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ENVIRONMENTAL PROTECTION AND THE GREEN SECTOR IN CHINA: LEGAL FRAMEWORK AND BILATERAL BUSINESS OPPORTUNITIES

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INDEX

INTRODUCTION

Four decades of unprecedented economic growth led to the enhancement of living standards for more than a billion of Chinese nationals. After the shock of Cultural Revolution (1966-1973) and the death of Mao Ze Dong (1976), the new Chairman Deng Xiaoping launched a programme of deep reforms, which aimed to replace the central planned economy model with a more market friendly apparatus, with gradual opening towards the inflow of foreign direct investment, always under the guidance of the Communist Party (Naughton 1993). This model was then theoretically defined as a "socialist market economy", as ratified in occasion of the 14th PCC Congress on 1992. The result was the booming of the economy, with an average growth rate of 9.4% over more than three decades.

Abundant and low-priced labour resources, export orientation, foreign investment-friendly policies, and quickly developing infrastructures were the fundamentals of the "Chinese miracle", which turned the country into the "world factory".

Nevertheless, this stunning development brought several social and environmental disequilibria.

Air pollution is one of the most evident environment negative externalities, both for its impact on people lives and socio-economical indicators, both for its power of suggestion on the national and world audience, as happened during the 2013 crisis[1], when the images of Chinese cities surrounded by a tough blanked of haze travelled around the world and stimulate and intense debate in China and abroad on this issue.

Moreover, the World Factory paradigm is not likely to last forever. Economic development means the increase of operational costs: just as an example, labour cost increased more than four times over the last 15 years in Beijing area (Cesif, 2016). The pressure made by fast increasing operational costs on the productive structure is likely to erode the profitability of many of Country's industries whose efficiency (measured by

[1] http://www.chinadaily.com.cn/opinion/2013-01/15/content_16121559.htm

Manufacturing Value Added) is likely to grow slower than costs, leading to the so-called Middle-income trap (Ohno, 2009). On the social side, a richer country means richer population and new demands, both for material goods, both for improved living conditions. All of these forces convinced the Chinese authorities that the paradigm that led to the astonishing economic growth of "Chinese Miracle" would not have been possible –nor suitable- for forthcoming years.

The 11th and 12th five year plans launched then the so-called "New Normal course", that it to say a set of reforms that would lead to the transition from the past paradigm towards a new one, characterized, in few words, by a lesser attention on quantity and a bigger attention on quality of growth. Double figures economy growth rate will not be possible anymore and economy will grow at a slower pace. Export orientation will leave room for internal consumption, public sector will be reorganized and manufacture will make way for advanced tertiary sector. Social disequilibria and increased demand for improved living conditions will be supposed to be satisfied by improved healthcare system and better environment conditions (Green and Stern, 2015).

The 13th five year plan (2016-2020) is on the same line of the previous ones and aims to strengthen their achievements. As for the environment protection, it shows many new goals, such as introducing an audit system for outgoing officials that will take environmental protection into account, and make protecting natural resources part of an official's performance evaluation. Moreover, the promotion of clean production will be an important point, setting up green and low-carbon industry systems, promote green finance, and establish a green development fund. At the urban level, the plan aims at the promotion of the use of new-energy vehicles and the enhancement of the e-car sector. Information disclosure will be crucial as well, with the setting up of a nationwide, real-time online environmental monitoring system.

In such a background, one of the key challenges for the transition to new normal and more generally for Country social and political stability is finding suitable solutions for the environmental crisis, popularly represented by worldwide broadcast of the smog blanket of December 2013 emergency but consisting of many dramatic aspects, like water pollution and soil contamination and desertification, likely to severely impact country's economy and people's life. The importance of this challenge is evidently

acknowledged by the Country's authorities, as it covers an important space both within public debate and Country's policies[2].

For this reason, the "crisis" definition assumes a twofold meaning, fully seized by the power of the Chinese word for it, "Wei Ji" (危机), with its double intrinsic meaning of "danger" and "opportunity". While it is in fact undeniable that the environment pollution crisis is a dramatic problem for the Chinese people and a more and more relevant social and political issue that may compromise the overall Country's social stability and future development, the undertaking of this crisis is at the same time an extraordinary occasion for the national industrial and technological innovation, and a stimulus for international cooperation and business international development. In particular, it is a great opportunity for those European small and medium enterprises to enter the Chinese market through its main entrance: environmental crisis, in fact, needs for technology, know-how and management solutions that are just at the core of European small and medium enterprises intangible assets and can of course give their contribution, at the condition to fully understand the current conjucture, the different local institutional and normative background and avoid the barriers that commonly occur when approaching this market. A significant role can be played by western local government institutions, under the point of view of the decentralized international diplomacy, by reducing the institutional gap between two distant and different worlds.

The aim of this work is to provide an in-depth analysis of the country institutional and normative framework in the environmental sector under a multidisciplinary and historically dynamic point of view, in order to highlight the opportunities and the related obstacles that a European small and medium enterprise is likely to face when approaching the market and markedly the environment protection sector today.

The first chapter will introduce the Environment protection normative framework and its formation throughout the almost seventy years of history of the People Republic of China. The *corpus legis* at the basis of the environment protection will be reported by focussing on the political and institutional background, with reference to the key facets of law enforcement capability both at the national level, both at the local level, where it will be taken into account the case of Hunan Province. Hunan has been selected as a relevant

[2] http://www.danwei.com/beijing-fog-investigating-air-pollution-policy-making-in-beijing-between-2011-and-2013/

case of study for focussing on the dynamics characterizing the political, law making and enforcement on the local level due to his relevance under the environmental, the economic and the institutional facets. As Hunan is a fast growing province, with a forecasted GDP growth of 8% over the next 5 years (CeSif, 2016), and the headquarter of many important national players (like Zoomlion, Sanyi, Sunward). It accounts for an important share of the national iron and steel, mining and automotive industries, while the primary sector keeps an important role[3]. The environment protection emerges thus as a key priority; this is one of the reasons leading Hunan recent activism on decentralized international relations, developing and furthering the cooperation with foreign local government bodies, like the Italian Marche Region[4], with whom signed on 2010 the first memorandum of understanding of mutually friendship and cooperation, then renewed on 2013 and on 2016 with the involvement of a growing number of institutions dedicated to food security and environment protection[5].

The second and third chapters will analyze the specific context and normative of soil and air protection, as two of the key areas of the China environmental crisis, where international institution and business cooperation can play an important role. The case of Hunan will give a perception of how policies and normative are produced and implemented on the local level.

The fourth and fifth chapters will analyze respectively the cases of Loccion, an Italian enterprise which invested in China in the green sector, and the case of Zoomlion, a Chinese firm with interests in the green sector, which recently entered the European market by acquiring the Italian CIFA. The two cases of studies represent a perfect example of bidirectional opportunities in the green sector but also highlight the problems that differently sized companies, with different cultural and industrial background, commonly face when going abroad.

[3] http://www.thechinaperspective.com/topics/province/hunan/
[4] http://www.expo2015.marche.it/Portals/0/Documenti/Accordi-Protocolli.pdf
[5] http://enghunan.gov.cn/News/Localnews/201604/t20160419_3046132.html

CHAPTER I
THE ENVIRONMENTAL LAW IN CHINA

China's environmental law is the result of more of sixty years of development, which crossed the country's recent history, from the socialist foundation, to political instability and paralysis, through the reform inaugurated by Deng Xiaoping in later seventies and unprecedented economic growth and industrial development. Environmental law can be said to be developed in China along with economic development and sometimes, to some extent, despite of it: progressive normative production coexisted, in fact, with shortcomings in implementation. This is particularly evident on the local level, where we will take into account the case of Hunan, a particularly important (and polluted) manufacturing Province of China, famous also for its food production. The recent amendment of Environmental protection law tried to solve this problem and to give an answer to growing demand for regulation.

1.1 China and the environment: a policy perspective

China is world's largest population country, with more than 1.3 billion inhabitants. It is a diverse country with a large number of languages, religions, and cultures (Vermander 2008)[6]. During the past 40 years, the economic and industrial growth of the country has been extremely fast. This, combined with the population growth, has put an immense pressure on environmental capacity.

For nearly three decades, all the world, we have watched how the Chinese people have transformed their country from a poverty-stricken nation into an economic powerhouse. Equally striking, however, has been the terrible price China's environment has paid for this impressive transformation. Today, the environment is exacting its own toll on the Chinese people, impinging on continued economic development, forcing the environmental policies reform, and inflicting significant harm on the public's health (Elizabeth, 2010).

[6] China "possesses 9% of the planet's cultivated land, 6% of its water supply and 4% of its forests, which must meet the needs of 21% of th earth's population."

