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HYPOTHETICO-DEDUCTIVE METHOD IN MANAGEMENT SCIENCES: ITS DEVELOPMENT AND APPLICATION

Zbigniew ORBIK

Silesian University of Technology, Faculty of Organization and Management;
zbigniew.orbik@polsl.pl, ORCID:0000-0001-7092-1567

Purpose: The aim of this article is to analyze the hypothetical-deductive method (HD) in its applications in management sciences. This method is studied from the perspective of the general methodology of sciences, with particular emphasis on the specificity of management sciences. The path that led to the development of the HD method is also outlined.
Design/methodology/approach: The article analyzes selected literature on both general methodology of science and works in which the subject of analysis is the hypothetical-deductive method applied to research in management sciences.
Findings: The hypothetico-deductive method is a cornerstone of scientific inquiry, including in management sciences, where it facilitates structured hypothesis testing and decision-making. This method involves formulating hypotheses based on observations and then testing these through experiments or further observations to confirm or falsify them. Its application in management sciences has been pivotal in advancing the field, providing a systematic approach to problem-solving and decision-making.
Research limitations/implications: The article refers to a limited number of studies. Historically, the hypothetico-deductive method has dominated management and organizational studies, driving significant progress by providing a structured framework for research and analysis.
Originality/value: The article is devoted to the analysis of the hypothetico-deductive method as, on the one hand, one of the basic methods used in the general methodology of sciences and, on the other hand, as a basic method also used in management science. The scientific status of management sciences is mainly based on the application of this method although it is not the only method used in these sciences. The analyses conducted indicate the place of management sciences in the whole of science understood as a certain historical product.
Keywords: Methodology of sciences, management sciences, hypothetico-deductive method, induction.
Category of the paper: Conceptual paper.

1. Introduction

Method is the determinant of every science. It determines its nature. Reflections on the scientific method as an instrument for understanding each scientific discipline, including management sciences, will be mainly theoretical in nature. The aim of this article is to characterize one of the basic scientific methods used in empirical sciences, including management sciences. This is the hypothetical-deductive method (HD). The path that led to the development of the HD method also needs to be briefly described.

There are at least several reasons why we should, at least as scientists, understand the methods used in scientific knowledge. One of the most important is the desire to understand. We need to know the essence of the scientific method in order to understand how new knowledge is created and distributed (Gower, 2012). The historical reflections on the development of scientific methodology, as stated above, made here in outline only serve to show that the methodology of science is the result of a long process of development that began in antiquity. It developed together with science and is one of its most important elements.

The beginning of reflection on the scientific method date back to ancient Greece. Greek philosophers were the first who, trying to explain the nature of the world, gave up referring to myths and supernatural explanations, but instead referred to reason and experience (Vignais, Vignais, 2010). Already in Greek times, a very important methodological motif emerged: the idea of systematized knowledge (Teplow, 2023). In the most general sense, scientific method is the combination of reason and experience in the process of acquiring scientific knowledge. In a more specific sense, the scientific method in empirical sciences is understood as a way of solving problems in which experiment, observation, and induction are combined with experience and reasoning.

After centuries of oblivion, the scientific thought of the Greeks was revived in the late Middle Ages. The first European universities were founded in the era as well. Although it was a period dominated by philosophical and theological thought, already then there appeared scientists who postulated that when studying nature we should also refer to experience. The main representative of medieval empiricism was Roger Bacon.

In the Renaissance, as the name suggests, there was a clear return to the achievements of classical thinkers. In the seventeenth century, Francis Bacon in his work entitled *Novum Organum* formulated one of the key problems for the new methodology of science – the problem of induction (Bacon, 1878). It was later taken up by David Hume in his *A Treatise of Human Nature* (Hume, 2000). The problem of induction is that even if the premises are true, it does not guarantee the truth of the conclusions. In other words, induction is fallible reasoning. Attempts to solve this problem led to the formulation of many methodological concepts in subsequent centuries. The most important include, among others, Carnap's program,

Bayesianism, and Popper's falsifications. One of the answers to the above mentioned problem is HD method.

Methods used in management sciences belong to the class of empirical sciences. In management sciences, as in all empirical ones, research conducted according to a specific method is aimed at achieving progress in scientific knowledge, establishing new statements, theses, generalizations or definitions.

