İnsan ve Sosyal Bilimler Dergisi

The Chinese Miracle and Its Retrogression: Why Could China Not Have Pursued Her Technological Ingenuity?

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ABSTRACT

Ancient China achieved a very rapid technological progress and introduced many new techniques and instruments which fundamentally changed the world history. Despite that progress period, the technological pace of China was abruptly halted just after the fall of the Song dynasty. This situation raised the question why China could not pursue its development and become the first industrial nation. Within a comparative perspective which puts the West in the center, that failure was explained by several authors as a result of the unique cultural properties of the Chinese people. However, introduction of diversities of the Chinese culture as the reason of retrogression would not be coherent with the course of history as the Chinese people achieved those technological advancements with the same culture. The paper introduces an historical investigation for the retrogression of China after fourteenth century through employing parallelism between the Chinese technological progress and urbanization at the core of the elucidation.

Key Words: China, technology, urbanization, innovation, history.

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Çin Mucizesi ve Gerilemesi: Neden Çin Teknolojik Yaratıcılığını Sürdüremedi?

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ÖZET

Antik Çin, hızlı bir teknolojik gelişme yaşayarak insanlığa dünya tarihini değiştiren çok sayıda yeni teknik ve araç sunmuştur. Çin'in hızlı teknolojik gelişme dönemi Sung hanedanının düşüşü ile ani bir şekilde durmuştur. Bu durum Çin'in neden gelişmesine devam edemediği ve ilk sanayi ulusu haline gelemediği sorularını beraberinde getirmiştir. Batıyı merkeze koyan bir karşılaştırma bakışı ile bu sorun bazı yazarlar tarafından Çin halkının kültürel özellikleriyle açıklanmaya çalışılmıştır. Ancak Çin kültürünün farklılıklarını gerilemenin nedeni olarak sunmak Çin'in hızlı gelişmeyi de aynı kültür içinde başardığı düşünülecek olursa tutarlı olmayacaktır. Bu makale, Çin'in 14. Yüzyıl sonrası gerilemesini Çin'in teknolojik gelişimi ve şehirleşmesi arasındaki paralelliği açıklamanın merkezine koyan bir tarihsel araştırma sunmaktadır.

Anahtar Kelimeler: Çin, teknoloji, şehirleşme, inovasyon, tarih

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Introduction

The ancient China achieved a stunning technological progress and this old civilization had managed to be the world's technology leader for a long period. The inventions of various techniques which deeply shaped the history and the mode of life of the humanity like paper, printing, gunpowder, and magnetic compass were first introduced and diffused by this ingenuous society. Although China made huge contributions to the development of humanity, the Chinese technological miracle stagnated and halted mysteriously after the 14th century. The society once invented water-clock and achieved mechanization of textile in spinning silk, hemp and ramie had forgotten all these advanced techniques until the time that they were reintroduced by the Europeans to China during the colonization period after the 16th century, which was intensified in the 19th century.

This enigmatic stop and retrogression of China was explained by some investigators through the unique and dissimilar culture of the Chinese. While Joseph Needham (1975) and Robert Hartwell (1971) considered the dominant effect of the analogical and associative logic as responsible for the decline of the technological progress, Colin Ronan, Joseph Needham (1986) and Bertrand Gille (1978) took Confucianism which constituted the State ideology of the epoch as the reason of the incapacity of China to achieve an industrial revolution. However, can the cultural properties really be taken as responsible of the decline of the miraculous era although the retrogression may also be examined in relation with the political developments of the Chinese history and the parallelism between the rapid urbanization and the technological progress in the country?

This paper aims to focus on both of the possible explanations to see whether the cultural diversity arguments or the parallelism between the urbanization and technological progress in order to elucidate the reason of the retrogression. In order to study these explanations, first, the technological development of China will be introduced. In the second part, the retrogression period and the continuation of the economical development after the decline in technological level will be highlighted. Then, the cultural characteristic properties of China and the impacts of these diversities on the decline will be investigated. At last, the parallelism between the urbanization of China and the technological progress will be introduced to understand whether the ruralization was the actual reason of the stagnation of the Chinese ingenuity.