The pollution of air, water and soil, combined with drought and desertification threaten the well-being of the population and influencing the agricultural and industrial production (Zhang, 2016). In the winter of 2012-2013, China is over again in the spotlight for the level of air pollution in the country and in particular in the city of Beijing, Beijing's air pollution index has been continuously beyond the warning line. In the city of Beijing have been promoted plans for reducing industrial activities, reducing the use of cars by government officials, to ensure the safety of the population, specially the elderly and children. In 2014, January, the Beijing Municipal Environmental Protection Bureau officially announced the annual air quality status report, in which the PM2.5 annual average concentration value is 89.5 micrograms / cubic meter. This is the first official release of PM2.5 annual average concentrations of Beijing, a value that exceeds the "Ambient Air Quality Standards" [7] (35 micrograms / cubic meter) about 1.5 times.

The Asian Development Bank and Tsinghua University, issued the "national environmental analysis of the People's Republic of China"[8]: the report said that China's 500 large cities were meeting on 2012 less than the 1% of the World Health Organization (WHO) air quality standards.

According to the report, the main problems of China's environment can be divided into:
a. Water pollution and water availability continue to be critical problems. The government has made major advances in the control of industrial and domestic point sources of water pollution. But there is a growing challenge from nonpoint source (NPS) pollution from runoff of fertilizer, pesticides, and discharges from intensive animal production facilities. Water availability in the PRC also represents a major development challenge with some estimates showing that, by 2030, demand could exceed supply by as

[7] In 29 February 2012, the Ministry of Environmental Protection of the People's Republic of China published the new"Ambient Air Quality Standards" together with the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSIQ). This standard will implement in all the country since the beginning of January 2016.

[8] The report "Toward an Environmentally Sustainable Future- national environmental analysis of the People's Republic of China" was published by the Asian Development Bank and Tsinghua university in 14, January 2013, for the content see:
http://storage.globalcitizen.net/data/topic/knowledge/uploads/2013012023185955176_toward-environmentally-sustainable-future-prc.pdf

much as 200 billion cubic meters (bcm), unless major capital investments to strengthen water supplies are made beyond those presently planned.

b. Air quality will continue to be a major environmental challenge, notwithstanding the advances that have already been made. Less than 1% of the 500 largest cities in the PRC meet the air quality standards recommended by the World Health Organization, and 7 of these cities are ranked among the 10 most polluted cities in the world. Although industrial emissions have stabilized in the past few years, a rapid increase in private car ownership is creating a new threat in the form of vehicle emissions.

c. Solid waste management is becoming a top priority in the PRC. The country currently produces about 25% of the world's solid waste. Major investments in the development of facilities for the safe disposal of municipal solid waste were made during the 11th Five-Year Plan period, but these have not kept up with supply. Industrial solid waste management is an even bigger challenge.

d. The occurrence and economic consequences of natural disasters in the PRC have progressively increased over the past 50 years due to a combination of factors including climate change. The consequences of disasters have been increased by a combination of increased wealth, population, and urbanization. Earthquakes, typhoons, floods, and droughts have had the greatest impacts historically and present the largest risks going forward.

e. Other environmental challenges facing the PRC include land degradation, reduced biodiversity, and inadequate forest resources. One-third of the total area of the PRC is prone to desertification, of which 80% had already been desertified by 2004. The country has also been suffering from large-scale land degradation caused by water erosion. Habitat destruction, unsustainable forest harvesting, pollution, and introduction of exotic species have imposed serious threats to the country's biodiversity. The government has made major advances in reforestation and forestation but forest quality continues to be

generally low, and there exists high pressure for the conversion of forested land to uses such as agriculture, urban development, or other construction.

Oxford dictionary defines the environment as "the natural world, as a whole or in particular geographical area, especially as affected by human activity". Nonetheless, a more precise definition of environment as a research topic for international law includes but goes far beyond the concept of "nature", as environment is rather a concept that has significantly evolved over time, under the influence of a wide range of inputs from different domains like philosophy, economics, science. According to this approach, a legal definition of environment is affected by both scientific and political considerations, which may lead to different ways and outcomes in defining the scope of the legal subject and the competence of international organizations. That is the reason because many early treaties (like the GATT, General Agreement on Tariffs and Trade) do not elect environment as a key concept, preferring stricter scopes by addressing to "fauna and flora" or "natural resources", while many others international agreements used the concept of environment without offering an analytical definition (like Stockholm 1972 and UN Convention on the Law of the Sea 1982) (Sands and Peel; 2012:14-15).
There are various categories of environmental pollution, according to the elements of the environment: air pollution, water pollution, soil pollution. By human activity points: industrial pollution, urban environmental pollution, agricultural pollution, marine pollution.

1.1.1 The Chinese policy for Environment: the 5 Year Plans

The five-year plans of People's Republic of China (PRC)[9] are a series of social and economic development initiatives.[10] Every five years, the Chinese government sets out a national development plan that aims to set national policies in major social and

[9] the First Five-Year Plan was published in 1953 under the leadership of Mao Zedong, Zhou Enlai, and other revolutionary veterans，were prepared to embark on an intensive program of industrial growth and socialization.
[10] "The Twelfth Five-Year Guideline was debated in mid-October 2010 at the fifth plenary session of the 17th Central Committee of the Communist Party of China (CPC), the same session in which Xi Jinping was selected as Vice Chairman of the Central Military Commission. A full proposal for the plan was released following the plenum and approved by the National People's Congress on March 14, 2011, with the goals of addressing rising inequality and creating an environment for more sustainable growth by prioritizing more equitable wealth distribution, increased domestic consumption, and improved social infrastructure and social safety nets.", "CPC sets targets for 12th Five-Year Program". Xinhua. October 27, 2010. Retrieved December 22, 2010.

economical areas over the next five years. The government has made public the Twelfth Five-Year Plan in early 2011. The plan is representative of China's efforts to rebalance its economy, shifting emphasis from investments towards consumption and development from urban and coastal areas towards rural and inland areas - initially by developing small cities and green field districts to absorb coastal migration. The plan also continues to advocate objectives set out in the Eleventh Five-Year Plan to enhance environmental protection, accelerate the process of opening and reform, and emphasize Hong Kong's role as a center of international finance.[11]

a. The 11th Five-Year Plan (2006–2010)

The plan includes both qualitative and quantitative objectives. The key quantitative targets under the 11th Five-Year Environmental Plan and the actual outcomes are listed in Exhibit 1:

Exhibit 1: Primary Environmental Objectives and Achievements under the 11th Five-Year Plan (2006–2010)

Goal	**Plan**	**Result**
1 SO 2 reduction (million tons)	22.95	21.85
2 COD reduction (million tons)	12.70	12.38
3 Ratio of recycled industrial solid wastes	> 60%	69.0%
4 Ratio of urban sewage treatment (secondary)	> 70%	75.25%
5 Ratio of sanitary disposal of urban solid wastes	> 60%	71.4%
6 Ratio of village environmental improvement	> 20%	Basically reached the indicator
7 Ratio of state-level nature reserves meeting national standards	> 25%	11.8%
8 Ratio of the water supply sources in key cities meeting national standards (in volume)	> 80%	73%
9 Ratio of sections of surface water bodies monitored by state level monitoring stations having water quality below Level V	< 22%	18.4%
10 Ratio of sections of the seven largest rivers having water quality better than Level III	> 43%	57.3%

[11] Zhang Jingya, ed. October 28, 2010. "China unveils 12th Five-Year Plan". CNTV.

11 Ratio of coastal areas having water quality better than Level II	> 70%	72.9%
12 Ratio of key cities having air quality better than Level II for more than 292 days	> 75%	95.6%
13 Ratio of effective annual exposure to radiation for residents living adjacent to nuclear power plants lower than the threshold of national standard	< 10%	9%

COD = chemical oxygen demand, SO 2 = sulfur dioxide.

Source: Chinese Academy of Environmental Planning. 2010. State of the Environment. Unpublished report prepared as background paper to the Country Environmental Analysis. Beijing.

Period (2006-2010). More laws were passed and/or amended, in addition to the substantial body of environmental laws, regulations, and rules that were already in place. Exhibit 2 highlights some of the major developments.