Management sciences are empirical disciplines. They are also characterized by interdisciplinarity. This article attempts to demonstrate the place of the HD method in management sciences. This is, of course, only an outline of the topic. The aim is both to outline the historical development of the titular method in these sciences and to indicate its place in the methodology of contemporary management sciences. Currently, these sciences reject methodological fundamentalism, which assumes a neo-positivist model drawn exclusively from the natural sciences (Dźwigoł, 2019). Moreover, methodological studies emphasize the need to use various research methods (Harrington, Voehl, 2016; Midgley et al., 2017; Streicher et al., 2025; Moreira et al., 2025). Contemporary management sciences are therefore characterized by methodological pluralism. However, the HD method is still used.

The originality of the material presented in this work lies primarily in demonstrating the importance of the hypothetical-deductive method for management sciences. There is a gap in the literature regarding the importance of this method for research conducted within these sciences.

2. Methods

The article uses a literature review research technique to collect, analyze, and synthesize relevant information from a wide range of sources. A literature review is a fully-fledged research method (Hadi, Afandi, 2021). A well-conducted literature review allows you to get acquainted with the current state of knowledge in a given field and provide reliable answers to research questions (Snyder, 2019). It summarizes and evaluates a set of writings about a specific topic (Knopf, 2006). This is an excellent method for analyzing interdisciplinary research. It also allows for the synthesis of research results and the discovery of areas where further research is necessary. The literature review was conducted on the Google Scholar and Science Direct platforms. The databases were searched based on the following keywords: Methodology of sciences, management sciences, hypothetico-deductive method, induction.

The table 1 below summarizes the different types of literature review.

Table 1.
Types of Literature Review

Type	Systematic	Semi-systematic	Integrative
Typical purpose	Synthesize and compare evidence	Overview research area and track development over time	Critique and synthesize
Search strategy	Systematic	May or may not be systematic	Usually not systematic
Research questions	Specific	Broad	Narrow or broad
Analysis and evaluation	Quantitative	Qualitative/quantitative	Qualitative
Sample characteristics	Quantitative articles	Research articles	Research articles, books, and other published texts
Examples of contribution	Evidence of effect. Inform policy and practice	State of knowledge. Themes in literature. Historical overview. Research agenda. Theoretical model	Taxonomy or classification. Theoretical model or framework

Source: own elaboration based on: Snyder, 2019.

The other method used in this article is the method of logical analysis. This method involves the use of logical tools to distinguish correct arguments, i.e. those that are consistent with the laws of logic, from those that violate the rules. The laws of logic determine the correctness of reasoning used in all sciences. Logic and its methods also allow to discover the most general structural aspects of our thinking and actions (Peregrin, Svoboda, 2017). A version of logical analysis is a thought experiment. The application of the tools of logical analysis to propositions expressed in natural language is justified by the fact that the rules of such a language are also subject to the laws of logic.

Logical analysis is also helpful in research conducted in management sciences. It enables better understanding of their theories and conceptual framework (Ngulube et al., 2015). Management sciences, like any other scientific disciplines, have their own research methods and are characterized by interdisciplinarity. For this reason, some kind of methodological eclecticism can be attributed to these sciences. It allows to combine methods from various disciplines, paradigms and approaches, ensuring their cognitive and pragmatic efficiency. These are both quantitative and qualitative methods. The research process in management sciences is often accompanied by various types of models, including: theoretical and conceptual, research or statistical. The model, in general, means a hypothetical thought structure, i.e. the arrangement of assumptions, concepts and relationships between them, allowing you to describe some aspect of reality. A model should not be confused with a theory. The purpose of a model is to represent something. A theory is to explain a class of phenomena (Frigg, Hartmann, 2025; Nersessian, 2010). The role of logic in research is crucial because it allows to draw correct conclusions and avoid errors in reasoning.

Logic is a formal science (Copi et al., 2016). The basic concept of logic is the concept of truth and its opposite concept of falsehood (Quine, 1986). In the most general sense logic is concerned with the principles of valid (true) inference (Kneale, Kneale, 1962). Both formal and informal principles of logic can be applied to the analysis of a text in natural language

(Ngalande, 2011). The author of the article does not use formalisms. The goal is not to strictly reproduce the conceptual structure of the analyzed field but to capture the most central problems of the concept of hypothetico-deductive method in the aspect of its evolution. The term "logic" that appears here should not be identified with a priori science. It is rather a specific method of research used in the social sciences (Mahoney, 2021).

