PARADOXES OF POSITIVE VERIFICATION OF HYPOTHESES

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Abstract: *The notion of correctness of research procedures is emphasized, particularly in regard to the use of appropriate procedures of hypothesis verification. Management sciences are empirical, based on experiment as a fundament of cognition and as the sole means of verification (rejection or confirmation) of all scientific predictions. Research papers published by young scientists often present such conclusions as: "the tested hypothesis proved valid", "the hypothesis was positively verified". Such statements are hardly acceptable from the scientific viewpoint. And yet, principles of positive verification of hypotheses are seldom expressed in verification strategies. In this context, it may be useful to reach for arguments presented by Karl Popper and his followers, emphasizing the insufficient use of falsification as a research procedure.*

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1. METHODOLOGICAL CHAOS IN SCIENTIFIC RESEARCH

No amount of observations of white swans can allow the inference that all swans are white [11, p. 121]. As reported by the Group for Best Academic Practices, an advisory body to the Ministry of Science and Higher Education in Poland: "Negligence is the most common transgression in scientific research.

It is expressed in methodologically unprofessional research plans, careless execution of research tasks (experiments, observations), cursory editing of research publications, inadequate protection of research documentation" [17]. M. Kostera adds to the list of faults: "selection is always a derivative of the research problem; we select suitable testing methods based on what we want to test" [4, p. 97]. The most fundamental error in social science is then to intentionally employ a single "proper" research method depending on the subject of research. The problem of methodological chaos applies equally to other countries, but – for the sake of "political correctness" – it is perceived as taboo and typically "swept under the rug".

Many modern research and development centres feel unsatisfied in their use of methodology, as attested by numerous publications in this area. It may seem striking that the longer we cultivate a certain discipline of science, the more inclined we are to retrace its methodological roots – paradigms, methodological fundaments, the particulars of adopted research methods. However, the methodological specificity of the theory of organization and management makes it particularly resilient to any attempts at systematization and classification. Organizations are unique and individual, therefore we have to deal with enormous inconsistency and unpredictability of analysed variables. We have to deal with the problem of comparability between results obtained in different settings, different time and using different instruments. Each time we feel compelled to standardize our research procedures and provide comprehensive description of research conditions and context, to help us clarify any potential discrepancies [5, p. 43].

However, proper development of methodological techniques is a necessity. It inspires us to construct models and to order our knowledge in the form of paradigms. This is particularly important in relation to the so-called soft elements of an organization – the indeterministic, unforeseeable qualities that defy planning and resist measurement. For more than a decade now, we are witness to an unparalleled primacy of non-instantiated methods of research in respect to organizational culture. The multi-layered theoretical foundations of the cultural school of research, the integration of analytical and research paradigms (which, in their pure form, are clearly contradictory), the multitude of definitions of organizational culture, the indeterministic changes observed in this aspect of organization – these and other factors only add to the methodological chaos.

2. FORMULATION OF SCIENCE AND THE ROLE OF HYPOTHESES

Before we address the problem of formulation of science and the "scientific character" of research, we should start with the notion of paradigm, a set of concepts and theories constituting a foundation for a given discipline of science. Thomas S. Kuhn, an influential expert in the field and author of the term 'paradigm', in *The Structure of Scientific Revolutions* [7] explains the notion of a paradigm in global and local (particular) perspective. Thus, in global sense, a paradigm encompasses:

- a sum of internalized beliefs of a given scientific group;
- a set of characteristic beliefs and prejudices of a given research community;
- a sum of general outlooks on the world that dictate the selection of research objectives and the acceptance of results in a given time and space.