Exhibit 2: Main Laws for Natural Resources and Environmental Management Approved since 2006

Type of Instrument	Title
Laws	Law on Conserving Energy (28 October 2007) Law on Water Pollution Prevention and Control (originally passed on 11 May 1984, amended in 1996, and amended again in 2008) Circular Economy Promotion Law (29 August 2008) Renewable Energy Law (26 December 2009) Law on Island Protection (26 December 2009)
Regulations	Regulation on the Bio-safety Management of Pathogenic Microbe Labs (8 March 2006) Regulation on National General Survey of Pollution Sources (9 October 2007) Regulations for Management of Recycling Disposal of Waste Electric and Electronic Products (20 August 2008) Regulations on Plan Environmental Impact Assessment (12 August 2009) Regulations on the Prevention of Sea Environmental Pollution by Ship (2 September 2009) Management Rules for Ozone Depleting Substances (24 March

	2010) Measures on Environmental Management of New Chemical Substances (15 October 2010)
Departmental Rules	Measures for Compliant Reporting on Environment (24 June 2006) Measures for the Administration of Environmental Statistics (26 October 2006) Measures for the Supervision and Inspection of National Nature Reserves (26 October 2006) Measures for Environmental Administrative Reconsideration and Response (27 December 2006) Measures for the Disclosure of Environmental Information (Trial Implementation) (11 April 2007) Measures for the Administration of Environmental Surveillance (25 July 2007) Administrative Measures for the Prevention and Control of Environmental Pollution by Electronic Waste (7 September 2007) Administrative Measures for the Examination and Approval of the Export of Hazardous Wastes (25 December 2007) Classification of Construction Project Lists for EIAs (15 August 2008) Provisions for the Grading and Approval of EIA Documents of Construction Projects (11 December 2008) Administrative Measures for the Filing of Local Environmental Quality Standards and Pollutant Emission Standards (30 December 2009) Measures for the Administrative Penalties for Environmental Protection (30 December 2009)

EIA = environmental impact assessment.

Source: Ma, Zou; 2009. Strengthening [the People's Republic of] China's Environmental Protection Administrative System: Analysis and Recommendations. Unpublished report prepared for the World Bank, Washington, DC. Economic instruments.

b. Environmental Strategy for the 12th Five-Year Plan (2011–2015)

The 12th Five-Year Plan (2011–2015) was released on 5 March 2011. The key macroeconomic objectives that will directly impinge on the environmental agenda include:

• GDP growth: An average of 7% per annum;

• Increased service sector growth: Value-added of service sector to increase to 47% of GDP, a 4% increase over 2010; and

• Urbanization: Urbanization rate to reach 51.5% by 2015, an increase of 4%.

170

The main objectives with direct environmental consequence include:

• Decrease SO2 and chemical oxygen demand COD by 8% by 2015;

• Commence regulating emissions of two new key pollutants (nitrogen oxide [NOx] in air and ammonia nitrogen [NH3–N] in water) and reduce emissions by 10% by 2015;

• Decrease energy intensity of the overall economy by 16% by 2015;

•Increase nonfossil energy as a proportion of primary energy (currently 8.9%) to 11.4%;

• Decrease water intensity of the overall economy by 30%;

• Increase forest coverage to 21.7% and forest stock by 600 million cubic metres (Mm3).

And on 21 September 2011, The Ministry of Environmental Protection of the People's Republic of China published "The 12th Five-Year Plan for the Environmental Health Work of National Environmental Protection"[12]. On 15 December 2011, the State Council officially released the 12th Five-Year Plan on Environmental Protection[13]. The key objectives of this environmental plan are in the words of the 12th five year plan:

[12] "The Ministry of Environmental Protection of the People's Republic of China have drawn up this work plan in the spirit and requirements of the State Council Decision on Implementing Scientific Development and Strengtheni ng Environmental Protection, the National Environmental Health Action Plan (2007-2015), and the Outline of the 12th Five Year Plan of the People's Republic of China for Economic and Social Development." http://english.mep.gov.cn/Plans_Reports/12plan/201201/P020120110355818985016.pdf

[13] http://www.gov.cn/zwgk/2011-12/20/content_2024895.htm

"a. strengthen and expand total emission control of pollutants, b. further improve people's living quality and standards by enhancing environmental management and strengthening protection of drinking water sources, c. promote green development with environmental protection, and, d. broaden efforts to address international environmental issues such as climate change. The draft plan could reasonably be described as a continuation of the more balanced development approach that had some success under the 11th Five-Year Plan, combined with some augmentations to address new and emerging issues."

In the 12th Five-Year Plan on Environmental Protection the government decided to strengthen work on soil contamination. The main objectives are to strengthen the national database on soil contamination, strengthen capacity, and strengthen the legal and regulatory frameworks. The scope of work will include:

a. completing a nationwide survey of soil contamination;
b. capacity building and gradual establishment of a national, three-level (national, provincial, and municipal) monitoring system, along with a system that periodically publishes information on national and regional soil environmental quality data;
c. developing and strengthening of laws, regulations, and standards for the prevention and control of soil contamination; and
d. under taking experimental and demonstration work to remedy contaminated soils, to assess the effects of using wastewater and sewage sludge for irrigation, and other related topics.

Concurrently with the writing of this work, a 13th has being drafted[14]. Based on the principles of green development, rule of law, social and institutional innovation, the new plan will have the following targets, to be reached by 2020:

- the decrease of pollutants
- the improvement of environmental living standards

[14] http://gov.163.com/14/1126/14/AC018OAS00234IK8.html

- the enhancement of the stability of the ecological system
- the enhancement law enforcement system
- the introduction of an environmental auditing system

1.1.2 The development of measures of policy and of a legal framework for Environmental protection

In the EU SME Centre report of The Green Tech Market in China, The China's green tech sector is divided into the following categories:

Exhibit 3: The Green Tech sectors in China

Conventional & Renewable Energy Market	**Water Market**	**Other Markets**
Clean Conventional Energy	Water Resources	Waste to Energy(WTE)
Wind Energy	Municipal Water& Waste Water	Green Vehicle
Solar Energy	Industry Waste Water	Green Building
Biogas	Sludge Management	Smart Grid
Biomass	Desalination	Green Eco-systems

Source: EU SME Centre, "The Green Tech Market in China"

Divisions on the green sector are numerous; this is just one of them. Each sector is unique. They operate in different ways. There are various authorities involved in the management of different environmental sectors in China.
The National People's Congress: is the highest lawmaking organ of the PRC, reviews and enacts laws.

The State Council: is the highest administrative organ of PRC, and reviews and enacts regulations.
The National Development & Reform Commission: coordinates policy setting across different ministries sets guidelines for cross-sector issues.

And there are 20 ministries in China for different sector: Ministry of Agriculture, Ministry of Civil Affairs, Ministry of Commerce, Ministry of Culture, Ministry of Education, Ministry of Environmental Protection, Ministry of Finance, Ministry of Foreign Affairs, Ministry of Housing and Urban-Rural Development, Ministry of Human Resources and Social Security, Ministry of Industry and Information Technology, Ministry of Justice, Ministry of Land and Resources, Ministry of National Defense, Ministry of Public Security, Ministry of Science and Technology, Ministry of State Security, Ministry of Supervision, Ministry of Transport, Ministry of Water Resources.

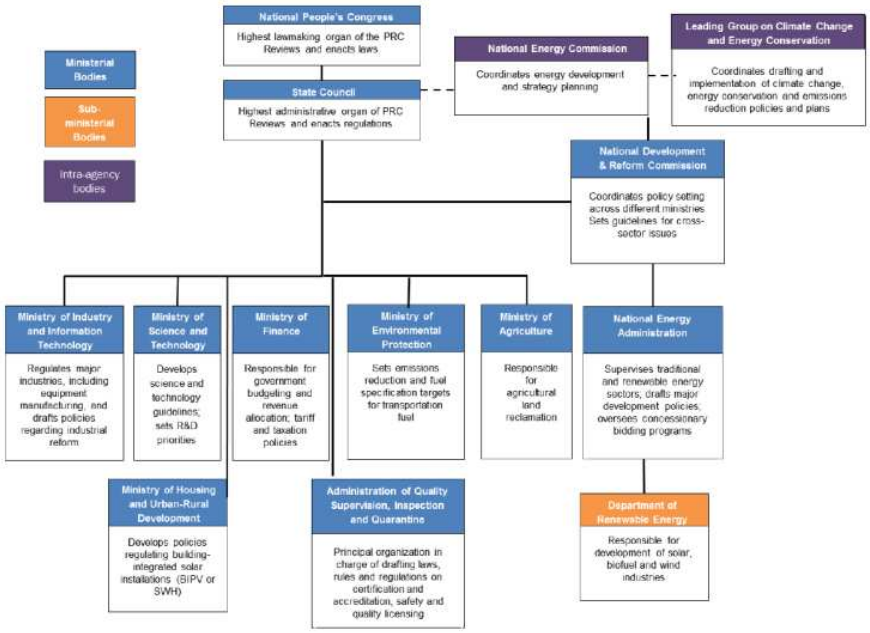
It should be noted that The Ministry of Environmental Protection (MEP) of the Government of the People's Republic of China, formerly State Environmental Protection Administration (SEPA) is a cabinet-level ministry in the executive branch of the Chinese Government (People's Republic of China). It replaced the SEPA during the March 2008 National People's Congress sessions in Beijing. The Ministry is the nation's environmental protection department charged with the task of protecting China's air, water, and land from pollution and contamination. Directly under the State Council, it is empowered and required by law to implement environmental policies and enforce environmental laws and regulations. Complementing its regulatory role, it funds and organizes research and development. In addition, it also serves as China's nuclear safety agency.