It is worth pointing out the difference between the terms "methodology" and scientific "methods". In the most general sense, "methods" mean the techniques used by scientists in their research practice (Bryman, 2008). Methodology is the study of research methods (Rajasekar, Verma, 2013. We distinguish general methodology of science, i.e. the theory of scientific methods used in all sciences, and detailed methodologies analyzing the methodological foundations of individual scientific disciplines.

3. Literature review

Science was born in ancient Greece in the 6th century BC. The first ancient Greek philosophers put forward the idea that the Universe is a certain structure and that its beginning was some primordial material, which they considered water, air, earth or fire. It was recognized that these elements can be transformed into each other and that natural phenomena are dependent on these transformations (Johansen, 2005). An inseparable part of this concept, which cut itself off from any reference to myths or religious beliefs, was the theory of the conservation of matter: nothing comes from nothing. Then Pythagorean philosophy, permeated with the science of numbers, introduced the idea of mathematization of the Universe (Barnes, 2002). Atomic philosophy proposed the structure of matter in the form of indivisible particles, or atoms, separated by a void (Pullman, 2001). Aristotle used empiricism to oppose Plato's theories on the geometrization of things in nature. As a keen observer of the form and habits of animals and the anatomy and functions of their organs, Aristotle is considered the first naturalist (Hähnel, 2020). He also gave us the basic principles of logic and is considered the discoverer of the empirical method.

There are four basic elements of ancient Greek science: the view of the whole, cause, analysis and composition (synthesis). Greek science was anthropocentric and developed the "physiocratic" (naturalistic) school of thought. On the other hand, however, it is easy to notice the humanistic motive, expressed in the belief that the basic goal of research is not practical application, but knowledge, which is an autotelic value (Charitos et al., 2022). Although in ancient Greece topics that are today classified as various scientific disciplines they were at that time called philosophy (literally 'love of wisdom').

The idea of science understood empirically appears already in the writings of Aristotle and in the late Middle Ages in the works of Roger Bacon. However, we owe the full understanding of the empirical nature of scientific knowledge to the thinkers of modern times. The first serious attempt in this area was made by Francis Bacon, who pointed to the so-called problem of induction (Bacon, 1878). Bacon distinguished two types of induction: enumerative and eliminative (Hintikka, 1968). Enumerative induction is performed by simply enumerating cases. It takes the form: if A_1 is B, A_2 is B, ..., A_n is B, then every A is B. This is simply naive reasoning. Eliminative induction is a method of finding truth by using evidence to eliminate false hypotheses and finding the true one (Hawthorne, 1993). Bacon's lasting contribution to the methodology of science is that in an attempt to explain the mechanism of eliminative induction he applied the idea of an experiment understood as a planned observation (Gooding, 2017). The essence of the problem of induction lies in the unreliable nature of the conclusions obtained through this method of reasoning.

David Hume noted that "inductive reasoning is an activity of the mind that takes us from the observed to the unobserved" (Sloman, Lagnado, 2005, p. 95). Hume, being an empiricist, pointed out the limitations of the inductive method (Howson, 2000). This was an important step in the development of the methodology of science because it forced subsequent scholars to undertake research, on the one hand, on the nature of scientific knowledge, and on the other hand, on the improvement of the research tools and techniques used.

Bacon was also the first scientist to point out the key role of hypotheses in scientific research. Although the concept of hypothesis already appeared in ancient thought (Forno, 2011), where it was often used by various thinkers, it was not until the modern era that this concept became an important element of methods used in science (McMullin, 2009; Brüssow, 2022; Karunarathna et al., 2024). In fact, the first scientific work to show the important role of hypotheses in the development of science were Euclid's *Elements*, written around 300 BC. (Heath, 1956). The importance of this work cannot be overestimated and is a separate issue that goes beyond the scope of this article. However, it indicates the continuity of the development of science also in terms of the used methods.

The actual beginning of the modern scientific method dates back to the seventeenth century involving: (1) a chain of research events from Copernicus to Newton, which resulted in (2) the gravitational model of the solar system, and (3) the theory of Newtonian physics to express the model (Betz, 2010). The methodological foundations of modern science, especially physics, were prepared by Galileo. The greatest emphasis in the method he developed was placed on reasoning (Finocchiaro, 2012). He was the author of the basic principles of conducting a scientific experiment, but he also developed and used a thought experiment. An important step was also the first philosophical work devoted exclusively to methodology, namely Descartes' *Discourse on Method* (Descartes, 1998). It seems to be no coincidence that the seventeenth century, in which methodology was the main subject of philosophical considerations, was also the beginning of modern science.

