

## Revisiting the Needham Puzzle and Contemporary Chinese Society

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**Abstract:** *The Needham puzzle is: Why did China fail to originate the scientific-industrial revolution before England? This paper aims to revisit Joseph Needham's work by identifying the reasons behind the expansion of modern science in Europe rather than China despite the revolutionary technical achievements of then China. The central research question of this study is: How relevant is the Needham puzzle to explain the recent development of Chinese society in relation to science and technology? Following the research question, this paper draws primarily on secondary data collecting information from published and unpublished research works. This paper developed an analytical framework to explain the Needham puzzle and examines the recent trends of Chinese development with a special focus on the domain of science and technology. In conclusion, this paper revisits the Needham puzzle and, based on the analytical framework, finds that the Needham puzzle is relatively less relevant to explain the socioeconomic, political, religious, scientific, and technological development of contemporary Chinese society.*

**Keywords:** Chinese society; Needham puzzle; Scientific revolution; Technological development; Industrial revolution

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### Introduction

The People's Republic of China (P.R.C.) is an East-Asian country that covers a population of more than 1.4 billion. Covering a total area of 9,572,900 km<sup>2</sup>, China has become the third-largest country in the world (Sparks, 2017). At present, this country has twenty-three provinces, five autonomous regions, four direct-controlled municipalities, and two special administrative regions (S.A.R.), namely Hong Kong and Macau. The estimation of Angus Maddison found that in 1820 one-third of the entire world economy was represented by China (Maddison, 1995). During the beginning of the nineteenth century, China became the world's principal civilization, which persisted of its largest

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population, a progressive administration system, the most significant achievement in trade, and the utmost capital. Throughout that period, the greatest inventions of China include paper, printing, the compass, gunpowder, and the abacus (Lin, 1995). Joseph Needham (1900–1995) identified several complicated societal, political, economic, and cultural influences that contributed significantly to the European scientific revolution and several crucial historical aspects that hindered modern scientific and technological growth in China. Although it was challenging for any nation to surpass the developments of then China, by some means, Europe swiftly developed and beat China within a hundred years. The puzzle of why China failed to originate the scientific-industrial revolution before Europe is known as Needham's 'Grand Question.'

Joseph Needham's writing reflects the time when the West underestimated China because of its communist political system of government. According to Needham, China's bureaucratic feudalism was different from the feudalism of Europe and described as "total inhibition of capitalism and modern science" of China when compared to the West (Needham, 1964: 395). The economic development of medieval China surpassed everything in Europe. During the medieval period, China was one of the most economically, militarily, socially, and politically developed regions in the world. By 1100, China had a population of about 100 million people, with high levels of economic monetization (usage of paper money, written agreements, mercantile credits, trade loans, checks, promissory notes, and exchange bills) and about one million residents in the largest cities (Elvin, 1973; Kracke, 1969). Therefore, Needham pointed out that the medieval economic system of China was more rational than the medieval European system. However, China failed to fully understand a mercantile system like Europe, as it was impossible to inherit the land and industrial enterprises in China. Consequently, capital accumulation did not happen in the then-Chinese society (Needham, 1964).

Needham considered merchant capitalism a prerequisite for the development of scientific knowledge and argued that China did not offer much economic inducement to develop scientific knowledge as it lacked a merchant-capitalist system. Merchant capitalism is a system where production usually remained under the control of imperialism (a distinct state policy, strategy, practice, or activity engaged in the expansion of power, authority, and control, especially through forcible territorial acquisition or control over the politics and economy of another region, often through the use of hard and soft powers including economic, diplomatic, cultural, and military forces) with the absence of division of labor between the industrial and agricultural sectors and, more importantly, where the emperor owns all land. In contrast, a centralized-bureaucratic system controlled China whose key

roles included tax collection for the imperial government, the supervision of public works, agricultural production, and topography management of the country (Olerich, 2017). Originally, the feudalism of China esteemed developments in "natural knowledge and its application to technology for human benefit, while later on, it inhibited the rise of modern capitalism and modern science in contrast to the West, which favored it" (Needham, 1964: 391). In the 1800s, Europe began to dominate the world politically, industrially, militarily, scientifically, economically, and technologically. However, scholars (Elvin, 1973; Pomeranz, 2000) have identified a "great divergence" and "equilibrium trap" between China and Europe during the industrial revolution, which raises the question of why China failed to start a scientific-industrial revolution before Europe.

Needham identified a fundamental difference between the Chinese and Europeans regarding the worldview that helped him develop his grand puzzle. The Chinese had developed seismometers, water wheels, wheelbarrows, mathematical numbers (for measuring tax, official rank, the value of products, wealth, social class, individual's status, and determining exchanges of grains), improved geometry (squares, circles, cylinders, rectangles, cones for farmland computation) and advancements in metallurgy before the first century B.C.E., although the scientific construction of natural laws was mostly unknown and relatively minor to them. Though the Chinese people documented experimentations that were recurrent with precision and measured the other-worldly atmospheres with perception for centuries, they failed to achieve the essential characteristics of developing modern science similar to the Europeans (Needham, 1969). That is why for Needham, the development of Chinese society was mainly dependent on practical applications in contrast to theoretical guidelines. By immersing himself in China's history of science and technology, Needham concluded that the earlier achievements of China were principally technical instead of scientific or theoretical. For this reason, China failed to shift to a scientific revolution before the Europeans.