MEP regulates water quality, ambient air quality, solid waste, soil, noise, radio activity. In the area of R&D activities, MEP has funded a series of "Key Laboratories" in different parts of the country, including: Laboratory for Urban Air Particles Pollution Prevention and Control for Environmental Protection, Laboratory on Environment and Health, Laboratory on Industrial Ecology, Laboratory on Wetland Ecology and Vegetation Recovery, and Laboratory on Bio safety.

In addition, MEP also administers engineering and technical research centers related to environmental protection, including: Center for Non-ferrous Metal Industrial Pollution Control, Center for Clean Coal and Ecological Recovery of Mines, Center for Industrial Waste Water Pollution Control, Center for Industrial Flue Gas Control, Center for Hazardous Waste Treatment, and Center for Solid Waste Treatment and Disposal of

Mines. The management of each different sector is not the same, but also has the same parts. For example, the China's Renewable Energy regulation bodies in Exhibit 4 and the Key Regulators in the Chinese Water Industry in Exhibit 5.

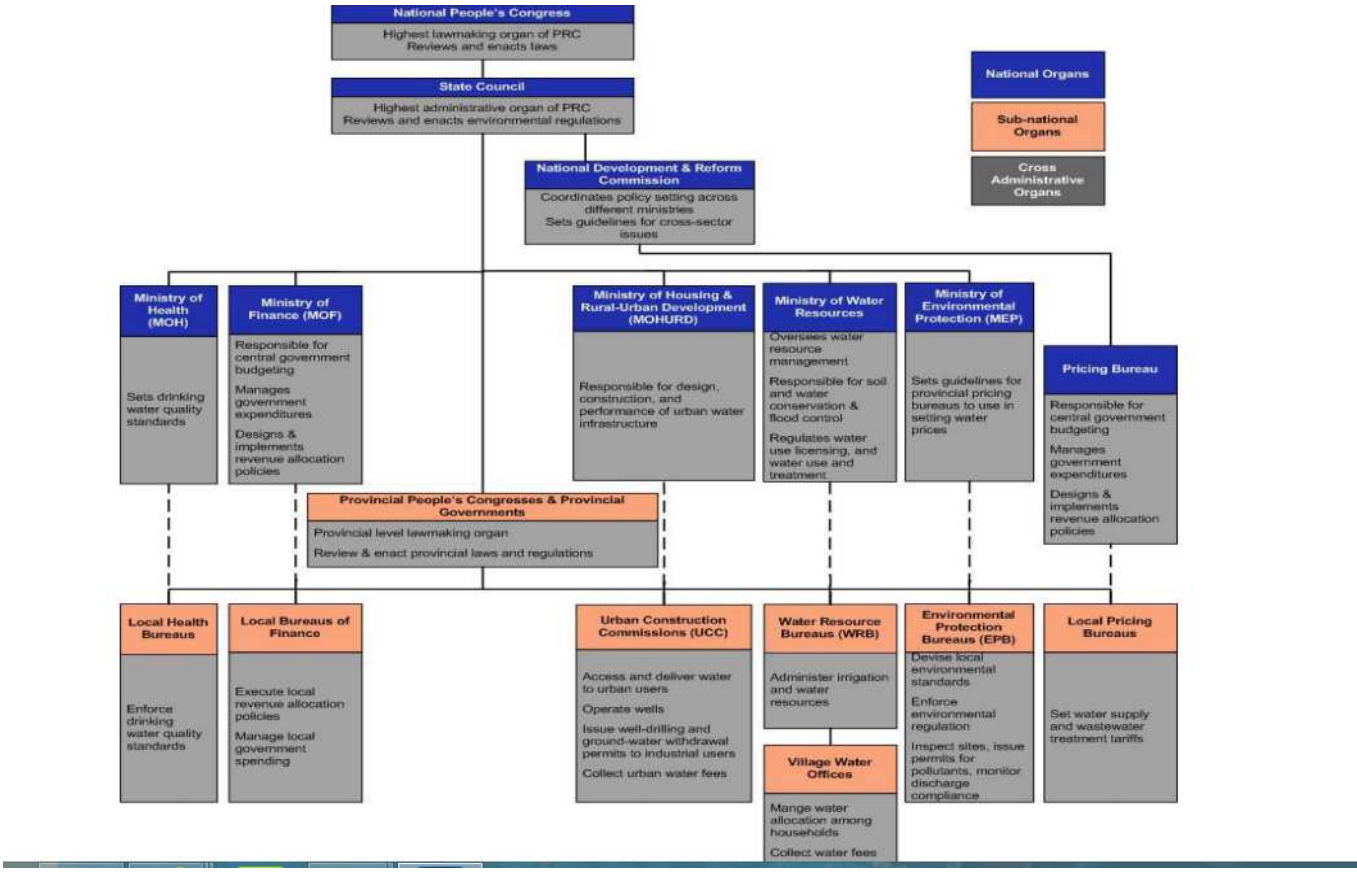
Exhibit 4: China's Renewable Energy Regulatory Bodies



Source: APCO Worldwide (apcoworldwide.com), 2010

Source: APCO Worldwide, 2010

Exhibit 5: Key Regulators in the Chinese Water Industry



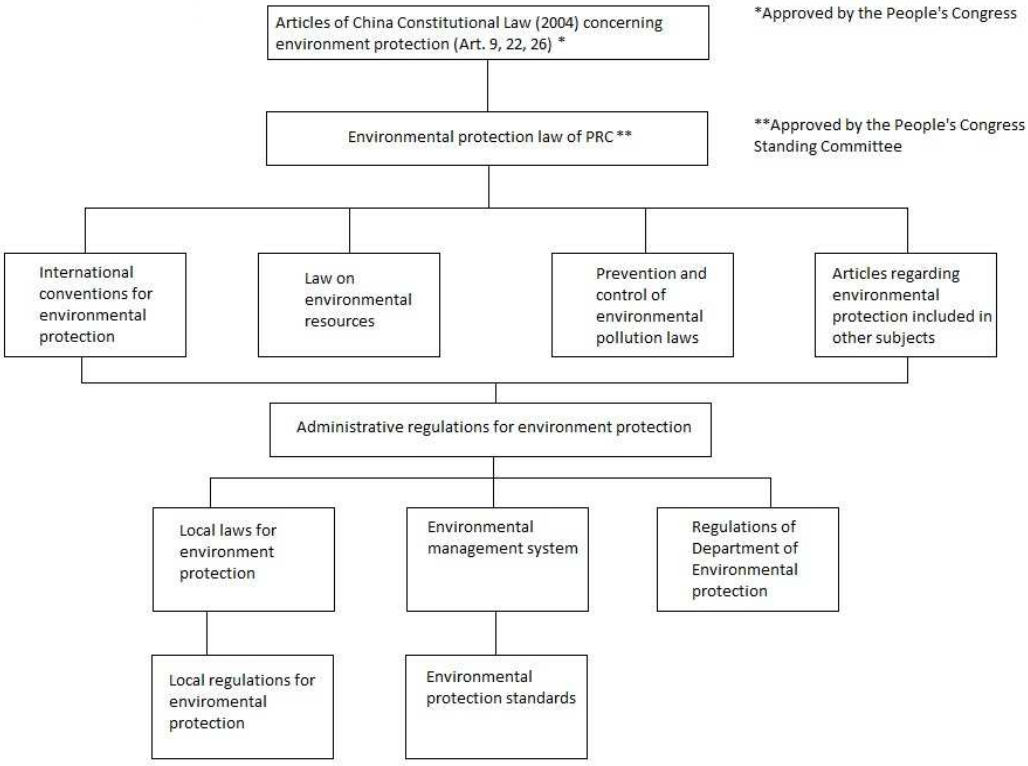
Source: APCO Worldwide, 2010

1.2 The Chinese legal system of environment

When observing the situation of the environmental legal system in China, from the legislative level, its backbone is formed by the principles and system of the constitution relating to the protection of the environment and resources and the legal system based on the environmental protection law. The whole legislative system includes 9 environmental protection laws (see Exhibit 7), more than 50 environmental protection administrative regulations, nearly 200 departmental regulations and normative documents, and more than 1600 local environmental laws and regulations and more than 800 national environmental standards, approved and signed 51 multilateral international environmental treaties (Ma, Zou; 2009).

The emergence and development of environmental law is closely related to the rise of modern environmental protection consciousness that began after the Second World War, along with the rapid development of industrialization of science and technology. Chinese modern environmental legislation has experienced three stages during its development, as described below.