The first clear distinction between scientific and metaphysical knowledge was made, under the influence of the successes of Newtonian physics, by Immanuel Kant. According to him, science investigates objects of experience, while metaphysics analyzes the ideas of God, the cosmos, and the soul. Kant argued that the justification for the scientific method comes from metaphysics. Science is possible thanks to the a priori forms of sensibility, which are space and time, and the categories of pure understanding, an example of which is causality (Kant, 1787/1965). Kant's philosophy combined two great epistemological traditions: empiricism and rationalism.

Positivism, founded by the French philosopher and mathematician Auguste Comte, rejected metaphysics as a science. This resulted in a radical turn towards empiricism. A hundred years later *the Vienna Circle* revived a new version of Comte's position called neo-positivism or logical empiricism. The neopositivists introduced a demarcation criterion according to which only those statements that are experimentally verifiable are scientific (meaningful). It soon turned out that scientific statements are not able to meet this criterion (Stadler, Nielsen, 2001). Therefore, it was replaced by Rudolf Carnap's criterion of gradual confirmability.

Karl Popper addressed the above mentioned problem with a modification. He considered the theory of scientific method to be crucial to all epistemology (Popper, 2005). Popper proposed that the criterion of demarcation, or the principle enabling the distinction of scientific from pseudoscientific statements, should be the falsifiability of the first ones (Mahner, 2013). These statements should describe what is possible in reality and thus should be susceptible to refutation. In science, certain statements are accepted not because they are largely confirmed or highly probable. All scientific statements are in fact accepted on probation. The appearance of a state of affairs prohibited by a scientific hypothesis refutes that hypothesis. The scientific method in this approach does not consist in confirming hypotheses. Scientific statements are only more or less probable. One should not strive to confirm them, but the scientist's efforts should be directed at attempts to falsify, i.e. to demonstrate the inconsistency of the hypothesis with the results of the experiment. In short, Popper claimed that a scientific theory cannot be ‘verifiable’ but only ‘falsifiable’ (Mitra, 2020). The method presented above is called the HD method. The concept of deduction also requires a brief presentation.

Deduction, unlike induction, is characterized by reliability in the sense that only true conclusions result from true premises. This is of course provided that the premises are not false and no logical errors are made in the reasoning. Deduction does not refer to empirical facts, but is based on logical facts. It is a process of reasoning, the essence of which is to draw conclusions from the general to the specific (Kac, Ulam, 1992; Martin et al., 2001). The sciences based on deduction are mathematics and logic. However, the deductive method is also used in empirical sciences (Stadler, 2004). The relationship between mathematics and logic is a complicated matter (Cellucci, 2013; Morsanyi, Szücs, 2014). The a priori status of these scientific disciplines is also sometimes questioned. This is an important issue from a methodological point of view, since the laws of logic are applied in all other sciences (May,

2018). Another important issue is the role of logic in scientific discovery. There are different possible positions here and the debate is more philosophical than scientific.

An example of a deductive reasoning scheme is a deductive argument form and rule of inference called *modus ponendo ponens*. It has the following logical form:

1. If p, then q
2. p
3. Therefore, q

The *modus ponens* rule may be written in sequent notation as:

I. $P \rightarrow Q, P \vdash Q$

An example of an argument that fits the rule *modus ponendo ponens*:

1. If today is Monday, Mary will be happy
2. Today is Monday
3. Therefore, Mary will be happy

The general principle of deductive reasoning is expressed by the deduction theorem. According to it: If we can derive B from a set of premises Γ including A, then we can derive the implication $A \rightarrow B$ from the original premises alone. In other words, we can derive that A implies B. Formally, it can be expressed as:

II. $\Gamma, A \vdash B \rightarrow \Gamma \vdash A \rightarrow B$

The deductive theorem allows us to transform a deduction that involves a hypothesis into a deduction without this hypothesis. It facilitates the simplification of complex arguments. This theorem is used in logic but also in mathematics, computer science and philosophy.

HD method in the face of the difficulties of induction presented above rejects this method and the possibility of verifying hypotheses. It accepts two basic assumptions: (1) that all statements occurring in science, including individual ones and those based on observation, are hypothetical and revocable; (2) that the aim of scientific procedure is to eliminate false hypotheses through falsification. These are the two basic methodological canons of this method.