Subsequently reviewing a wide range of literature on the Needham question, the author found that industrialization in contemporary Chinese society has not been sufficiently studied under the focus of the "Needham puzzle." This basic reality inspired the author to examine the relevance of the "Needham puzzle" in contemporary Chinese socio-political structure and technological framework with special emphasis on industrialization. Therefore, this paper aims to address the above-mentioned research gap. In this paper, the author revisits the work of Joseph Needham regarding the scientific and technological history of China by intricating the factors which identify the reasons behind the

development of modern science in Europe rather than China, in spite of the innovative technological successes of then China. Additionally, by developing an analytical framework, the paper also examines several impeding aspects of Chinese civilization that vetoed the growth of modern scientific knowledge throughout the seventeenth century. The central research question of this study is: How relevant Needham's puzzle is to explaining the recent development of Chinese society in relation to science and technology? Therefore, the main purpose of this paper is to examine the applicability of Needham's puzzle to explain contemporary Chinese socioeconomic, political, technological, and religious regimes by analyzing the question of Joseph Needham about the scientific and technological history of China and Europe throughout the seventeenth century. This paper is divided into four sections, and the first section deals with the background of the 'Needham question.' The following section explains the research methodology. The third section of this paper deals with the discussion and analysis; the final section is the conclusion.

### **Research Methodology**

The central research question of this paper deals with the relevance of Needham's puzzle in explaining the socioeconomic, political, technological, and religious developments of contemporary China. This paper is mainly based on secondary sources of data for three reasons. Firstly, due to the availability of published and unpublished research work, relevant books, journal articles, newspapers, magazines, internet documents, e-books, social networking sites, published reports, and scholarly interviews on this research topic, the author has used secondary data for this study. Secondly, the central research question in this study demands secondary data analysis. Thirdly, this paper includes the analysis of historical data and materials for a more knowledgeable interpretation of China in terms of the scientific-industrial revolution and economic development. To do so, in this paper, the author developed an analytical framework based on industrialization prerequisites for secondary data analysis. One of the major limitations of secondary data analysis was that the author sometimes faced difficulties in gathering specific information consistent with the research question. In addition, the quality and accuracy of the collected data also posed some problems during the analysis.

### **Discussion and Analysis**

This section is divided into three parts. The first part deals with the question of Joseph Needham regarding the industrial revolution of China and England as an analytical

framework. The second part of this paper explains Chinese development in different sectors and its recent trends in the field of science and technology. The final part discusses the relevance of the Needham puzzle in contemporary Chinese society.

### **Part one: Needham's Puzzle as an Analytical Framework**

A large number of historians and social scientists, such as Arnold Toynbee, Kenneth Pomeranz, Franklin F. Mendels, Adam Smith, and Peter Kridte, claimed that 'Industrial Revolution' was the commencement of modernity. In addition, in an analysis of why this industrial revolution commenced in England throughout the eighteenth century, numerous scholars questioned why the industrial revolution did not occur in China as an alternative, assuming that China had attained ample technological advancement by the fourteenth century (Needham, 1954). This question as to why China did not remain pre-eminent is termed the 'Needham question.' The social, political, technological, structural, and economic indicators are the most significant elements to analyze and realize the industrialization of the contemporary world. That is why the author tried to clarify the industrialization of China by using an analytical framework along with five indicators (political, social, technological, trade and business, and structural). In particular, in this section of this paper, the author explained the 'Needham question' as an analytical framework (see, Figure 1). That means, based on five indicators, the author here analyzes why the industrial revolution did not originate in China though historically, the science and technology of China were highly developed rather to other contemporary civilizations. In the second part of the discussion section, the author used this framework to analyze the major arguments by showing how political influences, economic growth, technological advancement, and social aspects helped to flourish the industrial revolution in contemporary China. In the third part of the discussion section, the author used this framework to examine the relevance of the 'Needham question' in modern Chinese society.

