SCIENTIFIC REVOLUTION

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ABSTRACT

It can be asserted that the Scientific Revolution and its development represent a complex series of events that have occurred. The opportunities and possibilities we enjoy in society today are result of the actions of many bold individuals that allow us to experience a vision of the world that would have been difficult to imagine in the past. Scientific Revolution marked progress in science, technology, and society. It laid the foundations of the scientific method, primarily based on observation and experimentation. Academies and scientific institutions were established, promoting science in its finest form. Science itself has the ability to evolve, regulate, and recover. With the changes in science, universities also evolved, responding to variable circumstances in social life since the 12th century. University, a place of research and teaching, transformed into a conscious participant involving many stakeholders. The Revolution reconstructed science based on new attitudes within certain communities. Its goal was to modify frameworks through the influence and persuasion of the scientific community. Scientific Revolution (Latin *revolvere* - to return, to overturn) according to Rodin, is essentially the revolution of science itself, while Hegel, from a philosophical perspective, sees Scientific Revolution as nothing other than the return of individual sciences in particular sectors of being to the origin of being itself. Term "science" comes from the Greek word *epistēmē* – understanding, comprehension, knowledge, and the Latin *scientia*, *scientiae* – knowledge based on data that can be proven and reproduced. The objective of this paper was to demonstrate how intellectual capital, which includes results of scientific research, scientific discoveries of theoretical, developmental, and practical significance, as well as the educational level and research activities of the active population, becomes a crucial factor for the contemporary functioning of social reproduction in the most developed countries in world, significantly influencing the overall social and economic development and transforming social reproduction through the contributions of individuals with their knowledge, skills and creativity.

Keywords: Scientific Revolution, science, university, classification of sciences, humanities and social sciences
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INTRODUCTION

The concept of science can be comprehended in the historical context in which it originated. The Scientific Revolution of the 17th century consisted of two interconnected developments in science: changes in scientific practice, which led to the establishment of associations, and accompanying changes in the way scientists described the behaviors emerging from these new scientific practices. Initially, the progress of science was relatively slow, as knowledge itself was passed down orally for centuries. The history of the advancement of knowledge and the development of science can be viewed as the history of humanity. With the progress of the Scientific Revolution, critical thinking also evolved, encouraging the analysis and exploration of many creations and theories. Scientific Revolution allowed science to develop in a new direction, where, thanks to the pioneers of modern science, became the primary authority in the modern world. The concept of Scientific Revolution is a speculative term, meaning that it does not express a stance on something external but rather denotes a self-contained concept. In essence, the Scientific Revolution carries its own problem, as it does not require a relationship with anything else but only with itself. Therefore, we can say that Scientific Revolution is, in fact, a revolution within science. The Latin root of the term *revolutio* is *revolvere*, which means: to turn back, overturn, reversal, rotation, upheaval (1).

The term *science* originates from the Greek word epistēmē – understanding, knowledge, and the Latin word *scientia*, *scientiae* – knowledge based on data that can be proven and reproduced. There are various definitions of science, with conceptual definitions distinguishing between science in a broader and narrower sense. The encyclopedic definition (Croatian Encyclopedia) of science understands it broadly as "a collection of all systematically methodical and structured knowledge, and the activity through which such knowledge is acquired." In a narrower sense, science is the collection of knowledge obtained through scientific methods and the rational activity of predicting and explaining phenomena in the environment, achieved by subsuming individual phenomena under universal laws (2, 3). Before the onset of Scientific Revolution, science as a discipline was often mixed with other fields, such as magic, which was then considered a form of science. Although many reject it today, it is essential to examine its origins and role during the time when it was widely accepted (4). During the Renaissance and early modern period, science began to separate from the arts, as seen in more recent scientific developments. In 17th century, there were various ways of understanding natural phenomena, most commonly accepted by scholars, as philosophy lacked adequate rational explanations for the natural world. Science, as we understand it today, has existed for approximately four hundred years. With the arrival of Galileo, Descartes and Newton, the idea emerged that the physical world could be described through a few basic concepts linked by quantitative laws. Throughout its history, science has aimed to be accessible to all, while Scientific Revolution paved the way for new enthusiasts and restored faith in knowledge. It laid the foundations of the scientific method (5, 6). In the mid-15th century, a need arose to establish

institutions where scholars could gather. In these institutions, intense debates on humanities-based topics took place. Such institutions were called academies, and they flourished in 17th century. (7) Unofficially, they were founded in the 1440s, with one of the first being established in Florence under the name *Accademia Platonica (8).* Following their model, the first scientific societies were also formed in the same century.