In the HD method, the following three stages can be distinguished:

1. The stage of collecting information about individual phenomena or processes, identifying facts that require explanation (anomalies) and formulating a research problem.
2. The stage of constructing a theory, in which the formulation of hypotheses is of key importance. It is carried out on the basis of eliminating false hypotheses. This is what falsification is all about.
3. The stage of deciding on the value of the theory. It consists in testing the hypotheses. The value of the theory is confirmed not, as in the inductive method, by full or partial confirmation of the hypotheses, but by their falsification.

It is worth noting that the formulation of hypotheses also takes place in the inductive method. The difference is that the basis for determining hypotheses in the inductive method is a set of facts that create a basis for inference to confirm the degree of their credibility.

In the HD method, on the other hand, the basis for formulating hypotheses is an attempt to explain the discovered anomalies (Lisiński, 2016). In other words, the hypotheses formulated on the basis of the HD method are bold, creative, and original ideas.

From the hypotheses, empirical consequences are then deductively derived. These are predicted facts that should occur according to the hypotheses. This process is a logical inference. The process of deductive reasoning can be presented by the following diagrams:

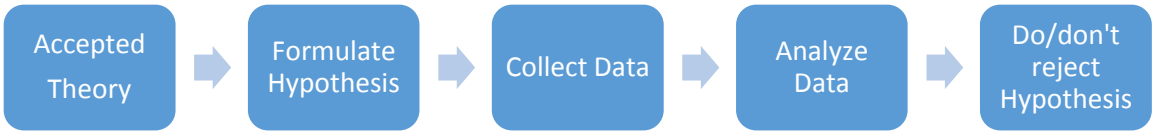

Figure 1. Deductive Reasoning Scheme.

Source: own elaboration.

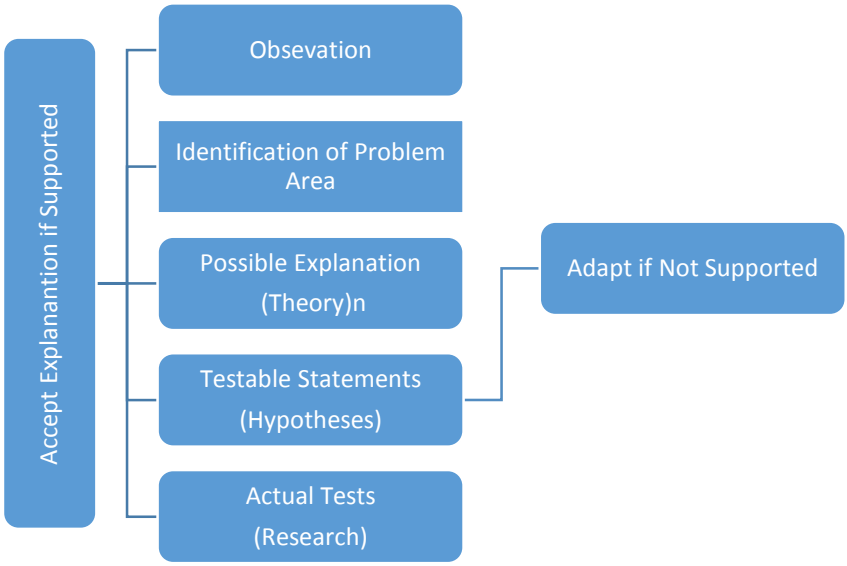

Figure 2. Model of the Hypothetico-Deductive Method.

Source: own elaboration.

Management science as we know it today did not suddenly appear fully formed. They emerged in a long process whose roots date back to antiquity. They belong to empirical sciences, or more precisely, economic ones (Dźwigoł, Dźwigoł-Barosz, 2018). It can be roughly assumed that the scientific approach to management appeared in the second half of the nineteenth century (Witzel, 2016). However, it should be remembered that scientific management is not the same as management science. From the point of view of the topic analyzed in this article, we are interested in the application of the HD method in these sciences. It should be stated that deductive method has been used in management sciences since its inception. Moreover, research on the history of economic methodology shows that the deductivist tradition is already present in classical and neoclassical economics (Klein, 1985).