Astonishing China

The Chinese emerged in the field of technological breakthroughs with splendid innovations in a very early period compared to the rest of the world and their accomplishments were, although they pursued a gradual development accompanied by some rush periods, matchless thus far. The ingenious Chinese people conducted many inventions which were commercialized and adapted to the daily life. Those innovations continued until the 14th century and crested during the Song dynasty (McClellan & Dorn, 1999, p. 123).

One of the most important inventions of the Chinese civilization was the invention of paper production at low costs and block-type printing. The invention of paper was mostly attributed to Tshai Lun, around AD 100. Paper was not only used for printing but also durable high quality paper was used for manufacturing of clothes, shoes and military armors (Mokyr, 1990, p. 217). The invention of the printing had also an important impact on the Chinese civilization in many aspects. The printing technology facilitated the diffusion of the knowledge and other inventions through codifying, dematerializing and transporting the ideas in long distances. The books that were printed at low costs diffused throughout the empire and knowledge especially concerning agriculture (Mokyr, 1990, p. 209), medicine and pharmacy (McClellan & Dorn, 1999, p. 124) became accessible for a greater public.

As the Chinese bureaucracy was relied on writing and literal traditions, printing that gave the chance to diffuse the knowledge at lower costs also served the government to standardize and to train up civil servants within a stronger bureaucratic system (McClellan & Dorn, 1999, p. 124). The standardized examinations and books invigorated the central authority of the emperors of China as well insofar as the local bureaucrats were aware of the central authority's policies and their purviews. Moreover, a state ideology -mostly relied on the philosophies of Confucianism and Buddhism- was constructed and diffused thanks to the dematerialized transportation of the culture through publications (McClellan & Dorn, 1999, pp. 119–120). Thus, the state authority was improved and became more objective -which might have equally helped to improve trade and mercantile activities- with the printing technology.

During the period of the Song, the government acquired more income from mercantile activities and commodity taxes than from agriculture. Insofar as the demand for coins increased in relation with the amplified volume of commerce, the government solved the problem by imprinting more paper money which was invented in 1024 and already dominated the market in the 12th and 13th centuries. The most important point in the paper money usage was not its being the first practice in the world, but its facilitating role in the growth of the economy and commerce of the Chinese civilization (McClellan & Dorn, 1999, p. 123). The Chinese also invented movable type of printing around 1040. However, that kind of printing was not practical because the Chinese language was written with pictograms and the alphabet had thousands of characters. Moreover, block printing was not only cheaper and more efficient, but it allowed to print illustrations as well (McClellan & Dorn, 1999, p. 125).

The achievements of the Chinese in the hydraulic engineering were impressive. Chinese people constructed a huge infrastructure including canals, reservoirs and reforested regions against soil erosion. The canals were used for irrigation and shipment. Rice was shipped from the south -the agricultural center- to the north -the political center1. The introduction of seed drills, weeding rakes and the deep-tooth harrow occurred during the Song and Yuan dynasties (Mokyr, 1990, p. 209).

Because rice paddies produce a higher yield compared to other cultivated crops, rice became the major product of Chinese agriculture and rice cultivation was the major agricultural activity. During the Song dynasty, the government introduced and systematically distributed new methods in rice production. Those new methods allowed to harvest two and sometimes three times a year in favored places, which was an important progress in agricultural production (McClellan & Dorn, 1999, pp. 118–119). Moreover, the Chinese used new fertilizers and both chemical and biological insect and pest control (Mokyr, 1990, p. 209). Consequently, the productivity in agriculture increased astonishingly, which had led to a rapid urbanization period.

The urbanization of the China was matchless due to the hydraulic engineering. The population of China reached 115 million in AD 1200, which was twice the population of the whole contemporary Europe. The population density of China in that period was five times greater than the Europe's population density. Furthermore, China had five cities with populations more than a million and 20 percent of the population –which is quite high for an agrarian society - was urbanized during the Song dynasty2.