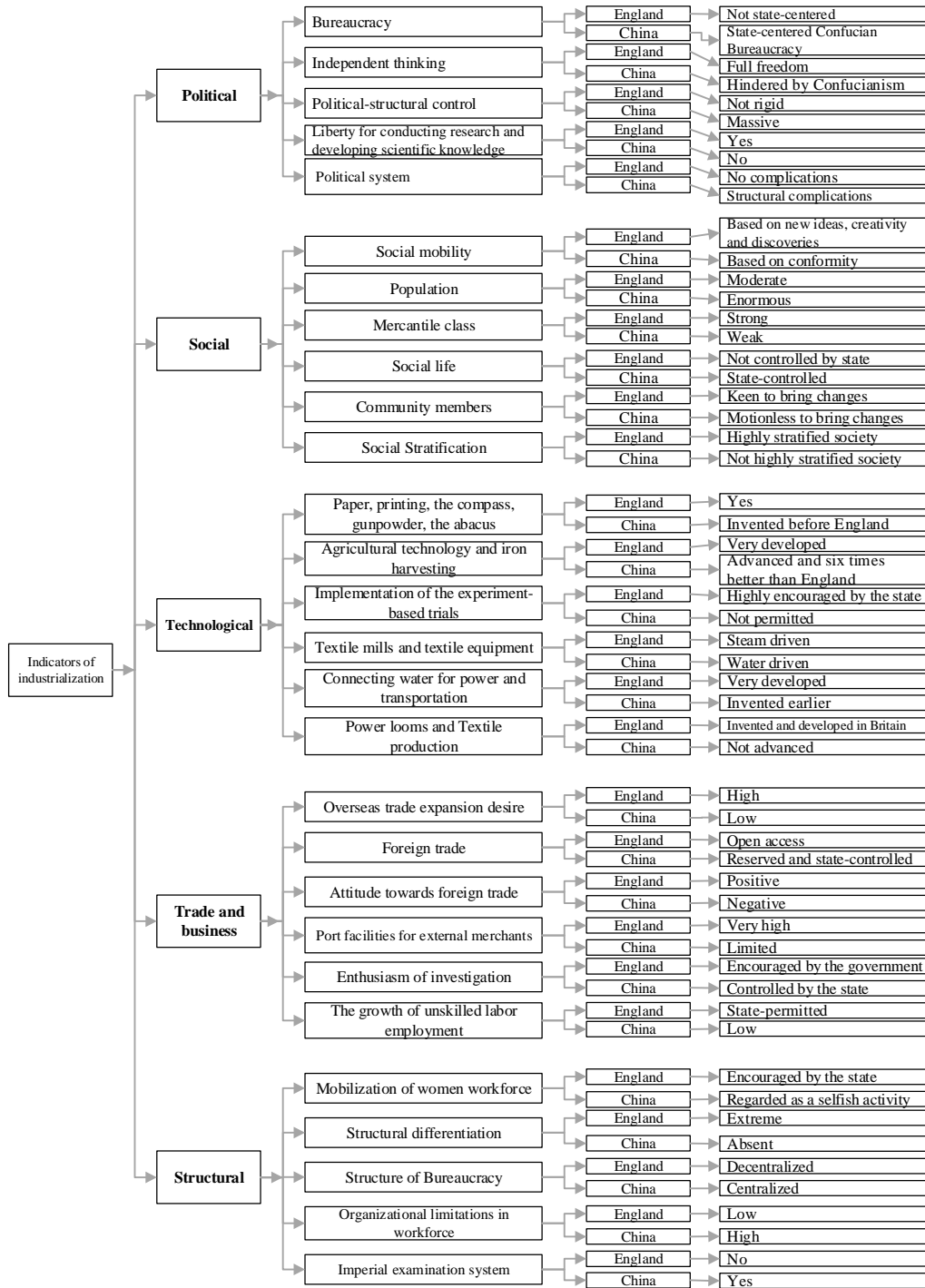


Figure 1: Needham's puzzle as an analytical framework

### *Leading factors behind the birth of the industrial revolution*

Needham argued that the leading factors behind the birth of the industrial revolution in England throughout the eighteenth century were also existing in China centuries prior (Needham, 1981). For example, China's great invention of paper, printing, the compass, and gunpowder had a profound impact on traditional Chinese society. Even in the initial period of the Han Dynasty, China's agricultural technology was so progressive than other corners of the world, through the usage of iron-tipped cultivation in the Northern part of China, including deep-tooth plows in the wetland parts adjacent to the 'Yangtze' river. Scholars writing also revealed that during the eleventh century, China's technology was so innovative (Elvin, 1973; Lin, 1995; Landes, 2006) that people of this country could harvest iron six times better than the achievements of Europeans (Chao, 1986). An outstanding achievement throughout the former stages of the industrial revolution in England was connecting water for power and transportation, which allowed for textile production, including the utilization of water-driven textile mills (Tvedt, 2010). Nevertheless, Elvin (1973) claimed that China had produced water-driven textile equipment four centuries former for spinning fibers from hemp and ramie plants. However, in spite of prior technological accomplishments, China was hit with technological torpor, and was incapable to come up with more accelerated developments to its technological sector, like in what way England developed beyond the water-driven mills, through the creation of steam-driven mills and power looms (Needham, 1981; Landes, 2006). Consequently, this technological torpor obstructed the expansion of water systems, which affected China's skill in developing transportation structures for trade and manufacturing.

### *Technological advancement*

Although China had been ahead of contemporary societies concerning technological advancement, it started lagging, and England and Europe quickly overtook it. Intellectuals labeled this feature as the 'Great Divergence' (Pomeranz, 2000). They accredited supply failure, political understanding of environmental circumstances, and primarily mechanical locks between China's culture and political system to the explanations behind the progress of modern scientific and technological knowledge, being reserved in China (Lin, 1995; Landes, 2006). Actually, the industrial revolution is the combined result of technological developments and institutionalized processes. Thus,

the structural complications within the political system of China interrupted essential institutional development from taking place, resulting in a social order that did not fortify to produce systematic scientific knowledge and progressive modernization of technological objects.

### ***Absence of structural differentiation***

Confucian bureaucracy overwhelmed China's political system, resulting in the absence of structural differentiation, stratification of societal structure, and community members being remarkably motionless to bring changes (Nielsen, 2010). On the other hand, feudalism in England and Europe permitted for extreme structural differentiation, forming organizations that were absent in China, and allowing persons to enjoy more liberty for conducting research and developing scientific knowledge, vital for the improvements of prevailing technologies (Lin, 1995). Furthermore, these reasons were responsible for the expansion of England's production, as labor could be simply assigned to meet essential manufacturing requirements in England, particularly since the women workforce did not face organizational limitations and were also organized to engage in the workforce for salaries (Goldstone, 1996).

Lin developed a theoretical model for allowing scholars to categorize the aspects that directed a slowdown of China's ability for technical invention, other than those political and structural aspects mentioned earlier. Though China enjoyed faster developments in technical innovations between the eighth to the twelfth century, it was still unable to start a scientific revolution throughout that period. Lin (1995) argued that, for technical alteration, as enormous as the scientific-industrial revolution to happen, the incorporation of three factors must occur. The first one is the successful outcome from increased trial and error. The second one is that returns from existing technology were insufficient to meet the needs of a vast population. And the final one deals with the accessibility of appropriate resources accompanied by an improved body of scientific knowledge. However, China was unable to implement experiment-based trials.