In response to problems that cannot be solved within the conceptual framework of a dominant paradigm, a new paradigm emerges to replace it. The new paradigm is typically incommensurable with the old one. The process of qualitative changes in science involves formulation and development of new paradigms as well as invalidation of the old ones. In particular sense, a paradigm constitutes a major, widely recognized scientific discovery (a particular subset of the group's common beliefs), which provides model solutions in a given discipline of science and may produce similar model solutions in related disciplines, thus becoming an important element of the group's world outlook [Kuhn 1968]. The above definition seems adequate for the purpose of the discourse on the necessity of paradigm shifts, but it may be useful to elaborate the notion in a wider, global context. Things get complicated if we take a closer look on the content of the cited work. One of the book's reviewers has managed to identify as much as 22 different meanings of the term paradigm in Kuhn's text. In response to criticism, Kuhn chose to clarify the concept of a paradigm in his subsequent publication *The Essential Tension*. Thus, in a global sense, a paradigm constitutes a disciplinary matrix, an ordered set of beliefs, attitudes and convictions shared by all scientists in a given field. Kuhn then goes on to specify individual elements of a disciplinary matrix, as follows: 1) symbolic generalizations (expressions presented in the form of a logical formula – formal or easily formalized), 2) models (providing the group with analogies of preference or even gaining ontological dimension if widely and strongly accepted), 3) specimens (specific solutions of particular, important problems, deemed by the group paradigmatic in a lexical, narrow sense of the term) [6, p. 425]. Kuhn shares the belief that the power of a disciplinary field grows with the amount of symbolic generalizations at the group's disposal. However, he also believes that specimens (and models) are much more effective determinants of the group's subculture than the symbolic generalizations.

Kuhn argues that progression of 'normal science' is based on the output of mature scientific communities working under a single paradigm or a set of closely correlated paradigms. The progression is also a result of the fact that individual scientific communities are not typically involved in the study of the same problems or phenomena. Progress is expressed by results of effective and creative solutions of problems. In fact, only 'normal science' is capable of achieving continued and certain progress.

Emergence of new paradigms constitutes, in Kuhn's approach, a formulation of science. Since management is an epistemological science, knowledge in the field is gathered through research processes. One of the preconditions of proper research procedure is to formulate problems and hypotheses to elaborate the research objective and research scope, in an attempt to test and question the correlations between a phenomenon and its underlying causes [15, p. 21].

Hypothesis is a Greek term for supposition or assumption. The notion of hypothesis typically refers to the act of assuming that a certain phenomenon under study takes up a certain form or is somehow correlated with another phenomenon. Hypothesis, in this context, represents an attempt at providing answers to questions posed in research problems. Obviously, such an answer should be interpreted as preliminary and presumed. If this is the case, then what qualities make the hypothesis different from a simple observation stated as part of a descriptive evaluation of a scientific fact? The most fundamental difference is that hypothesis cannot readily be taken as true or false. Hypotheses play an invaluable role in scientific research, because they help identify and determine research objectives. The use of well-defined and properly formulated hypotheses is what sets apart scientific cognition from general cognition [10, pp. 126-132]. Correct interpretation of results obtained in the course of verification of hypotheses is another important element of the notion under study, because it provides premises for decisions that may affect whole populations, based solely on research findings gathered on a sample of respondents. Observation of statistical analyses shows that samples are typically a small fraction of the studied population (in some cases, even a fraction of a per mille). In the light of this observation, it seems important to emphasize both the quality of procedures used in the course of hypothesis verification and the correct interpretation of results obtained in the process [16, pp. 82-83].

Scientific approaches to formulation of hypotheses can be classified into distinct groups. For example, I. Lakatos identifies three groups of methodological concepts used to differentiate between scientific and non-scientific qualities of statements. The first group represents scientific scepticism, based on assumption that any system of beliefs (including that of an opponent) is equally valid and may freely evolve as well as influence other systems. No system can be regarded as superior in an epistemological sense. The second group – the school of demarcation – represents the belief that products of human knowledge may be evaluated and subject to comparative analyses based on certain general criteria. In other words, there is always a definite demarcation line between science and non-science, and the task of scientists is to define this borderline. In this context, I. Lakatos puts a strong emphasis on the notion that scientists are free to pursue any objective they find interesting, provided that they publish the results of any 'feud' with opponents for public evaluation. The last group – the elitists – insist that only the privileged minority of scientific elites hold the key to 'proper' science, and only those elites can adjudicate upon what is science and what is not [8]. Regardless of scientific perspective adopted, the research must result in a theory. Naturally, no theory can provide ultimate answers, since each theory carries new problems born in and of itself, and those problems form a basis for formulation of new theories. If a new theory is to be regarded revolutionary, it must conflict in some way with the previous theory [12, p. 57].