Exhibit 7: China's legal system



Source: Municipal Bureau for letters and calls of Chen Zhou (郴州市信访局)[15]

[15] Letters and calls （xinfang 上访 or shangfang 信访) is the administrative system for hearing complaints and grievances from individuals in the People's Republic of China. "Under the system, State Bureau for Letters and Calls (*guojia xinfang ju*) and local bureaus of letters and calls ("petitioning bureaus") are commissioned to receive letters, calls, and visits from individuals or groups on suggestions, complaints, and grievances. The officers then channel the issues to respective departments and monitor the progress of settlement, which they feedback to the filing parties.", http://www.gjxfj.gov.cn/

1.2.1 The incubation stage (from 1949 to twentieth Century 70')

This stage is the incubation stage of the Chinese environmental law. As the People's Republic of China (PRC) was officially established on October 1 1949, in September 20, 1954 in the capital, Beijing, People's Republic of China held the first session of the Conference of the National People's Congress, it was at this meeting adopted the first Constitution of the People's Republic of China.[16]

The Constitution is theoretically the highest law of the land. No “law or administrative or local rules and regulations" may contravene it; all state organs, the armed forces, political parties, public organizations, and enterprises must abide by it; and no organization or individual “may” enjoy the privilege of being above” it (McElwee and Squire, 2011:32)[17].

It sets forth the basic structure of the Chinese state and the powers and duties of its key political organs (except the Communist Party of China). The constitutional outline is supplemented by legislation such as the various Organic Laws, and laws that define the procedures for certain legislative and administrative tasks, such as the Legislation Law (McElwee and Squire, 2011:32).

In the 1954 version of the Constitution[18], which absolutely presents no article relating to environmental protection, there is only one article about environment. The article 5 states that: “The state economy is socialist public ownership of the economy, is the material basis of the national economy and the country's leadership to realize the power of socialist transformation. State guarantees priority to the development of the state economy. Mineral resources, waters, as required by law of state-owned forests, wastelands and other resources are owned by the whole people”.

During this period, the State began to pay attention to the industrial production environment pollution and developed the relevant prevention and control. Such as the State Council on 1956 promulgated the "plant health and safety regulations", requires clearly that the plant should respond of the production wastes, waste gas, noise and material waste, and of the treatment of the properly waste water and material waste, and

[16] “The Constitution has undergone several significant revisions, most notably in 1975(when it took a sharp turn to the left), 1978, and 1982, when Deng Xiaoping remade it to support his drive to preserve domestic stability and encourage modernization. Minor amendments were made to the 1982 version in 1988, 1993, 1999, and 2004.”.

[17] Constitution art.5, 2004.

[18] With reference to the content of the constitution in 1954, see: http://www.npc.gov.cn/wxzl/wxzl/2000-12/26/content_4264.htm.

shall not endanger workers and nearby residents. On The State Council 1959 promulgated the "drinking water health regulations".

The standard is for the control of the quality of drinking water and at the same time for the prevention and control of pollution of water source protected areas. These Provisions are more from the people's life and health point of view, the relevant administrative authority is the Ministry of health. Objectively speaking, at the economic recovery and construction period, the concept of environmental protection is very difficult to be defined, these scattered state regulations both from the legislative level point of view, or from the actual content, do not constitute a real thorough environmental legislation as they can only be said to be related to some extent to the environmental legislation.

The People's Republic of China's (PRC) environmental legal system did not start to develop until the country officially adopted reform and opening-up policy in 1978 (Zhang and Zhong, 2007). Hardly any progress was achieved in environmental law-making between the establishment of PRC in 1949 and the end of “cultural Revolution” on 1976 (Chen, 2009).

At Mao's death, formal law in China was close to be non-existent. The near lawlessness of the 1960s and 1970s was the result of a politicized struggle in which champions of flexibility and revolutionary values edged out proponents of rules and legal expertise (O'Brein 1990: 158).

1.2.2 The initial stage (from 70's to 80's at the end of twentieth Century)

The initial development of Chinese environmental legislation began in the 70‘s of the twentieth Century. The state sent representatives to participate in the United Nations Conference on the human environment in 1972 held in Stockholm Sweden. This meeting brought a modern environmental protection idea to Chinese, also promoting the starting of a true environmental legislative work. The first National Conference on environmental protection was held on 1973 August, The outcome was the draft of “Regulations on the protection and improvement of the environment (for Trial Implementation)”, and then the State Council officially approved the provisions of the regulations and established some guidelines and policies related to national environmental protection. On 1978 the National Congress revised the "constitution" explicitly adding the following statement:

"the state protects the environment and natural resources, prevents pollution and other public pollution". For the first time the fundamental law stipulates the contents of environmental protection, placing an important milestone of the environmental legislation of China. The fifth session of the Standing Committee of National People's Congress passed the "environmental protection law (Trial)" in September 13 1979, this law is the basic law of environmental protection, describing the main provisions and the basic policy of the country in environmental protection, and introducing some specific provisions that will be solved in the law of air protection, the law of water protection and other specific laws and regulations, which marks the official start of Chinese environmental legislation. After that, the NPC Standing Committee has formulated the "marine environmental protection law" (1982). “water pollution prevention law" (1984). “air pollution prevention law" (1987). After the trial for ten years, The NPC Standing Committee modified the "environmental protection law (Trial)” with the "environmental protection law".

1.2.3 The preliminary formation stage (since ‘90s)

The new amended China's Constitution of 2004 produced a new vision on environmental protection by the introduction of several articles that impact on environmental issues.[19]

Article 9: “Mineral resources, water, forests, mountains, grassland, unclaimed land, beaches, and other natural resources are owned by the state, that is, by the whole people, with the exception of the forests, mountains, grassland, unclaimed land, and beaches that are owned by collectives in accordance with the law. The state ensures the rational use of natural resources and protects rare animals and plants. The appropriation or damage of natural resources by any organization or individual by whatever means is prohibited."

Article 22: The state is required to protect “places of scenic and historical interest, valuable cultural monuments, and treasures and other important items of China's historical and cultural heritage”; and most significantly,

[19]About the content of the constitution in 2004, see：ttp://www.gov.cn/gongbao/content/2004/content_62714.htm

Article 26: the “State protects and improves and remedies pollution and other public hazards. The State also organizes and encourages forestation and the protection of forests.”

After more than 30 years from the China's reform and opening up policy, the economic construction developed rapidly, the environmental problems become increasingly serious, environmental legislation in China has entered a stage of rapid development: on one hand, were made a large number of new environmental law, on the other hand, were made a lot of amendments to the original environmental law. New environmental laws were produced, including the "the prevention and control of solid waste pollution law" (1995), “Environmental noise pollution prevention law" (1996), “clean production method law" (2002), “Environmental Impact Assessment Law" (2002), “radioactive pollution prevention and control law" (2003). Other laws were revised, including the "air pollution prevention law" (1995, 2000 two revision), “water pollution prevention law" (revised in 1996), “marine environmental protection law" (revised in 1999). The State Council and the relevant departments of the State Council also established the environmental protection department administrative regulations, rules. Chinese environmental legal system frame is preliminary formed (Bie, 2005).

Up to now, China has initially established a relatively thorough environmental protection legal system (Exhibit 8) (Jia, 2007:45).

Exhibit 8: Environmental legislation of China

Prevention and Control of Environmental Pollution Laws	“environmental protection law” (Trial). “environmental protection law" was revised in 2014
	"marine environmental protection law" (1982), revised in 2013.
	"water pollution prevention law" (1984), was revised in 1996
	"air pollution prevention law" (1987), was revised in 1995

	"the prevention and control of solid waste pollution law" (1995), was revised in 2004
	"environmental noise pollution prevention law" (1996)
Resource recycling laws	"Renewable energy law" (2005)
	"Circular Economy Promotion Law" (2008)
	"Clean Production method Promotion Law" (2002)
Environmental Impact Assessment Laws	"Measures for the administration of environmental protection of construction project" (1980)
	"Environmental Impact Assessment Law" (2002)
Sewage charges regulations	"The sewage fee collection regulations" (2002)
The hearing regulations of Environmental legislation	"The legislation law" (2000)
	"Sewage permit (Draft)" the burden of hearing (2004)

Source: Liao (2016)

1.3 The New Environmental Protection Law

China's Environmental Protection Law is the main national environmental legislative framework.

Chinese legislators have passed the first amendments to the country's environmental protection law in 25 years, promising greater powers for environmental authorities and harsher punishments for polluters. The amendments, which the Standing Committee of National People's Congress passed on 4 April 2014 after two years of debate, will allow authorities to detain company bosses for 15 days if they do not complete environmental impact assessments or ignore warnings to stop polluting. The new law will come into practice on 1 January 2015. With 70 articles compared with 47 in the original law, the revised Environmental Protection Law sets environmental protection as the country's basic policy.[20]

The new law says that economic and social development should be coordinated with environmental protection and encourages studies on the impact environmental quality

[20] Yang Yi, "China's legislature adopts revised Environmental Protection Law". XinHua net, published on 24 April 2014

causes on public health, urging prevention and control of pollution-related diseases. It says that the country should establish and improve an environment and health monitoring, survey and risk assessment mechanism.