### ***Massive political structural control***

As a result of the massive political structural control, scientific knowledge failed to grow in China. Therefore, China's expert craftsmen and peasants could only produce minor alterations (Lin, 1995). Additionally, the imperial state differentiated the mercantile class and made this class weak by producing several laws. Compared to the trade expansion desire of England, the attitude of the Chinese imperial government to foreign trade was



not positive, and China never encouraged overseas merchant voyages. Accordingly, even facilities for external merchants to trade in the Chinese ports were also limited and controlled. According to Needham (1981), though China had an enormous population, if the Confucian bureaucratic system had not reserved the enthusiasm for investigation and did not abstract the Chinese people from pursuing scientific-technological inventions, China would have possessed many scientific scholars compared to Europe and England.

### ***Confucian bureaucracy and totalitarianism***

During the imperial government, China's Confucian bureaucracy and totalitarianism vetoed the institutional development, inducements, and perspectives essential for expanding scientific knowledge and technological skill. Consequently, the scientific-industrial revolution fails to occur in China in the equal period as it happens in England. The bureaucracy of China was state-centered, which lacked a decentralized structure (like the structure of England and Europe), thus incapable of producing practical consequences of the scientific-industrial revolution (Weber, 1951; Keightley, 1978). Each part of the social life for the Chinese people, including food production, clothing, agriculture, trade, information, selective knowledge, community activities, etc., was controlled by the state during the reign of the Ming and Qing dynasties (Balazs, 1964; Landes, 2006). The appeal and implementation of Confucianism as societal control and an ethical system within the political-administrative structure gave rise to a political system that did not carry structural differentiation. Thus, Confucianism was a philosophy and doctrine that prevented the independent thinking and rational behavior of Chinese people during that period (Greif & Tabellini, 2010).

### ***The Imperial examination system of China***

The imperial (civil service) examination system of China was a platform for rulers to identify the best knowledgeable and brilliant personalities within the ruling administration. Nevertheless, compared with the scholars of Europe who invented scientific and technological knowledge, the innovative findings, ideas, and philosophies of Chinese scholars were normally found with state confrontation, and they had to compete hard and extensively to achieve societal appreciation (Lin, 1995; Needham, 1981). This shows that the means for rising societal mobility in China was based on conformity rather than on new ideas, creativity, and discoveries.

### ***Centrality and Commonality***

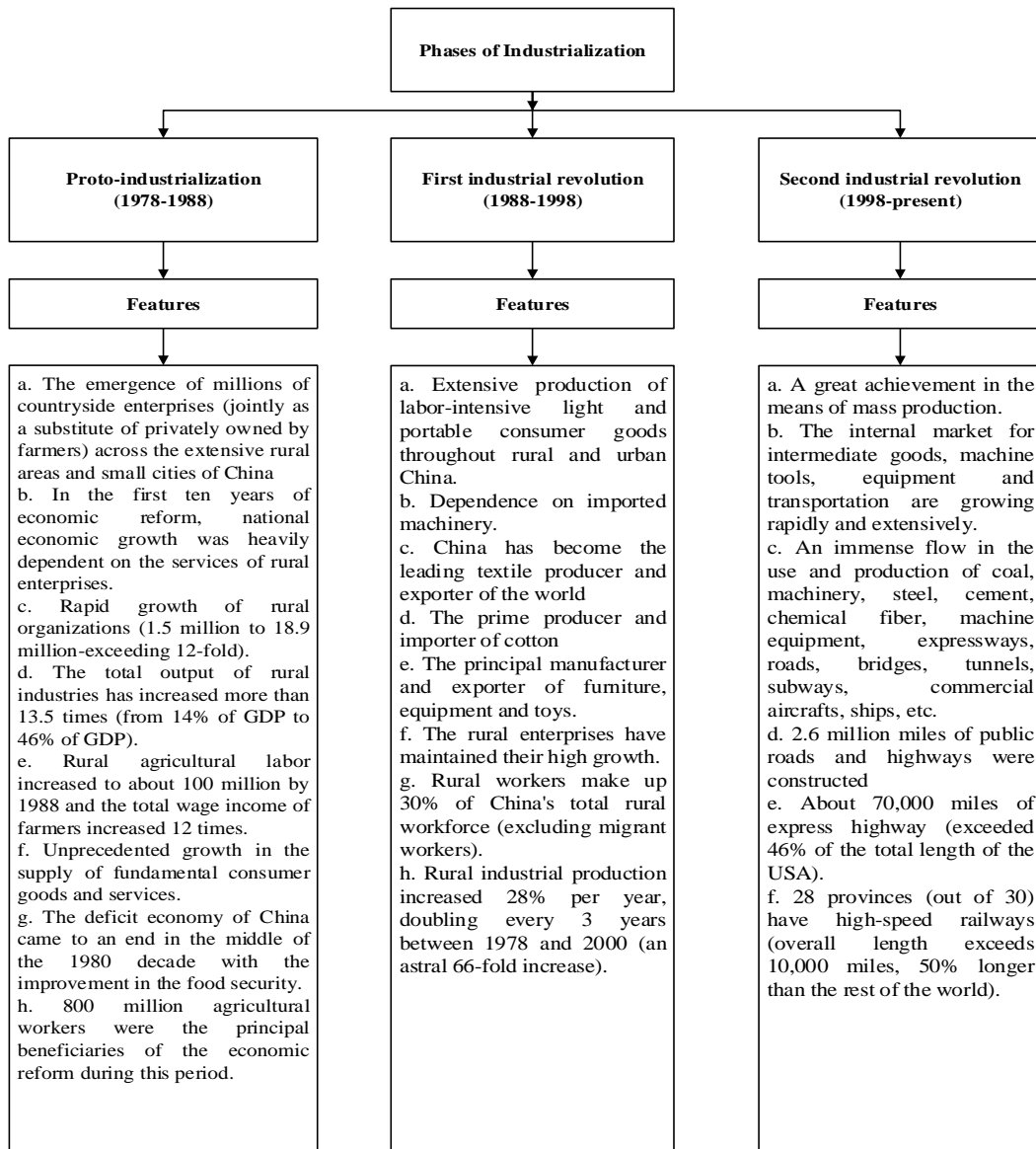
The author highlights that England had the advantage over China to commence the scientific revolution primarily as England's political structures permitted the growth of unskilled labor employment. Mobilization of women was not possible in China, because China heavily enforced Confucian behavioral rules and potentials during different powerful dynasties like the Qing realm. Throughout the Qing realm, women were unable to search for employment outside the home because this practice was viewed as a selfish activity and an attack on the authoritarian structure of Chinese society. Though China possessed a large population of skilled labor, it failed to achieve the advantage of the industrial revolution due to the immobility of the women workforce (Goldstone, 1996). Nevertheless, England got that advantage since the industrial revolution relied deeply on the employment of unskilled labor for industries, hence mobilizing women into the workforce by giving them remunerations. This is a major reason behind the starting of the industrial revolution in England prior to China.