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[1] The political center of the China was located in the north. The transportation of the agricultural surplus was immense in China. In the 11th century 400,000 tons of grain transported annually. During the Ming dynasty, 11,770 ships manned by 120,000 sailors handled inland shipping (McClellan & Dorn, 1999, p. 123). On the other hand, although the South of China was not very suitable for agriculture, this region was not highly urbanized and their agricultural products were mostly transported (Wen, 2011, pp. 29–30).

[2] According to McClellan and Dorn as a result of the urbanization "*a leisured middle class arose along with the commercialization of agricultural commodities, increased trade, and expanded manufacturing*" (McClellan & Dorn, 1999, p. 119). This new middle class allowed the Chinese progress pursue in the culture domain as well.

Introduction of mechanization in the textile production is another achievement of the Chinese. Spinning mill was present in China since AD 1035. The Chinese also invented technologies to utilize waterpower to unwind silkworm cocoons and to wind silk onto bobbins (McClellan & Dorn, 1999, p. 124). The weaving equipment was developed even earlier. The draw looms which were used to weave complicated patterns came into being around 200 BC. The Chinese first exploited this technology to weave silk, but later they also used it to weave cotton. Moreover, the ginning process of cotton was achieved by mechanical gins. The advancement of the Chinese in textile manufacture was so immense, which would have resulted in an Industrial Revolution similar to the experience in Britain even much earlier than it (Mokyr, 1990, pp. 212–213).

These three achievements can be thought as the cardinal achievements of China due to the results they bear. However, the achievements of the Chinese were not thus much but more. They invented magnetic compass and gunpowder, and had technological progress in iron production, ship designing, construction and navigation, time keeping and pottery. The limited resources of tin and bronze compelled the Chinese metallurgists to occupy iron as the key resource of metalworking. Since the smelting point of iron is extremely high, which makes it difficult to be shaped and worked on, the Chinese used water-powered bellows to attain high temperatures from the combustion of coke in order to attain the high temperature of iron's smelting point. In huge State foundries, the Chinese metallurgists conducted immense production of pig iron thanks to that technology (McClellan & Dorn, 1999, p. 125).

The improvements in ship construction took place during Song and Ming dynasties. The vessels of the Chinese were quite different than the European vessels. They were the grandest vessels of the epoch in the world, some of which were even ocean-going junks. The construction technique of those ships was called bulkhead construction, which used watertight buoyancy chambers to prevent the ship from sinking (Mokyr, 1990, pp. 216–217). Those ships were highly maneuverable1 and the Chinese were capable to sail even in the Indian Ocean, thanks to their improvements in maritime technologies2 including the magnetic compass which is one of the most important inventions of all the history.

In the 10th and 11th centuries -during the Song dynasty- Chinese clockmakers built accurate water clocks using escapement mechanism3. The Chinese clocks were extremely complex and accurate, which was a sign of high level of mastery of materials and mechanism, and accuracy of measurements in China (Landes, 1999, pp. 17–36). At the end of the Han dynasty, the Chinese originated porcelain and perfected it in the twelfth century. It was a sign of advancement and wealth for the Chinese, and it was used as both commonplace and luxury items. As a consequence, porcelain had become a major item of internal and international trade in China (McClellan & Dorn, 1999, p. 124).

The invention of the gunpowder coincided to the mid-ninth-century, but initially it was utilized to ward off demons and its application to military ends began at the 12th century. When China was threatened with a foreign invasion, Song military engineers developed the formula of gunpowder and used it in military applications like rockets, explosives, bombs, mortars and

[1] The use of the sternpost rudder was an innovation of the Chinese (McClellan & Dorn, 1999, p. 126).

[2] The Chinese admiral Cheng Ho conducted voyages *"to Vietnam, Thailand, Java and Sumatrain southeast Asia, to Sri Lanka and India, into the Persian Gulf and the Red Sea (reaching Jedda and Mecca), and down the coast of East Africa, possibly as far as Mozambique"* (McClellan & Dorn, 1999, p. 126). However, the aim of these expeditions was political, *"to establish the authority and power of the Ming dynasty"* (McClellan & Dorn, 1999, p. 126).