The law gives harsher punishments to environmental wrongdoing, and has specific articles and provisions on tackling smog, making citizens more aware of environmental protection and protecting whistleblowers.

It says citizens should adopt a low-carbon and frugal lifestyle and perform environmental protection duties, and nominates June 5 as Environment Day. The public is encouraged to observe environmental protection laws and make its own efforts in this regard, including sorting their garbage for recycling.

The country's Environmental Protection Law has not been revised since it took effect in 1989. The amendment was adopted after four readings. It is rare in China for a law or amendment to go through three readings and not be passed, highlighting the importance of the legislation in the country's pursuit of sustainable development.[21]

About the stiffer punishments parts of the environmental protection law, lawmakers said during their panel discussion that the phenomena in which the cost for observing environmental legislation is higher than violating laws widely exist, causing environmental pollution.

Beside the fact that the environmental legal system is still incomplete, one of the key issues is the implementation and enforcement of environmental laws, which have shown big shortcomings (OECD, 2016).[22]

Xin Chunying, deputy director of the Legislative Affairs Commission of the NPC Standing Committee, gave an example during the deliberation of the law, saying that an electricity generator complex with production capacity of 100, 000 kilowatt needs to pay between 500, 000 and 600, 000 Yuan in environmental protection fees to alleviate and control pollution. But if the factory shuts down its pollution processing equipment and does nothing to protect the environment, it may only face a 10, 000 Yuan fine, she said.

Handing out heavier punishment for environmental wrongdoing is an important principle of the new legislation, and will deter enterprises from violating the law. The new law

[21] Jonathan Kaiman, “China strengthens environmental laws”, published on theguardian.com, 25 April 2014.

[22] Organization for Economic Cooperation and Development, Environmental Compliance and Enforcement in China: An Assessment of Current Practices and Ways Forward (OECD, Paris, 2006)

stipulates that enterprises will be named and shamed for breaking environmental protection laws.

The most important amendments of The Environmental Protection Law:

a. Daily-based fine system. The law says a daily-based fine system will be introduced to punish offenders. If an enterprise illegally discharges pollutants and is fined and asked to correct its wrongdoing by authorities, but refuses to make corrections, the enterprise may face a fine which accumulates daily. In the past, enterprises received a one-off fine.
b. Penalties of Administrative detention. It says that responsible persons would face up to 15 days detention if their enterprises dodge environmental impact assessments and refuse to suspend production after being issued a ban; fail to obtain a pollutant discharge permit but discharge pollutants, and refuse to suspend the discharge after administrative bodies issue a ban; or if they shirk supervision through means including forging monitoring data or improperly operating pollution prevention equipment. The length of detention would depend on the impact of their violations. Responsible persons would face the same punishments if their enterprises produce or use forbidden pesticides and refuse to make corrections.
c. The law also proposes that organizations in charge of environmental impact assessments and supervision would bear joint liabilities if they are found to have acted fraudulently. Local officials may be demoted or sacked, if they are guilty of misconduct, including covering up environment-related wrongdoing, falsifying data or ask others to falsify data, failing to publicize environmental information which should be made public according to law or failing to give closure orders to enterprises which illegally discharge pollutants. If offenders' behaviours constitute crimes, they will be held criminally responsible.

However, despite the positive turn the reform process took, the revised law still missed some opportunities and faces many challenges. Most importantly, the ubiquitous question of implementation looms large also for the New Environmental Protection Law. The

existing institutional setup will not make it any easier: local governments still tightly control Environmental Protection Bureaus in terms of personnel and finance, potentially creating difficult conditions for implementation. It is still uncertain to what extent local bureaus will be able to make use of the powerful weapons available to levy real punishments[23]. It also remains to be seen whether the stipulation will foster a general trend towards Environmental Impact Assessments in legislation.

The biggest disappointment from the view of civil society, however, is that possibilities for environmental litigation remain limited. Since only organisations registered above the city-level will be able to launch lawsuits, many others will not be eligible for litigation. The NGO Friends of Nature has criticised the fact that many NGOs registered below the city-level or as enterprises, are excluded as barriers to registering NGOs are high. Luckily, the stipulation of previous drafts that only societal organisations with a "good reputation" be allowed to litigate did not feature in the final version of the law. This phrase was replaced by the condition that these organisations should "have no record of illegal activity". Without this change, authorities would have had almost unlimited discretion to keep unloved organisations away from litigation[24].

The New Environmental Protection Law is not a perfect law, but it is certainly much stronger than could have been expected and has the potential to influence the dynamics of environmental protection in China in a long lasting way. If the issuance of the law is supplemented by the much rumoured expansion of the Ministry of Environmental Protection's sphere of influence, taking over environmental responsibilities from other ministries to integrate environmental management within one organisation, it could make the implementation of the law even stronger.

The Environmental Law provides the environmental authorities with powerful instruments to lead China into a cleaner future. Now, it is their turn to make use of these

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[23] http://news.xinhuanet.com/politics/2014-03/11/c_126250052.html

[24] http://politics.people.com.cn/n/2015/0408/c70731-26811543.html

instruments, taking an important step towards solving one of China's biggest challenges in the 21st century.[25]

1.4 Local environmental legislation of Hunan province

China is a country with a vast territory and abundant resources, a large population, different natural conditions, the uneven distribution of natural resources and the environment, with strong differences amongst the regional economic and social development levels. In order to ensure the sustainable use of environmental resources, realize the coordinated development of economy, society and environment, China not only established the basic national policy of environmental protection, developed the basic law of environmental protection and pollution control, but also according to all the needs of local environmental protection, developed many local environmental regulations. In this work we take into consideration the specific case of Hunan, as it is one of the most important manufacturing and agricultural areas, as well as one of the most polluted regions of the Country. The conflict that arises between food security and pollution caused by manufacturing makes of Hunan a potentially privileged laboratory for environmental protection and a new sustainable development model.

The Chinese local environmental legislation refers to people's Congress and its Standing Committee and to regional people's government of China's provinces, city, and autonomous regions. The local government formulates, approves, amends, supplements and abolishes the local environmental law, according to the Constitution and law, and on the basis of local peculiarities like environment and development level, local utilization of natural resources and natural environment (Wang, 2013).

According to the "legislative law", People's Congress and its Standing Committee of Hunan, the People's Congress and its Standing Committee of Changsha City, People's Congress of 1 Autonomous Prefecture and 7 Autonomous Counties have the legislative power to formulate the local environmental regulations. The Hunan provincial government and the Changsha City government have the legislative power of local environmental regulations; these power legislative bodies have actively carried out the local environment legislation. There have been more than 60 local regulations on the

[25] Jost Wübbeke, "The three-year battle for China's new environmental law", published on chinadialogue.net 25 April 2014.

protection of the environment and resources in Hunan province, more than 30 local government environmental regulations, but among them there are only 15 directly related to resources protection and pollution prevention and control. The local environmental legislation covers all areas like: rational development and protection of natural resources, ecological protection (the most typical such as in 2011 "Hunan Province alien species Regulations"), pollution control and other fields. From the ratio of local environmental legislation of Hunan in the province's all the local legislation, Hunan Province in the central provinces is in the forefront (after Shanxi), but there are many deficiencies in Hunan environmental legislation, these deficiencies in other areas of the country is existing in different degrees and different forms.