K. Popper presents a completely new outlook on methodology. The author questions the role of hypotheses in science that may suggest that science evolves through careful generalization of relatively certain statements (namely, results of observation) and that generalizations gain their strength from the number of cases corroborating the assumption under study. According to Popper, the true logic of scientific discovery involves formulation of a research problem, followed by a hypothesis of potential solution, which is then subject to stringent critique of falsification. This process leads to identification of new problems in a permanent cycle of development [13, p. 12]. K. Popper argues that the progress of science does not stem from the fact that we collect more and more perceptive observations. "Bold ideas, unjustified anticipations, and speculative thought, are our only means for interpreting nature" [13, p. 224]. Thus, in Popper's approach, freedom of science is a prerequisite of progress.

3. THE PROCEDURE OF HYPOTHESIS VERIFICATION

Popper's work provides valuable epistemological conclusions on criteria to be used for the purpose of differentiating between science and non-science. Those can be summed up as follows [9, pp. 101-126]:

1. Sources of knowledge are never ultimate.
2. The truth of sources is evaluated based on their accordance with facts.
3. The accord between observation and theories is the ultimate test.
4. Tradition is the most important source of our knowledge [12, p. 52].
5. Knowledge is not born from ignorance. Knowledge develops mostly through modification of previous knowledge.
6. There is no objective criterion for truth, but there are criteria for identifying error and falsehood [12, p. 52].
7. Neither observation nor reason can be seen as authorities. The truth is beyond any human authority of judgement.
8. We should strive for clarity of postulated solutions, as opposed to their accuracy or exactitude [12, p. 54].
9. Each solution of a problem bears new questions, and their number is proportionate to the originality of the problem and boldness of the solution.
10. Researchers should be wary of the explanatory power of theories, of their ability to explain all problems [11, pp. 179-182].

In his approach to the problem of theory formulation, Popper emphasized the fact that cognition cannot start from nothing (no tabula rasa). However, he also stressed the idea that cognition should not originate from observation, data nor facts, but from identification of problems. Observation may lead to problem formulation, but only insofar as it contravenes our conscious or subconscious expectations. But even then, the starting point is not the observation as such, but observation in the real sense of the term – a problem-defining act [14, pp. 83-84]. Hence, the main thesis of Popper's theory of cognition holds that methodology of social sciences involves testing solutions to those problems which initiated our research. Solutions should be postulated, and then tested using material and stringent critique (such as testing their compliance with observations). If the critical evaluation results in refuting the theory, another solution should be postulated and put to the test. If, on the other hand, the theory passes our critical evaluation, it should be accepted on a temporary basis – i.e. accepted as object of further critical evaluation and peer review. This means that methodology of science is a process of formulating potential solutions (or ideas), a critical development of the trial and error method [14, p. 85].

Popper's philosophy of science generally rejects the notion of questioning the sense or rationality of knowledge sources. Instead, it poses the following question: what is the best method of approaching the problem of identification and elimination of errors [12, p. 49]. This is where the law of falsification comes into the equation. According to Popper, we should adopt the methodological principle of probing for evidence to refute the thesis (i.e. look for falsifying hypotheses), rather than concentrate on evidence that confirms the theory.

In this context, Popper postulates the following theses:

1. Hypotheses formulated in the course of research should be as bold (and *a priori* improbable) as possible.
2. Testing of hypotheses should focus not on cases that confirm its validity, but on diligent attempts at falsifying the theory – no amount of confirming cases will warrant the truthfulness of the thesis, whereas even a single falsifying case is enough to refute it, therefore the failed attempts at falsification will best support the hypothesis [13].

