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Abstract: The purpose of this study is to explore the convergence between economics and quantum physics and to show that the advance of information economics and the network societies were enabled by the developments of physics and quantum mechanics. There is a need to establish the research departing point for the information economics emerging area. The paper argues that this departing point should be in quantum mechanics, that is, by establishing connections between the shift of human knowledge paradigm and information economics. This study briefly presents the evolution of human knowledge and science (quantum mechanics) that led to (and are an integral part of) the network societies and the information economics area as a new branch of economics.

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Key words— Information economics, knowledge, network societies, transformation.

I. INTRODUCTION

The objective of this paper is to establish the starting research point of information economics and network societies. That is, to show that the advance of the information economics and globalisation was enabled by the developments of physics and quantum mechanics, this in turn was possible by dismantling the Cartesian philosophical view.

This study briefly presents the evolution of human knowledge and science (quanta mechanics) that led to (and are an integral part of) the network societies and the information economics area as a new branch of economics (summarised in the figure 1).

Fig. 1: The Evolution of the Revolution

The remainder of this paper is organized as follow: in Section 2 it will be reviewing the scientific transformations that lead to the quanta mechanic discoveries which enabled the information technology transformation (Section 3), which in turn gave the rise of information economics and network societies (Section 4).

II. SCIENTIFIC TRANSFORMATIONS

This section presents the genesis of human knowledge. It was considered as a necessity to show how the way of understanding the nature was changing over the time and that it was essential to develop ‘new phrasing’ for the modern science.

Hellenistic period was an international, cosmopolitan age with advances, which were made in various fields of scientific inquiry, including engineering, physics, astronomy and mathematics. One of the initiators of the ‘Hellenistic explosion’ was Aristotle (384BC-322BC). The main point for Aristotle was that there was one overall principle: united sky above and earth beneath, the idea that everything has its function within a greater whole. This principle was the scientific and philosophical pillars for the next centuries, i.e. until the Medieval, to use Marx’s words, “Scientific Renaissance” or the First Great Transformation.

The institutionalised 2,000 year-old tradition of Aristotelian science was started breaking down by discoveries of Nicolaus Copernicus (proposed heliocentric theory), Giovanni Battista Benedetti (who showed that velocity of falling bodies is not...
related to their weight), Tycho Brahe (*the heavens were not immutable*), Giordano Bruno (who claimed that Universe is infinite) and so forth. Further advance of the First Great Transformation was shaped by Isaac Newton’s *Principia*, who analysed the motion of bodies in resisting and non-resisting media under the action of centripetal forces, and Rene Descartes (1596-1650), who established deductive (complimentary rather method to the inductive Aristotelian) method of reasoning, concluding that explaining the nature by only inductive method was not possible “because all explanations were beyond experience” which was then just speculation.[9]

Furthermore, the Darwinian revolution of the nineteenth century suggested an alternative approach. The development of the new nature’s method – evolution was certainly in discrepancy with Cartesian changeable definite mechanistic approach to the world. However, it needed further physics advances to finally break down the Cartesian mechanistic view. The work of Albert Einstein (1879-1955), Max Planck (1858-1947), Niels Bohr (1882-1962), Lorentz, (1853-1928) Werner Heisenberg (1901-1976), Ernest Rutherford (1871-1937) and many others who not only disputed the mechanistic approach but also set up the foundations for the quantum leap of the science that has risen to the today’s Informatics Paradigm and the Network Revolution.

These discoveries were a turning point in the contemporary science which Einstein, somewhere, conceived as the science that was certainly in discrepancy with Cartesian unchangeable definite mechanistic view. To resolve this problem, Planck made an assumption that energy, at the sub-atomic level, can only be transferred in small units, called *quanta*. Based on the quanta idea, Louis de Broglie in 1923 developed fundamental concepts in modern physics that light has a wave and particle state (but not at the same time), called wave-particle dualism Classical physics was untied with problems of wave/particle duality, but was completely dismantled with the discovery of the uncertainty principle, developed by W. Heisenberg. [9]

The relevance of the quantum physics to the information technology can be seen through the Heizenberg’s *Principle of Uncertainty* which was a corner stone of Shanon’s theory of information, which expanded our understanding of the nature of information. Further convergence between the information technology and economics and the quantum mechanics can be illustrated by the phenomenon called *quantum tunnelling*, which was a basis for the discovery of transistors.

### III. INFORMATION TECHNOLOGY

The technical foundations of today’s information technology, based on the use of the electronic valve as a high speed switch, were laid during the 1939-1945 period. However, two events in the post-war period may be singled out – Claude Shanon’s work on information theory in 1948 established the criteria for data transmission and the invention of the transistor by Bardeen, Brattain, and Schockley in 1947/8.