### **Part Two: Chinese development and its recent trends in the domain of science and technology**

The contemporary Chinese social, economic, scientific, technological, religious, and political regime is completely different from the ancient and medieval periods. China made rapid progress in science and technology during the 1990-2010 period. The Chinese government has focused on financing, reforming, and socioeconomic development of the country, including the socialization of science and technology for national dignity. China has made rapid progress in various fields such as research, education, high-tech infrastructure design, commercial application, industrial sector, manufacturing, engineering, academic writing, scientific publishing, patents, trade, and business, and it is now leading the world in many sectors. In this section, the author discusses Chinese development in various sectors and its recent trends in the domain of science and technology, focusing on four main indicators: the stages of Chinese industrialization, technological development and economic progress, political regime, and the position of religion.

## Phases of industrialization in China

The following figure describes the key phases of Chinese industrialization.



**Figure 2: Phases of Chinese Industrialization**

**Source: (Yi Wen, 2016)**

**Political regime**

Communism started in China in 1921 with the formation of the Chinese Communist Party (C.C.P.). Although the Communist Party of China (C.P.C.) has been ruling the country since 1949, contemporary China has become a completely different country in today's world in terms of political affairs compared to the past. Rapid urbanization, swift industrialization, and the explosion of G.D.P. figures have made economic miracles possible in China. Despite the Communist Party of China (C.P.C.) expressing its unwavering stance on power, this miracle has transformed China into one of the major world powers. In China's current political system, there is no transfer of political power from one leader to another. The current Chinese President Xi Jinping has rejected the idea of a term limit for ruling leaders, declaring himself a lifelong Chinese president and lifelong C.P.C. leader. The Chinese communist party (C.P.C.) has approximately 95.1 million members, which makes it one of the largest political parties in this contemporary world (The Organization Department of the C.P.C. Central Committee, 2021). In spite of the long reign of the C.P.C., the Chinese government system proved to be persistent, and China has made rapid progress in science and technology during the period 1990-2010. The Chinese government has focused on financing, reforming, and socioeconomic development of the country, including the socialization of science and technology for national dignity. China has made rapid progress in various fields such as research, education, high-tech infrastructure design, commercial application, industrial sector, manufacturing, engineering, academic writing, scientific publishing, patents, trade, and business, and it is now leading the world in many sectors. In addition, the Chinese political government is putting great emphasis on establishing economic and technological development zones (ETDZ) to build high-tech industries, attract foreign investment, boost exports and expand the regional economy.

***Scientific-Technological development and Economic Progress***

At present, the government of China has taken various steps for reviving the country's scientific and technological sectors through new policies and management. The new scientific and technological management scheme of China combines science and technology with industrial and agricultural productivity. China's open policy has helped

Chinese scientists, technicians, doctors, and engineers to focus on world-class scientific and technological development. China attaches great importance to global technology exchange and scientific cooperation because the acquisition of scientific technology will greatly transform China's special skills and technological development. Therefore, the Chinese government is spending billions of dollars on the development of scientific and technological sectors.

China's information and communication technology has developed rapidly and is now one of the principal telecommunications markets in the contemporary world. The information technology industries of China are similarly contributing to the economic growth of the country in terms of achieving triple the Gross Domestic Product (G.D.P.). The concept of the socialist market economy was introduced in 1978 by Chinese revolutionary leader Deng Xiaoping for economic reform and to reduce trade barriers between China and the rest of the world. In December 1978, ten years after the Cultural Revolution, China became open to trade and investment with the international community and foreigners through different phases of economic transformation or reform. In fact, China's reforms and liberalization have had a positive impact on the rapid economic growth of the country. The accession of China to the World Trade Organization (W.T.O.) in 2001 indicates the country's official inclusion in the world market economy. China's economic reform has brought about an incredible transformation around the world. For example, Alibaba.com is the world's largest retailer company, the Industrial and Commercial Bank of China (ICBC) is the largest bank in the world, 'Tencent' is the world's largest gaming and social media company, 'Huawei' is the second highest seller of smartphones after 'Samsung,' 'DiDi' is the ride-sharing giant that rivals Uber. 'WeChat' - a versatile social media and mobile payment Chinese app, have become a way of life for over one billion users worldwide. In addition, China Southern Airlines is the largest airline in China, and the 1st ranked airline in Asia with the 6th position in the world. China has launched the largest high-speed fifth-generation mobile network (5G network) in the world in a joint venture of three wireless companies. The development of the 5G network is considered a key component of China's 'Strategic Emerging Industry' and 'Made in China's policy. China is leading the global 5G network rollout and plans to launch the sixth-generation network (6G). The following table 1 shows the recent development of China in different sectors.