Popper's approach is often questioned on the basis of his argument that falsification is never definitive and irrefutable. Moreover, evidence used as basis for refuting the hypothesis is, at the same time, an argument for confirming its negation, therefore evidence classification depends on the adopted viewpoint. Popper's theory of verification through falsification was particularly strongly opposed by Thomas Kuhn. The latter believed that incompleteness and imperfections observed in the adjustment between evidence and theories as part of the puzzle-solving quality of science are typical for institutional sciences. If, in line with Popper's suggestions, failure to adjust the two aspects forms the basis for refuting the theory, then all theories will be refuted at some point. If this is the case, then how to approach the development of science and what is the nature of such development? [6, pp. 390-394]. However, the same can be said in the context of the verification approach. It seems that this dilemma can be solved with the help of statistical analysis, with its precise clarification of the problem at hand.

And, from this point of view, if should be reiterated that strategies for verification of hypotheses in scientific research hardly ever provide arguments to attest their truthfulness. This conclusion is present not only in Popper's work, but also in publications by such authors as J. Klayman and Y. Ha [3, pp. 211-228] or D.J. Glass and N. Hall [2]. Therefore, statements claiming that a hypothesis under evaluation proved valid or passed the verification test are simply unfounded. One can only state that the testing process failed to provide arguments for refuting the hypothesis under evaluation, since the lack of refuting evidence cannot be used as confirming evidence. The theory of statistical inference does not provide conclusions for adjudicating the truthfulness of a hypothesis. It can only make conclusions on the lack of evidence to refute it. These two categories are by no means identical, since absence of evidence is not evidence of absence.

From statistical viewpoint, one cannot assume that a hypothesis is true, nor conduct the testing procedure with the purpose of proving the truthfulness of it. M. Szreder argues that this approach results in a logical contradiction [16, p. 85]. The author postulates the following:

- Logical contradiction can be avoided if the only legitimate decisions are: refutal of the hypothesis under evaluation, or statement to the effect that no evidence was found to refute it;

– The real usefulness of statistical testing is manifested mainly in its potential to refute the hypothesis under evaluation [16, p. 85].

The above principles apply also to scientific hypotheses. Also in this context, the most important quality is the potential to refute the hypothesis; to find it false [16, pp. 86-87]. "A proper scientific hypothesis should be falsifiable. If you cannot think of any empirical evidence that would contradict your hypothesis, your hypothesis is not valid in the scientific sense of the term" [1, p. 474].

4. METHODOLOGY – FIRST AND FOREMOST

What is the main conclusion of this discourse? First of all, it is meant to emphasize the correct methodology of scientific research. Other conclusions include:

– the need for proper orderliness and organization of methods (and methodology) in scientific research;
– the need for reinforcing the theory of management with knowledge in the realm of social sciences, most notably psychology and sociology (in particular, with results obtained through empirical studies);
– the recommendation for adoption of methods that are adequate in the context of the studied phenomenon;
– the postulate of good editorial skill and proper use of scientific terms and expressions;

This paper emphasizes the fundamental role of methodology in scientific research. It provides information on rudiments of research procedures and postulates careful approach to the task of hypothesis testing. The main problem addressed here is the verifiability of hypotheses, but other elements of proper research procedure should also be taken into account, such as the selection of research objectives and suitable methods of research. Reliability? Diligence? Credibility? The quality of research is the duty of each individual researcher.

In this context, one other problem should be taken into consideration. We must bear in mind that credible research should not be justified on the basis of academic aspirations, but stem from the real need of eliminating significant gaps in knowledge [16]. The work of a scientific researcher should be dedicated to the pursuit of utilitarian values in the realm of science. In the best possible scenario, it may also contribute to formulation of new paradigms.

Coming back to the critical evaluation of experience and expertise among young adepts of the academic community – as voiced in the introductory notes – it may be interesting to note that "new paradigms are almost always formulated by young researchers or ones that are fairly inexperienced in the particular field of science they choose to reformulate" [7, p. 107]. Thus, it seems that reconciliation of experience and expertise is difficult, but by no means impossible.

One other argument comes to mind in this context (and this conclusion is not addressed solely to young scientists): the overwhelming popularity of case studies as methods of scientific research should be questioned. Case studies cannot be used for the purpose of hypothesis verification. Their role is to exemplify certain correlations presented in an analytical outline or model. Case studies may be employed for the purpose of falsification (subject to numerous limitations), but their principal role is to illustrate and understand the real world.

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