[3] The most sophisticated clock among those clocks was possibly the Su Song's clock that was built in 1086 A.D. It was 40 ft. (12.2 m) high and *"displaying not only the time but also an impressive array of astronomical variables"* (Mokyr, 1990, pp. 214–215). However, Landes (1999, p. 336) also implies that *"the water clock is a dunce by comparison to the clocks invented in Europe."*

guns. That invention significantly influenced the world history (McClellan & Dorn, 1999, p. 125).

Besides the technological creativity, the Chinese were also ingenuous in mathematics, astronomy and medicine. The scientific ingenuity of the Chinese in those fields might be considered as being related to the distinctive religious beliefs of society. The traditional Chinese medical practices were developed over several thousands of years. Those practices included theories, diagnosis and treatments such as herbal medicine, acupuncture and massage. Some of these techniques are being even practiced today as methods of the alternative medicine. While medicine followed some Taoist techniques and demonic healing methods through warding off the demons (Unschuld, 1985, pp. 29–46), mathematics was used to facilitate the calculation techniques of astrological prediction and fortunetelling methods (Grand Larousse universel., 1986, pp. 2728–2729). Although mathematics was first influenced by both ancient cosmological beliefs and the royal calendar, in the course of time it was employed by the feudal bureaucracy for the calculations of accounting, taxation and barter. Consequently, the Chinese contributed in arithmetic and algebra of their period as well. During the Han dynasty, Chinese mathematicians developed techniques some of which were used for simplifying the fractions, finding common denominator and calculating the greatest common divisor. The Chinese developed a practical geometry based on the calculation of surface area and volume. However, apart from the small scraps of an inductive geometry of Mozi School which had relied on a priori definitions, the Chinese could not have developed an advanced geometry (Grand Larousse universel., 1986, pp. 2728–2729).

Despite all those scientific achievements, there was not a methodology of Science in China, that means, they had sciences but no Science (Sivin, 1985). The scientific knowledge of China mostly arose from religious beliefs and practices. As those techniques were fundamentally practical and less interested in any theoretical basis, there was neither a scientific methodology nor systematical approach. However, Chinese scientists practiced and contributed in many breakthroughs in different fields; astronomy, meteorology, cartography and seismology are some of the fields which were not mentioned here.

Retrogression

With the advent of the Ming dynasty, the technological progress came up to a sudden end. The techniques fell into disuse and some of them were even forgotten until the arrival of the colonialist Europeans. The innovations that had potential to lead new developments were not pursued anymore and "only with its encounter with the West beginning in the 17th century would technological innovation once again moved to China" (McClellan & Dorn, 1999, p. 128). Although, the technological ingenuity of China abruptly ended, the Chinese superiority was sustained as the empire stayed peerless and unrivaled for a long period. Once the technological development was interfered, the economic growth was not anymore provided by technological progress; instead, it was elicited by the extensive growth policies employing more resources like it was the case in the extensive agricultural exploitation of the South of China (Mokyr, 1990, p. 120).

The most important and perplexing point in this technological retrogression is not the end of the technological progress, but the disuse and the oblivion of the existing techniques. While the technological ingenuity disappeared, the artisans who could retain and maintain the existing devices also vanished. For instance, the masterpiece water-clock of Su Song constructed under the emperor's instructions in order to monopolize the measurement of time and the calendar (Mokyr, 1990, p. 240), which was, after a while, broken down and then destroyed, was totally forgotten by the 16th century and there was even nobody left who knew how it worked (McClellan & Dorn, 1999, p. 134).

A notable and informative case of retrogression has occurred in the design of the famous junks of the Chinese. The peculiar ships of the Chinese were forgone in the mid-fifteenth century and the junks with four to six masts were no longer built. The revealing point is the legal arrangement of ship building and the restraint of the number of the masts allowed in a ship set by the central authority. The delimitation of the number of masts in a ship up to two by a legal application can be adduced to point out the role of the political authority and bureaucracy in the retrogression as it was even forbidden to construct junks bigger than two masts (Mokyr, 1990, p. 236).