If we accept the assumption that the methodology of management sciences should meet the criteria of rationality to the highest possible extent (Mantere, Ketokivi, 2013), then the use of the HD method seems to be indispensable. Due to space limitations, the importance of abductive reasoning is omitted in this study. However, it is worth being aware that it also plays an important role in management studies (Szydło, 2020). The concept of abduction comes from Charles Peirce's philosophy (Peirce, 1934). Broadly speaking, abductive reasoning involves formulating the most probable hypotheses to explain a given set of facts. Abduction is in fact the explanation of what is already known.

In the opinion of some scholars, one of the key problems of the relatively young management sciences are heterogeneous research methods. To increase the credibility of research, combining various research methods is proposed (Dźwigoł, 2022). The HD method is theory-based and allows for testing theories (Barkema et al., 2015; Walsh, 2015) which is particularly important in the development of management sciences. According to the HD method, hypotheses can contradict all existing theories and all literature on a given subject (Siponen, Klaavuniemi, 2020). This creates enormous opportunities for developing the theoretical framework of these sciences.

The HD method is used in quantitative management, which focuses on adapting mathematical models and processes to management situations (Pindur et al., 1995). Mathematical models support decision-making and problem-solving processes. In qualitative data analysis, a deductive approach is also used alongside inductive analysis, ensuring a greater degree of objectivity in the obtained results (Azungah, 2018; Kennedy, Thornberg, 2018). The deductive approach is also used in the commonly used content analysis (Pandey, 2019).

The general mechanism of applying the HD method in management sciences is aptly described by the following words: "Management is deductive: it states a goal and measures achievements, it is based on science. Science is inductive, using experiments and observations to draw conclusions and then deduces hypotheses for testing" (Davis, 1985, p. 588). The ability to reason deductively is obviously used at various stages of research. First and foremost, applying theory to practice requires a deductive approach (Lee, Lo, 2014).

Deductive reasoning in management sciences often involves using collected information and logical selection of a solution that appears most advantageous under the specific conditions of a given task (Konczak, Paslawski, 2013).

Research methods in management sciences are constantly modified and improved due to the fact that research conducted in these sciences concerns dynamic changes of a social, economic, scientific, technological and cultural nature (Rose et al., 2023). This, of course, forces scientists to use various research tools and techniques. There is a tendency to reject traditional thinking in favor of combinative thinking. This also applies to the methods used within these sciences (Dźwigoł, Dźwigoł, 2018). As already noted above, management sciences are empirical ones and therefore they use methods characteristic of these disciplines. The HD method is one of the most commonly used.

4. Results and Discussion

The term "methodology" comes from the Greek words "methodos" and "logos", which together mean "way" or "study". In the most general sense a method is always a method of a certain specific type of human activity. Each such activity, in turn, is a process. Each process is a certain whole, that is, a type of complex object. Each such complex object has its own structure that can be understood in a broader or narrower sense. In the broader sense, a structure is a system of relations between the components of a whole; in the narrower sense, it is a set of components of a whole and a system of relations between them (Kotarbiński, 1977). This is a general, even philosophical, approach to the concept of method.

The hypothetico-deductive (HD) method is a term for the scientific procedure of validating theories by formulating hypotheses (premises) and deriving and testing conclusions. J.S. Mill, a proponent of methodological empiricism, proposed that political economy should be studied first by postulating a series of general definitions and laws concerning the behavior of the objects studied, and then on their basis deriving conclusions concerning specific and observable facts. Interestingly, Mill also considered mathematics and logic to be empirical sciences.

HD method is based on two assumptions: (1) all statements made in science, including individual ones and those based on observation, are hypothetical and revocable; (2) the aim of scientific procedure is to eliminate false hypotheses through falsification. According to the above considerations, it can be stated that HD method consists of: (1) freely putting forward the most daring and risky theoretical hypotheses until they can be falsified, i.e. shown to be false; (2) deductively deriving observational conclusions; (3) carrying out the most rigorous attempts to refute them by pointing out inconsistencies between predictions and experimental results.

Some of the major problems associated with the HD method are the problem of alternative hypotheses and the Duhem-Quine problem, in light of which a number of alternatives to the HD method have been proposed, such as Carl G. Hempel's account of confirmation, probabilistic and Bayesian accounts of confirmation, and Milton Friedman's instrumentalism. One of the basic problems of the HD method, which we only mention, is the fact that scientific hypotheses, if they are to be useful in science, should be calibrated with the empirical world. However, the relationship between hypotheses and empirical data raises many difficulties (Sprenger, 2011; Casula et al., 2021). According to Hempel's (1967) interpretation of the HD method, which is widely accepted, the main purpose of the HD method is to determine whether the theory is (at least observationally) true or not.

