non-linear relationships in the system;
- reflection of the relationship between the system and its environment, simulation of the system’s new states in alternatives depending on environmental conditions;
- expression of system’s dynamics, the real dynamics created by the reaction to internal movements and external circumstances;
- reflection of the fact that the model’s end state is a beginning state at the same time, i.e. the model should be open-ended;
- capability to systematically generating futures alternatives instead of making predictions.

Several studies have attempted to combine narratives and numbers. In some cases, the quantitative analysis has been intended to underpin the qualitative narratives. In other cases, brief narratives have been used to structure inputs into quantitative analysis.
Experiences of practical modeling also require that distributional assumptions applied in traditional statistical methods should not limit forecasting models.

In a socio-economic environment characterized by rapid changes, where besides a high degree of complexity the non-linear character of processes prevails, prognostic techniques based on extrapolations of the past are not enough and not even adequate to forecast events, processes and underpin strategies. Traditional forecasting methods may only be applied assuming the repeat of past characteristics. Feeding back from this kind of forecast towards the present means as if we changed the time-flow assuming the reversibility of events and feedback towards the present from the past [41].

Therefore, mathematic-statistical methods may only be applied to forecast less complex phenomena in the short term. We can say that predictions, prognoses and other forecasts made by traditional methods serve to understand the behavior of continuous factors among scenario driving forces. As a result they provide valuable information about trend-type influencing factors and help evaluating futures alternatives.

We might hypothetically argue that dealing with a high level of complexity requires the contribution of the human brain [21]. Besides future building methods the application of artificial neural networks—analagous to the human brain—for forecasting seems to be promising [20]. Neural networks belong to the family of artificial intelligence and evolutionary models. They are able to handle and simulate non-linear and non-functional relationships, recognize patterns and forecast. Furthermore, they can process defective, missing and/or inaccurate data, and can involve qualitative factors into the modeling process. Neural networks together with scenario planning might solve the problem of integrating narratives and numbers. Therefore, we can say that the answer to the question raised in the title of the study lies in the combination of foresight and forecast approaches.

A central problem in the theory and practice of futures studies is how good the forecasts are in the sense, how they reflect future reality in the present and how they might serve for basis of decisions and action programs. This refers to foresight approaches as well. A forecast is reliable, if [34]:

- it has an internal content,
- which enables the optimal underpinning of decisions, and
- its conclusions, impacts and environmental assumptions
- most serve development,
- or averts threats,
- and its probability of occurrence is big.

Reliability of forecasts—although in itself does not express that forecasts are scientific as well—doubtless reveals the ‘wellness’ of forecasts. After all we can say, we have good forecasts, if they contribute that during decision-making we take more and more future aspects into account.

4. Summary

The previous sections have presented the significant scientific-philosophical challenges and methodological problems of futures studies. Theory and methodology of futures studies has

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15 Scenarios represent the main element of the methodological synthesis.
16 Foresight involves scenario building, participatory futures studies methods, computer simulations and technology assessment.
been renewed. It has become clear that mechanical determinism, scientific predictions, traditional mathematic-statistical methods and seeking the most probable future are not viable during forecasting in a chaotic, uncertain, unstable and complex environment. At present a paradigm shift takes place in futures studies, through which it endeavors to transform from reality’s monolithic cognition to cognitive interpretations. Chaos theory, evolutionary theory and post-modern streams explore three possible future paradigms.\textsuperscript{17}

Methodical instruments of futures studies has been broadening. Since the end of 1990s a promising shift can be noticed from the superiority of mathematic-statistical methods along with economic theories and models forced by economic imperialism to diverse, interdisciplinary procedures following the dynamics of real processes and integrating qualitative and quantitative information. A specific methodological synthesis might emerge based on chaos theory, evolutionary modeling, artificial intelligence simulations, scenario building, participatory futures studies and—as a supplementary procedure—mathematic-statistical methods. The article clearly defines the requirements towards forecasting models in the 21st century.

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\textsuperscript{17} In another approach we may speak about traditional, critical and evolutionary paradigms [14].