The second point that must be considered is the incuriosity for pursuing and hauling out the potential outcomes of the existing technologies with assistance of minor innovations. The Chinese did not have incentive for improving the available techniques for economic ends (McClellan & Dorn, 1999, p. 121). The mechanization of spinning of silk was not applied for spinning of cotton by implementing some modifications to equip the technique to the spinning process of cotton. However, although the mechanization technique of spinning was known, it was only used for spinning of silk, hemp and ramie but somehow that technology was not used in cotton spinning (Mokyr, 1990, p. 229).

The last important point is the pace of the economic growth during the period that the technology felt behind and then totally lost. The growth which had continued during the retrogression period was based on an expansion of internal trade, monetization and colonization of the southern provinces (Mokyr, 1990, p. 227). Although the population was growing, Manchu China was able to sustain the economic growth only through exploiting more resources until the 19th century.

From the Ming dynasty until the end of the 19th century, the Chinese economy experienced the growth based on population growth, commercial expansion, deforestation and more intensified agriculture. The increase in the inputs was the major determinant of the growth of the economy and extensive growth policies were implemented consequently. On the other hand, technology was excluded and lost its importance. Thus, the prominent ingenuity era of China was ended.

Distinctive Characteristics of the Chinese Civilization

The political, economical and social structure of China has been shaped by the distinctive characteristics of the country. These characteristics can be summarized under four major factors: isolation from outside effects, archetypal hydraulic engineering, centralized bureaucratic political power and Confucianism. Isolation from outside influences has always been an important factor in the history of China. The earliest Chinese civilization arose in the Hwang-Ho valley (by the Yellow River), and in the later periods the civilization spread to the valley and flood plain of Yangtze River. The Chinese civilization was surrounded by mountains, rivers and steppes. The contact between West Asia and Europe was impeded by the geographical factors until the 17th century. The geographical isolation resulted in an authentic culture transpired with its own dynamics. The second factor –archetypal hydraulic engineering- was also quite important to understand China. The result of the archetypal hydraulic engineering was a densely populated society with a high urbanization level. The population of China was around 115 million in AD 1200 and the urbanization was 22% during the Song dynasty. The effect of the large agricultural surplus as a consequence of technological developments in agriculture was influential in attaining the high level of urbanization (McClellan & Dorn, 1999, pp. 117–119).

The third characteristic of the Chinese civilization was its distinct central political power based on a very complex bureaucracy. The authority was strictly centralized and managed by a huge bureaucratic apparatus. The effect of the printing technology was facilitated the development of the bureaucratic system. The result was a good working bureaucracy which was vital for the economic life. The strong central authority working with a standardized and functioning bureaucratic system furnished the reliance and the enforcement of law (McClellan & Dorn, 1999, p. 121).

The last distinguishing property of the Chinese civilization was Confucianism. This moral philosophy imposing a life in harmony with nature and the belief of the universe as a living organism was accepted as a state ideology in Song times (McClellan & Dorn, 1999, p. 120). The philosophy of Confucianism did not focus on the universe and its working as its main interest was human as a system of morality. It accentuated on family, justice, harmony and submission to authority (Fung, 1922). The bureaucratic system was thus marshaled with the rectifications of Confucianism thanks to its teachings preaching docility to the masses. In short, in ancient China, Confucianism was a practical philosophy that served to sustain the status quo, and the paternalistic and patriarchal society (McClellan & Dorn, 1999, pp. 119–121).

The Effects of Distinguishing Characteristics of China on Retrogression

Although the Chinese once became the world's technological leader, this ingenious society of the history was unable to preserve this advantage. Hence, one of the most enigmatic subjects in the history of science and technology would be considered as the retrogression of China after the Ming dynasty while rationale of this retrogression was sometimes discussed and explained along with the distinct characteristics of China.