**Table 1: Recent development of China in different sectors**

Sectors	Development of China
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Sectors	Development of China
<b>Health (Biotechnology and Genetics)</b>	<ol style="list-style-type: none"> <li>1. World's largest D.N.A. sequencing facility in Beijing</li> <li>2. Advanced stem cell research and stem cell treatments</li> <li>3. Regenerative medicine- advanced tissue engineering and gene therapy</li> <li>4. Brain research- aims to study the human brain</li> <li>5. Pharmaceuticals and medical technology-one of the largest pharmaceutical markets in the world</li> <li>6. Rapidly growing medical tourism.</li> </ol>
<b>Transportation</b>	<ol style="list-style-type: none"> <li>1. World's longest high-speed railway network (H.S.R.)</li> <li>2. The National Trunk Highway System (NTHS) or national-level expressway network system</li> <li>3. Subways and metros - Shanghai, Beijing, Guangzhou, and Chengdu - the world's top four longest metro lines</li> <li>4. Aims to launch domestically produced commercial aircraft</li> <li>5. The largest producer of motor vehicles</li> <li>6. Leading position in producing electric vehicles</li> <li>7. Shipbuilding-One of the top largest shipbuilding countries</li> </ol>
<b>Space Science</b>	<ol style="list-style-type: none"> <li>1. Chinese satellite (Dong Fang Hong I)</li> <li>2. Shenzhou 5- the first human spaceflight mission</li> <li>3. Spacewalk with the Shenzhou-7 mission</li> <li>4. Tiangong-1: Chinese space station</li> <li>5. Chinese Lunar Exploration Program (ALEP)</li> <li>6. Advanced rocket technology</li> <li>7. The Five-hundred-meter Aperture Spherical Telescope- the world's largest radio telescope</li> </ol>
<b>Polar research</b>	3 Antarctic and 1 Arctic advanced research stations
<b>Military technology</b>	<ol style="list-style-type: none"> <li>1. Anti-ship ballistic missiles and Chinese anti-ballistic missiles</li> <li>2. Anti-satellite weapons</li> <li>3. The Chengdu J-20 fifth-generation jet fighter</li> <li>4. Electromagnetic pulse weapons</li> <li>5. Reconnaissance satellites</li> <li>6. Military projection technology- the Chinese aircraft carrier program</li> <li>7. The type 071 amphibious transport dock and thermonuclear weapon</li> </ol>

Sectors	Development of China
<b>Textiles</b>	Highly developed textile industries and top global textile exporter
<b>Mining and rare earth industry</b>	World leader in mining technology
<b>Machine tools</b>	World's leading producer and consumer of computer numerical control machine tools and cellphones.

The economic reforms of China have paved the way for various lucrative economic projects, such as 'The Belt and Road Initiative' (B.R.I.). This is an ambitious trillion-dollar project that aims to expand the economic and political influence of China worldwide. It also prepares the world stage for the rise of e-commerce and technology giants like Alibaba, Tencent, and Huawei. An additional Chinese reform policy is the formation of Special Economic Zones (S.E.R.) in some profitable coastal regions like Shenzhen and Xiamen, where overseas and local business firms can trade and invest without the identical red tape applied to other areas. Shanghai, today's global financial center, had been undergoing reforms for almost twenty years before its dramatic modification. Moreover, China's electronics and information technology are rapidly evolving through the application of artificial intelligence, drones and robotics, supercomputing, the software industry, microprocessors, and semiconductors. Indeed, China is leading the world in artificial intelligence, supercomputers, and drone technology.

### ***The position of religion***

There is a debate in today's globalized world regarding the position of Chinese society in terms of secularization and de-secularization. This debate arises the question of whether China is becoming more secularized, less secularized, or perhaps more de-secularized. Unfortunately, it is very difficult to answer this question due to the nature of people's religious practice and the state of religion in the Chinese societal structure. This question pivots on the sense of the word 'secularization,' and there is as hitherto no concrete theory of secularization as it applies to the Chinese situation. When Chinese scholars invoke secularization, they frequently use this term in a logic that has mainly been abandoned within sociology, specifically that religion declines with modernization. According to many scholars, some elements are responsible for the current position of the Chinese middle way between the secular and the religious such as the religious marketplace; the

probability of unbelief; diversity; forms of specific religiosity; privatization, and secularization as political ideology (Szonyi, 2009). The author thinks that these elements are potentially productive for studying Chinese religion and understanding the middle position of China between the secular and the religious.