The analysis of the current state of methodology in management sciences is of course a separate issue. One can find in the literature a view that this state is not satisfactory (Labarca, 2017; O′Leary, 2017; Quinton, Reynolds, 2018; Thomas, 2017). However, it seems that these

opinions are exaggerated. It should be remembered that management sciences are interdisciplinary in nature, which also influences the methodology used in them (Van Baalen, Karsten, 2012). This interdisciplinarity is the strength of these sciences and can bring new insights and support effective problem-driven research (Reinecke et al., 2024). However, this also brings new challenges, one of which is the clarification of the research tools and used techniques (Sieldok, Hibbert, 2014).

However, it should be borne in mind that the methods used in management sciences are not and cannot be of a universal nature (Dźwigoł, 2019). This is due to the dynamic nature of the environment analyzed by these sciences and the processes taking place in it. The HD method, sometimes called simply the scientific method, is often used in management sciences. Its use brings the methods of these sciences closer to a strict pattern of reasoning and allows for obtaining useful knowledge, which is particularly desirable.

Management research has a long and rich history of borrowing theoretical frameworks, methods and ideas from other disciplines. In terms of the influence of methodologies developed in other disciplines on the methods used in management sciences, one can point to fields such as machine learning (von Krogh et al., 2023), computational modeling, or qualitative comparative analysis (Bliesen et al., 2024). The methods used there can offer innovative ways of exploring new management problems or help to see existing problems in a new way. This also applies to the HD method. In its different versions.

The question of the role of deductive reasoning in knowledge creation arose already at the beginning of philosophy (Plato, 1962). It remains relevant even in the context of the considerations presented in this article. If management sciences are empirical disciplines, then the question arises: what is the contribution of deductive reasoning to the creation of knowledge acquired within these sciences? The concept of "learning by thinking" seems to be an interesting contribution to this issue (Lombrozo, 2024). Current progress in the field of artificial intelligence shows that such learning is possible not only in the case of human minds. It also opens up further possibilities for research into the nature and mechanisms of deductive reasoning. The use of the HD method in management sciences makes the obtained results more precise and these sciences themselves become methodologically similar to the exact sciences.

According to what has been found, there are not many studies devoted to the HD method in its historical development and significance for contemporary research conducted in management sciences. This article attempts to fill this gap. Its goal is to identify the origins of the HD method as a way to avoid the problems associated with the use of inductive reasoning, and to highlight its contribution and significance to achieving full methodological maturity in management sciences.

5. Summary

The history of the development of the scientific method began in ancient Greece. Greek philosophers are considered the founders of science precisely because they were the first who realized the need to study reality based on cognitive efforts rooted in rational reflection and experience. A brief outline of research on the methodology of science in the European tradition shows that science constitutes a certain whole and its development is largely determined by research methods that should be used in various types of cognition.

In the most general sense, it can be said that progress in scientific research is made through a dialectical dialogue between the formulation of hypotheses and their experimental testing. During the development of scientific knowledge, two basic research methods emerged: induction and deduction. The HD method has developed in a long process of evolution of research on methods of scientific cognition, particularly under the influence of difficulties related to induction.

The methodology of management sciences, as any scientific methodology in general, should meet the criteria of rationality to the greatest possible extent. Various types of research methods are used in management sciences. This is mainly due to the diversity of the issues addressed and the interdisciplinary nature of these sciences. Both quantitative and qualitative research methods are used. The problem of choosing a specific research method is dictated, on the one hand, by the aspect of creating new knowledge, and on the other, by the issue of its justification. The main research method, as in other empirical sciences, remains induction. Under the influence of Karl Popper's criticism of the inductive method, the HD method began to be used more and more frequently in economic sciences and then in management sciences.

HD method refers to empirical facts. The use of this method allows us to formulate statements that are only to a certain extent probable. They are hypothetical in nature, because they are only partially confirmed by the collected facts and events. The use of this method, which is particularly important in the case of management sciences, allows you to obtain useful knowledge.

It is worth paying attention to another rarely discussed theme: the HD method, due to the way in which hypotheses are formulated on its basis, most fully expresses the creative nature of scientific knowledge. Management sciences, on the other hand, analyze not only the objective facts and conditions accompanying management processes but also refer to actions undertaken by people who are free and autonomous moral entities.

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