Shannon equates information with uncertainty (Heizenberg’s Principle of Uncertainty) while studies of materials, particularly the application of quantum mechanics to solids (quantum tunnelling), led to new devices and the invention of the transistor (1947/8). The 1950's were a decade of transition. It marked the end of the development of sophisticated vacuum-tube systems and the beginning of the transistors - the semiconductor chip, which embodies transistors and many other formerly discrete components and their interconnections, enables information to be processed rapidly and cheaply using very little space and without generating appreciable heat.[7]

However, the most dramatic outgrowth of the microelectronics industry has been the virtual creation of an entirely new industry - the modern computer industry. Nevertheless, hardware is one side of the computing process – software is another, an inseparable one. The next section takes on the software ‘story’.

Since its inception in the early 1950s, the computer and software industries have been characterised by a rapid and sustained technical change. As an integral part of hardware, software operates as the ‘brain’ of a computer and provides an important role in modern commerce as it has one very special characteristic: it improves the competitiveness of other industries, which utilise software products to make themselves more innovative, efficient and competitive. The global software and computing industries are thriving on the benefits of continuous software innovation, which permeates much of the informational economy. The industry has literally transformed the ways individuals interact with one another, how business is conducted and how we gain access to information the world over.

The pace of change has recently accelerated through the Internet, online services, networking and new programming languages, such as Java and Visual Basic. The market for computer software has increased dramatically, and still growing rapidly. In addition, technical progress of the computer industry has led to the improvement in performance and decreases in prices, together with dramatic improvements in complementary technologies such as software, storage devices and telecommunications. With considerable innovations and customers’ “learning-by-using” developed skills, the software industry has become a worldwide multibillion-dollar industry.

Following on the above discussion on the attributes of information technology, the next section takes up subject of the information economics and network society’s analysis.

### IV. INFORMATION ECONOMICS AND NETWORK SOCIETIES

To close the ‘historical loop’ this section takes on the issue of how the technological paradigm has given a rise to the new (information) economics, that is to explain this coupling that led to the modern economies. The events of the last years have
transformed the social conditions and caused the breakdown of the prevailing system of the economic relations. These developments reflect substantive change in the economics foundations, that is, it emerges a new “information economics”.

It has become commonplace to talk of the globalisation of the world economy, but like so many such catch phrases, it is often poorly defined or poorly illustrated. If by globalisation we mean that national borders no longer exist and have no any significance then we have a long way to go. If we talk about the ratio of international trade to GDP we are close to that ratio in 1913. In an economic sense globalisation could be seen as meaning a world where factors of production or their output move freely across borders, with the result that the price of capital, labour and land, and the goods and services they produce is equalised across the world. This clearly does not occur; wages, prices, rents, and real interest rates differ considerably, even between countries with well-developed capital markets. However, if globalisation is taken to refer to a dynamic process of interconnectivity, then there seems little doubt that it is occurring. The interconnectivity process enabled by the computing power of modern networks, which may ultimately lead, through information economics, to the future network or truly global society.[6]

Understanding the globalisation as a process of interconnectivity of transnational networks means that further development of information technology and informational economics will ultimately lead to the development of a global or the future society. Once the networks ‘cover’ all global population and their activities and connect them in a higher transnational network, we will live in a ‘global village’ or the ‘future society’, instead in the partially networked societies. Therefore, I may argue that the fundamental change in modern civilisation and their economic and social effects manifest themselves in the acceleration of modern history, rather than in the ‘end of history’.

V. CONCLUSIONS

Information remains one of the least-explored aspects of economics activity. The recent emergence of the ‘informational-network economics’ asked for exploration of the historical genesis of the human knowledge that leads to the information paradigm and the information economics. This was the main objective of the paper.

There were few studies of information economics that explore the connection between the shift of human knowledge paradigm and information economics. In so doing, we went briefly back to Aristotle’s work, through Descartes philosophy to the quantum mechanics, technological paradigm to globalisation in an attempt to trace evolution of the human knowledge that lead to the information paradigm, and the network societies. We have tried to link information economics and physics that is, to show that development of the information economics was enabled by the development and discoveries of physics and quantum mechanics which in turn were possible by dismantling the Cartesian mechanics point of view.

In addition, we endeavoured to establish a clear cut between globalisation and network societies, defying globalisation as a process of interconnectivity enabled by information paradigm that will eventually conclude through information economics to the future network society.

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