The objective of this paper was to demonstrate how intellectual capital, which includes the results of scientific research, scientific discoveries of theoretical, developmental, and practical significance, as well as the educational level and research activities of the active population, becomes a crucial factor for the contemporary functioning of social reproduction in the most developed countries in the world, significantly influencing the overall social and economic development and transforming social reproduction through the contributions of individuals with their knowledge, skills, and creativity.

THE SCIENTIFIC REVOLUTION AS A CONCEPT

The development and dominance of Scientific Revolution was caused by a complex series of events that have occurred. Scientific Revolution is result of a grand idea about a new civilization, one that strives for constant progress. The opportunities and rights we have today in this world – from technological advances to social progress – were once unimaginable. Thanks to many courageous individuals, today we can say that we enjoy the vision of the world they imagined centuries ago. The great complexity of all historical events, from religious conflicts to scientific ones, led to Scientific Revolution as we know it today. Although talk of revolution is often exaggerated, most analysts agree that there were transformative scientific developments of various kinds (9). Unlike normal science, a revolution is a non-cumulative developmental episode. A revolution is essentially a reconstruction based on new foundational views within a scientific community. When speaking of revolutions in the plural, one can say that they are special episodes where there is a reversal in expert opinions. The goal of revolutions is to alter frameworks in a way that is impossible to do within the same framework. This is where the persuasion of the scientific community comes into play (10). History shows that the creation of knowledge has always embraced new opportunities. Therefore, Scientific Revolution must be directed in the right direction. Scientific Revolution is an overarching concept that encompasses a multitude of assumptions about the future creation and spread of knowledge. A revolution could relate to many things: to the process of creation, to the result, to scientists, but also to the rest of society. The diversity and ambiguity of discourse directly affect the changing scientific environment. Scientific Revolution, as such a whole, can be somewhat confusing (11).

TYPES OF CLASSIFICATIONS OF SCIENCE

The classification of science involves division of science according to certain principles and criteria, such as general characteristics, subjects, methods, and so on. Throughout history, there have been various classifications of science. Each classification leads to new insights

and new classifications (12). As for the method of classification, one could say that it is a ubiquitous and generally accepted method. Everything that had developed and branched out needed to be divided to a great degree, categorized, and classified, where the classification method helps. According to Kedrov, science can be divided into three main groups: natural sciences, social sciences, and philosophy. Thus, at the crossroads between natural and social sciences, we find technical sciences (13). Agricultural and medical sciences belong to the technical sciences. Psychology is the only independent science that studies human psychological activity from its natural-historical side (14). Today, science is most commonly classified according to the subject it studies. Formal sciences are those sciences that study formal side of real things and events, such as mathematics and formal logic. Real sciences study real objects and events, and they are divided into natural sciences, which study natural phenomena, such as biology, physics, and chemistry; spiritual sciences, such as psychology, sociology, history, and economics; social sciences, which study social phenomena, including political and social history and political economy; and systematic sciences, which aim to systematically round off knowledge of a particular area, such as systematic zoology, botany, and general sociology of plants and animals. Classification of science essentially involves discovering connections between sciences based on certain principles. No classification of science can be final. Nature of scientific revolutions is a topic that raises a series of questions about sciences and how to interpret them (15). This is a topic that concerns philosophers of science and their colleagues from other disciplines, as Lelas points out (16). To have trained, experienced, inventive, and creative intellectuals, researchers and scientists create scientific programs, projects, and other scientific, technical and professional written works, they must possess an appropriate quantum of disciplinary and interdisciplinary knowledge: about scientific fields, branches, areas, and disciplines (i.e., classification of science), about at least twenty scientific methods that can be successfully applied in scientific research in appropriate combinations (i.e., methodology of scientific research), and knowledge of methodological procedures and intellectual activities in the production of scientific products, or the transformation of ideas into written works (i.e., technology of scientific research). This is because the scientific industry cannot efficiently produce quality scientific products without the interactive link between classification of science, methodology, and technology of scientific research. Such an interactive link implies the existence of a stable interrelationship between classification of science, disciplinary, and interdisciplinary scientific research (17).