1.4.1 Existing problems of the Chinese local environmental legislation

According to Wang (2013), the problems with Chinese local environmental legislation can be subdivided such as follows:

a. Unitary Legislative Body

Legislative body is the legislative authorities, organizations and persons that have the right to participate or actual participation in the legislative activities. Including the legislators who have right to the terms of reference, also the entity that doesn't has the right but can play a substantial role or can has a significant impact on the legislation (Zhou, 2009). Therefore, the main local environmental legislation can be summed up as two categories: the subject and the legislative competence to participate in the legislative subject. However, environmental legislation, particularly at the local environmental legislation, as the legislative body, the People’s Congress is very subject to local government, the implementation is also very subject. The People's Congress's subjectivity status of legislation is often suppressed.

b. Lack of local legislative characteristics

China's local environmental legislation has long time problems, like a lack of autonomy from the central government and a low capability of producing solutions that suits the local situation. Therefore, only once the central People's congress establishes a

new law, the local government immediately develops the appropriate regulations or implementation. Sometimes, it may happens that the redaction of local laws is inspired by other provinces legislations with low capability to adapt them to local peculiarities. Most of the local provincial chapters of the Environmental Protection Regulations follow the provisions of the State Environmental Protection Law, without any substantial difference. This is the case of Provinces like Hunan, Hubei, Guizhou.

c. Local interest bias on law production

In China's local legislative system, usually the relevant government departments make the legislative requirements, even propose the draft law, and then, the People's Congress and the government establish the provisions on the draft of the local requirements. These requirements are seldom identified by a thorough research on the field and are often distorted by the influence of local group of interest. As an example, the local legislation in Hunan is lagging behind with regards to issues such as the heavy metal pollution in the Xiangjiang River, the South Hunan and western Hunan, the Mining, soil and water pollution, even because of the unbalanced interests between the department of mining, water and the environmental protection authorities (McElwee and Squire, 2011:9) [26]

1.4.2 The 13th Five-Year Plan for the Environmental Protection of Hunan

The People's Government of Hunan in September 2016 published The 13th Five-Year Plan for the Environmental Protection of Hunan. The key macroeconomic objectives that will directly impinge on the environmental agenda include[27]:

[26] These "informal networks" in China are usually referred to as "guanxi". The effects of guanxi permeate all levels of Chinese society, and the concept is too complex to describe in any detail here. Basically it involves a system of hierarchical, horizontal (e.g., classmates), and "contracted" relationships. These relationships establish a set of obligations that can, in certain situations, trump the authority inherent in relationships constructed by law such, as in the environmental context, that between environmental regulators and the regulated actors. Charles McElwee Sanders Squire, "Environmental Law in China: Mitigating Risk and Ensuring Compliance", 2011, page 9.

[27] http://www.hbt.hunan.gov.cn/new/ghcw/zhgh/content_64463.html

Exhibit 9: Key Macroeconomic Objectives of Hunan Environmental Protection

Kind	Denomination	Unit	2015	2020	Status
Air Quality	Prefecture level cities (including Jishou) air quality rate	%	77.9	82.9	Accomplished
	County (city) air quality excellence rate	%		85	
	Prefecture level cities (including Jishou) PM2.5 annual average concentration of urban areas	μg/m^3	54	44（-18%）	
Water Quality	Rate of water quality of the Yangtze River (state controlled section)	%	81.3	93.2	
	Pearl River System (state controlled section)			100	
	Dongting Lake (state controlled section)	%		Total phosphorus reached 4 kinds of standards, and the other indicators reached class III standards.	
	City Level (including Jishou) centralized drinking water quality compliance rate	%	96.7	Meet the requirements of national assessment	
Eco-environment	Prefecture level cities (including Jishou) built area black smelly water	%		10% below	Approximately
	Standard rate of soil environmental quality of cultivated land	%	—	Upgrade 10%	
	Forest coverage	%		Maintain more than 59%	Accomplished
Main Pollutants reduction	Chemical oxygen demand	万 t	120.77	-10.1%	Accomplished
	Ammonia nitrogen	万 t	15.11	-10.1%	
	sulfur dioxide	万 t	59.55	-21%	
	nitrogen oxide	万 t	49.69	-15%	
Total pollutants regional emission	Key areas of key industries	万 t		-10%	Approximately
	Volatile organic compounds	万 t		-10%	
Pollution prevention	Total phosphorus (Changde, Yiyang, Yueyang)		—	Comprehensive and stable discharge standards	Approximately
	Industrial pollution sources		—	Comprehensive and stable discharge standards	

	Domestic sewage treatment plant	%	—	95%	
	Centralized treatment rate of urban domestic sewage at or above the county level	%		85%	
	The towns sewage treatment rate	%	—	100%	
Environment Management	Harmless treatment rate of municipal solid waste			With an average annual increase of more than 20%	
	Added value of environmental protection industry			All round, full coverage	Approximately
	Ecological environment monitoring network			Basic realization	
	Fixed pollution source emission permit	%	100	Keep 100%	
	Safe disposal rate of hazardous waste	%	100	Keep 100%	
	Radiation safety license holder rate			Full coverage	

Source: 13th Five-Year Plan for the Environmental Protection of Hunan

Key tasks of the Hunan 13th Five-Year Plan for the Environmental Protection:

a. The establishment of the most stringent environmental protection system, thorugh the establishment of an emissions permit system for polluting enterprises

b. The improvement the environmental law enforcement supervision system, by means of the provincial environmental protection supervision and law enforcement agencies

c. The improvement of the environmental information disclosure system, throughout the establishment of ecological environment monitoring network, with full coverage of all sources of pollution

d. The promotion of environmental protection industry, with a planned annual growth of 20% of the environmental protection industry output value, and the improvement of both product and service performance in the environmental protection sector

CHAPTER II
THE SOIL ENVIRONMENTAL PROTECTION IN CHINA

In the past chapter we have seen how the environmental law has developed in People Republic of China during its history and how it is ruled within the institutional framework by the actors involved and across the different levels of administration, by supporting the analysis with the case of Hunan Province. The study will now progress by taking into account the soil environmental protection in China, as a key point of the environmental issue in China, both at a national both at the local level.

2.1 Main soil environment problems of China

China currently has a severe soil pollution problem and no national law governing soil pollution. Soil pollution has been one of the side effects of three decades of breakneck economic expansion in China, raising concerns over food security and people's health in the world's most populous Country. China's troubles with air and water pollution are widely known with its smog-clouded cities and chemical-filled rivers drawing international attention. However, there is another, less visible consequence of the whirlwind GDP growth the country has experienced over the past three decades: soil pollution. However, soil pollution is not only affecting the health and well-being of Chinese citizens, it is also putting the nation's food security at risk.[28] The report on national general survey on soil contamination released in April this year said that 16.1 percent of the country's soil was polluted.[29] The main contaminants are heavy metals such as cadmium, lead, nickel and arsenic, among others.

In China, the activities causing the site pollution include heavy chemical industry, oil extraction and distribution, mining, metal smelting, chemical production and use and industrial waste stockpiling, treatment and disposal (Lu et al, 2015). The sources and means of soil pollution of industrial enterprises and surroundings are mainly displayed in

[28] "Cadmium rice"- heavy metal pollution of China's rice crops, published in 24 April, 2014. In the paper said that "Greenpeace East Asia sampled soil and rice crops in villages close to a cluster of heavy metals smelters in Hunan Province, an area that ranks first in rice output and among the top five in nonferrous metals production."

[29] For the content, see the website: http://www.zhb.gov.cn/gkml/hbb/qt/201404/W020140417558995804588.pdf

the following aspects: improper storage and use of production raw materials and intermediate products; discharge of environmental pollutants during production; discharge of atmospheric pollutants subsiding to the ground surface; leakage of underground pipelines ; and unreasonable stockpiling of industrial solid waste.

Soil problems in China generally could divided in the following kinds (Huang, 2005):

a. Loss of soil resources and its rapid deterioration

China boasts vast expanse of landscapes, complex natural conditions and plentiful soil resources. The Chinese soil resources can be characterized by diversified soil types, huge absolute quantity, and small per capita soil resources. Currently China has two major problems concerning soil resources: namely loss of soil resources and soil deterioration. China has been facing with a number of soil resource problems including water loss and soil erosion, soil fertility reduction, desertification, soil salinization, rocky desertification as well as soil acidification, which has posed serious threats to ecological safety.

b. Acceleration of regional soil pollution

Results of recent soil quality survey revealed obvious pedogeochemical abnormity or pollution at watershed or regional level. Cd, Pb and Hg abnormity have been found in the Yangtze River basin, Pearl River basin and coastal areas, Songhua River basin and Liao River basin. High fluorine, high arsenic, and low iodine was found in the Yellow River basin. Soil mercury abnormity was reported in Chinese cities of different size. Preliminary analysis showed that the pedogeochemical abnormities at watershed level are combined results of high natural geochemical background and anthropogenic pollution. In some watershed with heavy metal abnormity or pollution, soil geochemical status deteriorates rapidly.

c. Lack of science & technology for soil protection

Although outstanding progress has been made in China concerning soil pollution survey, physical, chemical and biological remediation, gaps still exist between China and developed countries where soil remediation have been commercialized. China starts late

in the research of soil pollution control; technology, material and equipment for soil remediation. Therefore, it is time to initiate studies on innovative remediation technologies and to develop technologies, equipments and management system for contaminated farmland, soil around mining area and soil on industrial sites.

d. Weak public awareness and incomplete legislations in soil protection

Public awareness of soil protection is weak with little consciousness and enthusiasm. Government officials do not have adequate knowledge of soil resources, soil quality and soil function and the social value of soil, therefore little was done to raise the awareness of the general public to protect the soil protection. Education concerning soil environment is also inadequate with no specialized authorities or organizations. So far, China has not legislated any law or regulation for soil pollution prevention. Not much research has been done on soil environmental criteria and standards. Until now the soil environmental quality standard is still in revision.

e. The urgency of soil and environmental protection

Due to rapid social and economic development and highly intensified human activities in the past 20 years, soil degradation has increased in quantity and expanded, therefore more challenges are to be dealt with in the coming 15 years. The main reasons for soil problems are twofold. On the one hand, the importance of soil protection was not recognized. There is no specialized law, administrative structure, mechanism and supervision system for soil environmental protection. On the other hand, there was lack of investment and research on key scientific, technological, and management problems. And most of all, there is lack of macroscopic thinking of soil and environmental protection strategies.