First, some academic researchers like Joseph Needham (1975) and Robert Hartwell (1971) introduced the analogical and associative logic which dominated the Chinese philosophy and the social organization was responsible for the decline of the Chinese creativity. The supporters of the idea which adduced that the effect of associative logic was a reason of retrogression proposed that this logic was incongruous with the scientific thought and reasoning. Moreover, these supporters attested that the presence of scientific knowledge and method was crucial to carry on the technological progress. Accordingly, the absence of Science as a result of the domination of the analogical and associative logic forestalled the development of the technological advancement of the Chinese (Mokyr, 1990, p. 229).

On the other hand, researchers like Colin Ronan, Joseph Needham (1986) and Bertrand Gille (1978) considered Confucianism as another distinctive characteristic of the Chinese culture which could be seen as a source of the retrogression in China and the dominated moral philosophy of the Chinese society was taken responsible. This assertion was closely related to the first approach considering associative reasoning as a reason of the decline seeing the fact that associative logic and Confucianism were melt one in another in the same pot in the contemporaneous Chinese mind. Considering the Chinese state ideology as responsible for the decline had two dimensions. First, this philosophy was seen as being lack of the belief in a universal order which was created by God and consequently lack of the belief of comprehensible laws of nature that could be discovered and conceptualized by the human mind. The second point was concerned about the apprehension and the sphere of interest of Confucianism. The supporters of this approach claim that this philosophy was only concerned with society and human relations while it was looking down upon practical arts, craftsmanship, technology and commerce. Moreover, because the development through the technological progress was a complex positive-sum-game with many players and as a nonmilitary activity it was not interested in power, the technological progress was not encouraged by the authorities. Moreover, as a result of the intuition of the state's ideological philosophy on the harmony with nature and the interdiction to interrupt the working and the harmony of nature bred another obstacle for the advance of technology (Mokyr, 1990, pp. 227–229).

Although the supporters of these arguments were considered to have conceptualized the retrogression in the manner of the distinct characteristics of the Chinese, these assertions were lack of aptitude to clarify some significant aspects of the retrogression. First, the introduction of these characteristics as the responsible of the retrogression is not capable to capture the history of China and her technological achievements. Although Confucianism conceptualized the human nature and it was not interested in the mechanisms of nature, the Chinese accomplished in either way a long-termed sustained technological progress accompanied by those characteristics of the associative reasoning and Confucian philosophy. In contrast to these arguments, China was the most advanced country in technology in the world for a long period while Europe was extremely underdeveloped in technology although European mind was already dominated by Aristotelian syllogism based on deductive logic and by the belief first in Stoic philosophy defending a universal order of nature and than in a monotheist religion like Christianity alleging a genesis narrative in which whole universe was created by God. On the other hand, the beginning of the retrogression was not a result of a slowdown in technological creativity, but rather it was a sharp decline seeing the fact that the Song period was the last and the most brilliant period of the Chinese technological ingenuity. Thus, introducing the concepts like neo-Confucianism in order to adjust the assertion in coherence with history could not be persuasive.

Second, there was not any obvious relation between science and technology in the first steps of the Industrial Revolution in 1776 until the Second Industrial Revolution. The First Industrial Revolution was not initiated by the walloping contribution of the scientific knowledge. On the contrary, most of the inventions and innovations which took place during this period were achieved by the craftsmen who did not acquire scientific knowledge. Moreover, while England was experiencing the Industrial Revolution, the country had a deteriorated education system and a large portion of the society was uneducated (Deane, 1979).

The last objection is against the conceived negative correlation between science and the analogical and associative logic. It is important to capture the fact that at the beginning, the philosophy of nature relied on associative reasoning. The introduction of the essence elements of nature by Thalesian school based on a similar intellectual enterprise conceptualizing the nature in the way that the Chinese did since both examined the nature as being consisted of some elements which were involved in materials. Both of the approaches tried to deduce the qualities of the materials through the substances contained in them. Thus, the negative correlation between associative logic and science is not intelligible in that manner.