The traditional Chinese idea of the middle way is different from the Christian dipolar notion of religious vs. secular and the distinction between them. The Chinese idea gives importance to the practices, including the time-space that might be 'as worldly as it is other-worldly' (*Confucian Analects*; Book XI: Chap. XXV). It is also probable that a significant major tradition in a religiously pluralist society may hold a distinct category of a transcendent idea that does not focus on the dipolar notion of belief-unbelief distinction. For example, Confucianism, as the principal tradition of Chinese culture, fundamentally involves a value scheme that might be titled providential humanism. The Confucian idea of Heaven can be identified as an un-personified God. In this context, it is in some way identical to Deism in the Christian culture, with a distinction that Confucianism has no explicit notion of creation. Consequently, in the Confucian ideology, the connection between Heaven and human beings does not hinge on the dipolar notion of belief-unbelief rather, it hinges on sincerity and un-sincerity (Legge, 1960). From this viewpoint of an external observer, it might be considered as an alternative form of middle way that remains between the religious and the secular; however, it is not between belief and unbelief. In general, the traditional Chinese culture has no counterpart in contradiction to the Christian dipolar notion of religious-secular differentiation. Hence, the prime form of traditional Chinese culture appears neither extremely secular nor enormously pious (Dai, 2017).

In this context, the idea of Charles Taylor is very prominent to explain the situation properly. According to Taylor (2007), the alteration of 'the conditions of belief' had once taken place in Chinese society and culture approximately a thousand years ago. He also added that, while the alteration of 'the conditions of belief' in European social-history social history resulted in the uncomfortable coexistence and fight between belief and nonbelief, the Chinese transformation of 'the conditions of belief' principally lead to the Chinese middle way. In the historical structure of China, there was a time when intellectuals and performers were confused by the three distinct comprehensive religious doctrines, Confucianism, Buddhism, and Daoism, which occupied the identical societal cooperative system. Therefore, the author precisely identifies the alterations of the conditions of belief in Chinese society and culture since the age of "San-Jiao-Lun-Heng,"



(from the 6th through 10th century) and discloses the features of Chinese spirituality, the Middle Way, which is amidst the secular and the religious (Dai, 2017).

The author mentioned that throughout the period of the 6th to the 10th century, 'San-jiao-lun-heng' (contest among the three teachings) took place repeatedly at the royal court, which was recognized as the leading place of public communication. 'San-jiao-lun-heng' was basically a specific interreligious event in the history of China that had wide-ranging features and consequences. Occasionally it brought about violent religious conflicts among the three traditions, namely Confucianism, Buddhism, and Daoism. On the other hand, sometimes, it was nonviolent dialogue in search of inter-religious truth. In many cases, it was a ritual where practitioners of these three traditions shared admiration and fortunate status in the royal court. But sometimes, 'San-jiao-lun-heng' ultimately generated nationwide religious persecution (Hu, 1997). Through the 10th century, this historical 'San-jiao-lun-heng' phenomenon disappeared from the royal court of China. According to many viewers, it was an important sign that Chinese culture had come to its subsequent phase (Dai, 2017).

Scholars also argued that, during the historical period of semi-colonization, Chinese culture was once dominated by the information of Western secularity, and after that, this secularity terminated in a one-sided and indigenized system (Feuchtwang, 2002). During the post-cultural revolution period, essentially, a question arises in the world whether China is becoming gradually religious or becoming increasingly secularized, and this fundamentally becomes a controversial question for insider spectators. Assumed that there are exactly no consistent statistical methods and statistical figures concerning China's religious phenomena, this question gradually becomes challenging. Nevertheless, the utmost vital question is whether the dipolar impression of the distinction between 'religious' and 'secular' is applicable to Chinese Culture. Accordingly, the notions of secularization and its advanced counterpart, 'post-secularity,' are essential to be questioned. Subsequently, the Cultural Revolution and particularly after 1989, in contradiction of the background of global modernity and with the discourse of Western religious secularism as a contextual framework, Chinese culture appears to progressively re-discover and re-appropriate its individual capital in the traditional ethical principles and consequently return to the way that is middle (Szonyi, 2009).

The author opines that in a religious pluralist social structure, people from diverse backgrounds may not be able to arrive at a common socio-spatial understanding of the dipolar notion of the 'religious-secular' distinction. For several religious traditions, this

differentiation might be acceptable to recognize religion only as being about belief, whereas, to others, religion may mean a way of life; and to even some people, religion may also mean identity, and therefore many of them may refuse the notion of the extraction of religion from public spheres. Thus, the societal phenomena that are derogatorily labeled as secularization by practitioners of some religious traditions might be taken for granted by followers of other beliefs. That is why within a religious pluralist social structure, the notion of socio-spatial consideration about the dipolar notion of the 'religious – secular' distinction is more about the political coexistence among the diverse religions and less about the distinction between belief and unbelief (Dai, 2017).

Moreover, it is similarly probable that a state of 'elective belief' arises at the demotic level in a religious pluralist societal structure. In this regard, a person can say that this state of elective belief is somehow in between 'belief' and 'unbelief.' To my opinion, it is very difficult to understand the binary opposition between the secular and the religious. That is why the position of China does not center on the dipolar idea of belief-unbelief differentiation. Rather, Chinese culture selects a middle way in between the secular and the religious. Principally, the Chinese middle way focuses on the asymmetrical balance among Confucianism, Buddhism, Taoism, and others, which came into form in the 10<sup>th</sup> century (the beginning of the Song Dynasty). This balance contributed to the early-growing nature of the Chinese culture, which was an excellent instance of religious pluralism.

### **Part Three: Revisiting Needham and its relevance to contemporary Chinese society**

This paper claimed that while the scientific revolution remarkably shaped the sociocultural, academic, and technical constructions of contemporary western society, some intellectuals (Pomeranz, 2000; Hobson, 2004) argued that these structures are determined through a lens that was Eurocentric. Many critics (Manguin, 1993; Frank, 1998; Fu, 1999; Finlay, 2000; Barrett, 2008) identified that the Needham puzzle itself is grounded on misleading assumptions and can be clearly answered with rejection. Based on the earlier mentioned analytical framework, this section examines the applicability of Needham's puzzle to contemporary Chinese society by focusing on four indicators: industrialization, the political system, the economic and technological framework, and the religious context.