UNIVERSITY AS A SCIENTIFIC INSTITUTION

Although experts generally believe that universities are highly resistant to change and strongly oppose it, they have always evolved. Today's scientists comment that the development of science was questioned in the past and that the understanding of science and the acquisition of knowledge were dramatic (18). Namely, since the establishment of the first universities in Europe during the 12th century, universities have responded

to the changing circumstances in the social, economic, and political environment. Cumulatively, all these processes of change, which have been ongoing for centuries, led to the creation of the 21st-century university system, which is fundamentally different from all previous university systems (19). Higher education, the development of the knowledge society and the dominance of neoliberal public policies in education have led to the creation of new models of modern university. Models such as the second and third type of university and the triple helix emphasize the practical dimension of higher education and its applicability, which is manifested through innovations, patents, and collaboration with a wide range of regional, national, and supranational stakeholders. Previously dominant Humboldtian model, characterized by a foundation in teaching and research, is being replaced by an expanded role for universities through the "third mission," which is primarily defined by the commercial nature of creating new knowledge. Science is primarily evaluated through its applicable and commercial dimensions, and the role of scientists is changing, with scientists increasingly focusing on the managerial aspect of their work. Meanwhile, natural and technical sciences are taken as epistemic models, while social sciences and humanities are marginalized (20). The understanding of university as a place of research and teaching is expanded by the idea of the third mission, which is primarily based on the economic dimension. In this way, university transforms into a conscious and networked actor in regional development, connected to many different stakeholders (21). This type of approach is based on the principles of natural and technical sciences. In this context, social and humanities sciences become the "blind spot," and their contribution, due to the epistemological shift, is primarily evaluated through the criteria of natural and technical sciences, with activities directed toward social entrepreneurship. The critique of modern university models, which arises as a response to these trends, can be synthesized through three main responses: criticism of the entire models as universally inapplicable and/or methodologically insufficiently developed; attempts to integrate into the existing model by expanding the applicable dimension of social sciences, with an effort to redefine the third mission of the university to include the social dimension; and, finally, the rejection of modern university models as epistemologically incompatible with social and natural sciences (22).

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ZNANSTVENA REVOLUCIJA

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SAŽETAK

Može se utvrditi da je znanstvena revolucija kao i njen razvoj zapravo jedan kompleksan niz događaja koji se dogodio. Mogućnosti i prilike koje nam se danas pružaju u društvu su rezultat djelovanja niza odvažnih ličnosti i gdje zaista možemo reći da uživamo ideju svijeta koja je u prošlosti bila teško zamisliva. Znanstvena revolucija je označila napredak u znanosti, tehnologiji i društvu. Postavili su se temelji znanstvene metode koja se primarno bazirala na opažanjima i pokusima. Osnivale su se akademije i znanstvena društva koja su promovirala znanost u njenom najboljem smislu. Znanost sama po sebi može biti sposobna da se mijenja, regulira i da oporavlja. Mijenjanjem znanosti, mijenjala su se i sveučilišta koja su od 12. stoljeća odgovarala na varijabilne okolnosti u društvenom životu. Sveučilište kao mjesto istraživanja i poučavanja se pretvara u svjesnog aktera kojeg čini veliki broj dionika. Revolucija je rekonstruirala znanost temeljem novih stavova u nekoj zajednici. Njezin cilj je izmjena okvira i to utjecajem te uvjeravanjem znanstvene zajednice. Znanstvena revolucija (lat. *revolvere* - natrag vratiti, preokret) prema Rodinu je ustvari sama revolucija znanosti, dok Hegel s filozofske strane znanstvenu revoluciju smatra ničim drugim do povratkom pojedinačne znanosti o ovom ili onom sektoru bića na iskon bića samog. Pojam znanost dolazi od grčkog pojma *epistēmē* – razumijevanje, znanje i latinskog pojma *scientia, scientiae* – znanje koje se bazira na podacima koji se mogu dokazati i reproducirati. Cilj rada je prikazati kako intelektualni kapital, koji uključuje rezultate znanstvenih istraživanja, znanstvena otkrića teorijskog, razvojnog i praktičnog značaja, te razinu obrazovanosti i znanstveno-istraživačke djelatnosti aktivnog stanovništva, postaje ključan faktor za suvremeno funkcioniranje društvene reprodukcije u najrazvijenijim zemljama svijeta, značajno utječući na cjelokupni socijalni i ekonomski razvoj te transformaciju društvene reprodukcije kroz doprinos pojedinaca svojim znanjima, vještinama i kreativnošću.

Ključne riječi: znanstvena revolucija, znanost, sveučilište, klasifikacija znanosti, društvene i humanističke znanosti

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