To sum up, the introduction of the diversities of China cannot explain the sudden halt and the retrogression of technology in the course of history. Moreover, to suggest that China had to associate the properties of the Western societies so as to become successful in science and technology misreads the history. Although the circumstances of the Chinese were not convergent to the historical development of the Occident, it was obvious that China achieved an enormous success in technology. Similar to the Orientalist arguments (Said, 2014), this kind of an assertion under the comparative method implicitly suggests a teleological approach which insinuates the criteria of the righteous technological development are hidden in the cultural superiority of Europe. Setting those ambiguous arguments in the heart of a theory will avert the falsifiability of the postulate since it will be self-evidently true insofar as it only needs to refer to the historical facts that it considers as the path of the universal development. Thus, as non-falsifiable arguments, those postulates are far from being scientific.

Parallelism between Urbanization and Technology in China

The retrogression cannot be seen as a result of any economic stagnation either since the economic development pursued after the rise of the Ming dynasty in 1368 while the period of decline began at the same time. Moreover, since the Chinese were successful in innovation and invention before the Ming dynasty, the distinguishing characteristics of this society could not be introduced as the reason of the retrogression (Mokyr, 1990, p. 219). Thus, a closer look in the history would be helpful to see what the actual reason behind the decline was.

The period of the Song was the period in which the most important inventions took place (Elvin, 1973; Landes, 1999) An important characteristic of the Song dynasty was also the highest urbanization level attained during their reign. Moreover, during that period the Chinese government relaxed its monopoly on the commerce and let private sector participate to foreign trade within the approach of wu wei, non-doing or effortless action, an approach which is sometimes taken as the root of the laissez-faire politics in Europe (Clarke, 2002). The government transformed the loss-making tribute system to a commercially sustainable structure and by this means increased the tax revenues (Fairbank & Goldman, 1998).

After Song dynasty, the Chinese economy had turned into an agrarian economy whose growth was relied on deforestation and migration in rural areas. The demography of the country was significantly changed during the same period. China had experienced a continuous urbanization growth due to the security concerns after the Warring States period, around 300 BC. The urbanization ratio even attained its peak in the Song dynasty. However, after the fall of the Song dynasty, the country continuously deurbanized until the 19th century and as a result of this fact the urbanization rate of 22% achieved in AD 1200 felt below 7.7% at the last quarter of the 19th century. The continuous migration from urban zones to rural areas was the most significant characteristic of the social structure during the period following the rise of the Ming (Wen, 2011).

Another gripping point about the Song was the territorial changes occurred during their reign. China lost the whole Northwest (Central Asia) and Northeast (Manchuria) at the beginning of the Ming period. The northern borders of China were pushed behind the Great Wall. Some parts of the North China Plain were lost to nomadic states of Jin and Liao. Because the Great Wall was controlled by the nomadic people, China experienced first the invasions by Jin and Liao, and than by the Mongolian. Under these political uncertainty and vulnerability, many Chinese people migrated from north to south, which led to a population pressure in the South. However, the south of China was not suitable for farming like the North insofar as there were not as many plains as in the North. It took capital, labor and a long period of time to turn these plains into arable lands. All these factors applied a population pressure on the Song dynasty (Wen, 2011, pp. 29–30).

As a result of the population pressure during the Song dynasty, labor-intensive sectors expanded and service sector rose in tandem. The increased urbanization led to the transformation of the functions of the cities with the rise of the Song. Before the Song dynasty, cities were playing especially a political role as national or provincial centers while there were restrictions on commercial activities and city authorities exposed very restrictive rules on the business activities. However, with the Song, commercial activities were allowed particularly in the new cities at the coastal areas of Fujian and Zhejiang where ceramics became an important craft-industry. Moreover, the government encouraged artisans and craftsmen to establish guilds so as to collect taxes more easily (Wen, 2011, pp. 30–32).