#### ***Industrialization***

Industrialization depends on new innovations, access to raw materials, trade routes and partners, social change, and a stable government. All of these elements exist in contemporary Chinese society. The Chinese government is investing heavily in scientific innovation and developing new policies for profitable trade routes and partners. China has ample access to raw materials, which is transforming the country into a global hub. The stable C.P.C. government attaches great importance to dramatic social change and capital flow. The secrets of China's rapid scientific-industrial development include maintaining political stability, downstream reform (focusing primarily on agricultural development rather than economic development), encouraging rural manufacturing enterprises despite their old-fashioned technologies, development of capital-intensive production, huge government funding for infrastructural development, following the dual-track structure of public/private ownership instead of extensive privatization, etc. The stages of Chinese industrialization have proved that the Needham puzzle is not working in contemporary Chinese society because in just thirty-two years (1978-2010), China has shrunk the centuries-old development of Western society and has become the world's most important 'industrial center.'

### ***Political system***

Needham (1954) argued that China's centralized political system had slowed down the rise of industrialization in China compared to Europe. But this idea does not apply to contemporary Chinese society. Although China is currently ruled by a one-party political government called the C.P.C., which strictly controls the state, it has been able to achieve unimaginable scientific-technological development, planned urbanization, and rapid industrialization within a very short period of time compared to the other countries of the world. Therefore, in this regard, the Needham puzzle has relatively shown limited success to explain the recent centralized political structure of contemporary Chinese society.

### ***The economic and technological framework***

Modern China is the largest industrial and manufacturing powerhouse in the contemporary world. This industrial powerhouse produces about half of the world's key industrial products, including unrefined steel, cement, coal, automobiles, pharmaceutical products, industrial patent applications, ships, high-speed railways, robots, cellphones, machinery, subways, expressways, and computers (Wen, 2016). The combination of a free market economy and private enterprise is responsible for China's trillion-dollar

economic growth. Through the continuous advancement and enhancement of the country's scientific-technological policies, China will surely bridge the gap with other countries within a short period of time, especially the United States, and become a superpower in this contemporary world. This indicates that the Needham question is not applicable to the contemporary Chinese economic and technological framework.

### *The religious context*

Religion has a profound effect on China's social structure, political government, and scientific-technological development. Although Western scholars have traced the great improvement of Chinese historical achievements in the field of technology, the religious background of technological advancement has also become a problem in the historiography of China (Elvin, 1973). Joseph Needham argued that Daoism and Buddhism, in particular, provided a satisfactory situation for the advancement of certain techniques, especially in chemistry, medicine, and dietetics. On the other hand, Confucianism exhibited a much more conservative attitude towards scientific and technological invention. Confucianism vetoed the growth of scientific development and independent thinking in China. During the reign of the Southern Song Dynasty (960-1279), Confucianism was transformed into 'Neo-Confucianism,' which ultimately became the central value system of China (Needham, 1954). Although 'neo-Confucian' ideologies are still part of the contemporary Chinese political structure, the country has made remarkable advances in science and technology. Indeed, the scientific and technological sector of modern China is developing tremendously. The Chinese government thinks that religion could serve as a substitute for Communism and thus undermine public trust in the political government. Therefore, contemporary China is formally an atheist state, and C.P.C. members are not allowed to believe or practice any religious beliefs. At present, without the dominance of any particular religion, China is making the greatest progress in science, technology, and economy and has become the world's superpower. This proves that the Needham puzzle is relatively less relevant to interpreting contemporary Chinese society in terms of a religious context. 'Intellectual freedom' is an indispensable prerequisite for the advancement of science and technology in the modern world, which was absent in the writings of Needham concerning ancient and medieval China (Hao & Cao, 2009). Access to this 'freedom' in modern society is crucial in explaining why the Needham puzzle is less applicable in the present Chinese scientific-technological framework. Thus the recommended response to the 'Needham question' will be deemed worthless if contemporary China manages to surpass the Western world in fundamental

scientific and technological research without embracing the notion of inalienable human rights (Gorelik, 2017).

### **Conclusion**

This paper has examined the relevance of the Needham puzzle in explaining the recent development of Chinese society in relation to science and technology. In this paper, the author explained the applicability of the 'Needham puzzle,' in contemporary Chinese society and culture by reconsidering the Needham question and arguing that Europe's free enterprise system, competitive states, mobility of women workforce, and paid innovative work were responsible for the commencement of the scientific-industrial revolution in England before China. Additionally, in order to explain the recent trends of Chinese development, the author identified four indicators (phases of industrialization, the political regime, scientific-technological and economic progress, and religious position) and argued that the traditional Chinese pluralist culture (during the age of 'post-San-jiao-lun-heng') was neither excessively blasphemous and undisciplined nor obviously pious and dedicated. Instead, this culture was somehow in a middle way between secularism and religion, playing a key role in the recent development of science and technology in China. Through a revisit of the Needham puzzle based on four indicators (industrialization, the political system, economic and technological framework, and religious context), this study concluded that the Needham puzzle is not effective in explaining recent societal, economic, political, religious, scientific and technological developments of contemporary Chinese society. This paper theoretically and empirically helps future researchers to study the socioeconomic implications of scientific industrialization and technological development of modern Chinese society under the strict political control of the Chinese government.

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