On the contrary to the Song; during the successive periods of Yuan, Ming and Qing, all China experienced population declines while territory of the country was enlarged. By pushing the borders beyond the Great Wall, China secured once again the North China Plain which was the most important agrarian land. Likewise, although China's territory was further expanded during the Qing dynasty, the population continued to decline. The population pressure of the Song was not anymore relevant and the urbanization became not a compulsory factor of survival, which led to remigration to the rural areas and the restoration of cities as political centers (Wen, 2011, pp. 35–36).

During the Yuan (the dynasty of the occupant Mongolian), Ming and Qing dynasties there were large-scale of internal migration in China from large cities of the Yangtze region to hilly and mountainous regions of the South as a response to the population decline. As a consequence of the remigration to the rural areas, the land-intensive agriculture became more important instead of the labor-intensive crafts. Moreover, if the big cities are the symbols of high level of division of labor, the regression of the large cities indicates a stagnation in the division of labor in the contemporaneous China (Wen, 2011, pp. 37–39).

The deurbanization of China had two major outcomes. First, the ruralization of China was the actual reason behind the technological retrogression because the shift to the land-intensive production at the expense of labor and capital intensive production might have resulted in the lost of incentive to develop the labor-saving techniques and the division of labor. In other words, deurbanization of China brought about the devaluation of labor and continuous decrease in labor costs relative to the cost of capital goods. On the other hand, since the trade ceased as a consequence of the ruralization following the Yuan, the desire for pacing technological development diminished. The replacement of guilds by bureaucratic organizations after the fall of the Song dynasty resulted in the technological retrogression seeing the fact that the bureaucrats would be less inclined to take risks of innovation than the artisans. Thus, the cease of guilds hindered the free competition and the motivation of curtailing the production costs through labor-saving techniques.

Second, China was experiencing ruralization while the territories of the country were enlarged. The idea of the superiority of China was dispensed among the political authorities and bureaucratic class. This idea was materialized in the maritime expenditures of the country in the Ming period. The Chinese were considering that they were living at the center of the universe and their empire was unrivaled (Landes, 1999, pp. 335–337). This superiority idea was accompanied by the closed door policy and the relations between China and the West could not be established for a long period (Fairbank & Goldman, 1998). On the other hand, both the idea of superiority and no risk taking protectionist close door policy under the huge bureaucratic organization forestalled the technology transfer and hindered the entrance of the new technologies in China. Consequently, China did not pursue the technological developments in Europe until the 19th century. In other words, the closed door policy with the idea of superiority could have underpinned the technological stagnation of China.

Result and Discussion

The Chinese metallurgists deployed the iron, as a result of insufficient resources of other metals in the region, while the use of iron resulted in the hectic pace of growth in the agrarian productivity and expansion in population of the country. The expansion in the population caused urbanization of China in the early stages of the history. Moreover, until the end of the Song dynasty period, the pace of urbanization continued while the significance of labor-intensive sectors persistently increased. However, with the end of the Song period, this trend of urbanization halted while the internal migration reversed from urban zones towards the rural and hilly areas.

The technological progress of the Chinese streamed parallel to the pace of urbanization. China experienced, first, a gradual technological progress while with the rise of the Song and the achievement of the highest urbanization rate this technological development speeded up. However, with the end of the Song period, even the existing techniques were abandoned and fell into oblivion. The relinquishment of progress and the technological retrogression continued until the end of the 19th century parallel to continuously shrinking urbanization ratio.

Although, the dominant bureaucratic institutional structure of China might have buttressed the stagnation after the cease of the progress, the argument which considered the cultural diversities as being the source of retrogression could not be coherent with the historical facts because the Chinese once attained a matchless level of technological progress within the same social and cultural structure while the retrogression occurred as an historical evidence after the fall of the Song.

The paper has introduced a view point to the retrogression aroused in China. However, the paper is bounded by the background of the interpretation of the history and the historical rationale introduced on the basis of dialectic between labor-intensive and land-intensive production paradigms. Thus, it does not press for binding different culminations of various viewpoints which are challenging to its conclusions. On the contrary, the paper would become more meaningful with existence of confronting visions surveying the issue from diverse viewpoints.

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