According to the decision of the China's State Council, from April 2005 to December 2013, China launched the first national survey of soil pollution. The survey is covered all the territory of People's Republic of China (excluding Hong Kong SAR, Macao SAR and Taiwan), the survey points are covered all arable land, part of the woodland, grassland,

unused land and construction land. The actual survey area is about 6.3 million square kilometers. The Survey is used a unified approach, standard, basically defined the overall situation of national soil environmental quality. [30]

The overall national soil environment situation is not optimistic; in some areas the soil pollution is very heavy, cultivated soil environmental quality is worrying, especially the mining and industrial wasteland soil environment is a serious problem. The Mining Industry, agriculture and other human activities and the high environmental background values in soil are the main causes of soil contamination.[31] The total exceeded the national rate of soil is 16.1%, including: minor, mild, moderate and severe pollution point ratios are 11.2%, 2.3%, 1.5% and 1.1%. The pollution type is mainly inorganic, the organic pollution is ranked second, and the complex pollution is occupied a very small proportion, inorganic contaminants exceeding occupied 82.8% of the total median point.

From the point of view of distribution of pollution, the soil pollution in the South is more heavily than the north; Yangtze River Delta, Pearl River Delta and other parts of the northeast old industrial base area，the soil contamination problem is more prominent, and in the Southwest, and Centro south regions，the heavy metals pollution is generally more exceeded. Cadmium, mercury, arsenic, lead，the content distribution of this four kinds of inorganic contaminants showed a gradual increase in the trend from the northwest to the southeast, from the northeast to southwest direction.

a. Inorganic contaminants: Cadmium, mercury, arsenic, copper, lead, chromium, zinc, nickel ,this eight kinds of inorganic contaminants point exceeded rates were 7.0%, 1.6%, 2.7%, 2.1%, 1.5%, 1.1%, 0.9%, 4.8%.(see in exhibit 10)

[30] MEP and MLR announce the report on national general survey on soil contamination, published on http://english.mep.gov.cn/, 28 April 2014.

[31] Q&A about national general survey on soil contamination, published on the website of the Ministry of Environmental Protection of China in April 2014.

Exhibit 10: Inorganic contaminants

Type of contaminant	**Point exceeded rate （%）**	**Minor（%）**	**Mild （%）**	**moderate （%）**	**Severe（%）**
Cadmium	7.0	5.2	0.8	0.5	0.5
Mercury	1.6	1.2	0.2	0.1	0.1
Arsenic	2.7	2.0	0.4	0.2	0.1
Copper	2.1	1.6	0.3	0.15	0.05
Lead	1.5	1.1	0.2	0.1	0.1
Chromium	1.1	0.9	0.15	0.04	0.01
Zinc	0.9	0.75	0.08	0.05	0.02
Nickel	4.8	3.9	0.5	0.3	0.1

Source: Report on national general survey on soil contamination, 2014

b. Organic contaminant: BHC, DDT, PAHs.

The point exceeded of the rate of these 3 kinds of contaminant were 0.5%, 1.9%, 1.4% (see in exhibit 11).

Exhibit 11: Organic contaminant

Type of contaminant	**Point exceeded rate （%）**	**Minor（%）**	**Mild （%）**	**moderate （%）**	**Severe（%）**
BHC	0.5	0.3	0.1	0.06	0.04
DDT	1.9	1.1	0.3	0.25	0.25
PAHs	1.4	0.8	0.2	0.2	0.2

Source: Report on national general survey on soil contamination, 2014

2.2 The Key Regulators in the management of the soil contaminated sites

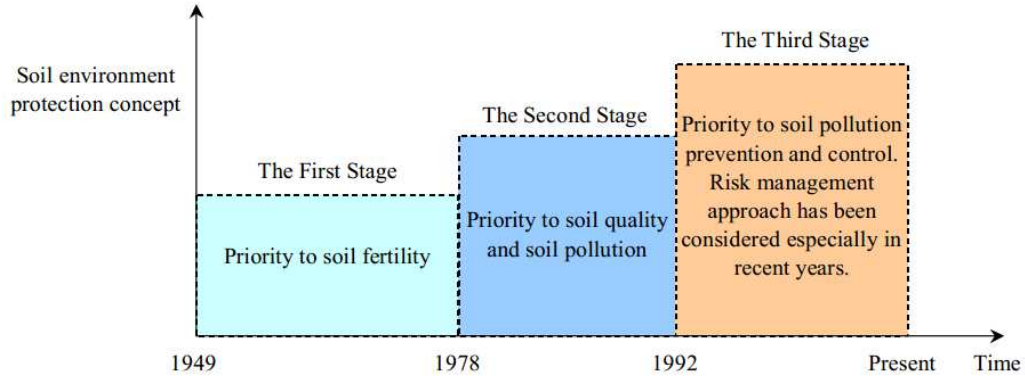
On the national level, the management of contaminated sites is currently divided over several ministries— the MLR (Ministry of Land and Resources of the People's Republic of China) , the MEP (Ministry of Environmental Protection of the People's Republic of

China, the National Development and Reform Commission (NDRC), and the Ministry of Housing and Urban-Rural Development (MOHURD). The MLR is responsible for the management of land, is a ministry under the State Council of China. The mission of the Ministry of Land and Resources as prescribed by the State Council is: to be responsible for the planning, administration, protection and rational utilization of such natural resources as land, mineral and marine resources in the People's Republic of China. The NDRC assists in the drafting of environmental protection planning. The MOHURD is responsible for urban development plans. Because there is no national soil pollution law, the responsibilities of each of these ministries for contaminated site cleanup have not been streamlined. There currently is no process to govern what the ministries should do with respect to contaminated sites. As a result, none of these ministries is being held accountable for the cleanup of contaminated sites[32].

2.3 Development of China's soil environment protection

Since the People's Republic of China was founded, the country's soil Environmental Protection can be roughly divided into the following stages (CCICED, 2015):

Exhibit 12: China's Development Stages of Soil Environment Protection



Source: CCICED, 2015

[32] http://cdmd.cnki.com.cn/Article/CDMD-10357-1015382524.htm

The extent of soil pollution in China is unknown. Since the 1950s, as China has become more urbanized, many industries have been shut down or relocated outside the cities, leaving behind soil pollution (Li and Xie, 2010). This process has accelerated as urban development has increased. For example, many polluting enterprises have relocated from the Fourth Ring Road of Beijing, Chongqing, Guangzhou and Shanghai.

Recognizing a need for a better understanding of soil pollution in China, the State Environmental Protection Agency (SEPA, currently the MEP) and the Ministry of Land and Resources (MLR) launched a three-year soil pollution survey in 2006 with a budget of one billion yuan.[33] The survey focused on main grain producing and industrial areas, including Jiangsu and Zhejiang provinces in the Yangze River Delta region, Guangdong Province in the Pearl River Delta area, Northeast China's Liaoning Province, and Central China's Hunan Province.[34]

2.3.1 Soil environmental protection legislation and policy development in China

The first stage (1949-1978)

Since the People's Republic of China was founded, the grain production has been facing huge challenges from the growing population. The country's priority for soil environment at this stage was to increase soil fertility and grain output. Since the 1960s, China began to produce and use massive organo-chlorine pesticides.[35] With the use of chemical fertilizers and pesticides, concerns began to rise regarding China's soil environment in the early 1970s. In 1973 China held the first national environmental protection meeting at which the environmental problems existing in China were raised. Subsequently, the country gradually carried out investigations on pollution in key regions. Environmental quality assessments, pollution control and other research efforts were undertaken. A preliminary environmental management system was developed. At this stage, environmental problems focused on were mainly air and water pollution. Soil pollution was not a priority.

[33] Nation Faces Soil Pollution Problems, CHINA DAILY, July 19, 2006.
[34] Soil Survey to Monitor Pollution, CHINA DAILY, Apr. 9, 2007.
[35] Report on Case Study on Soil Protection Strategies, Study on Macroscopic Strategies of China's Environment: Task of Environmental Element Protection Strategies, 2008

The second stage (1979-1992)

Since the implementation of China's reform and opening-up policy, rapid economic and social development had been made. Accordingly, soil environment protection entered into a new age of reform and innovation. More and more attention was paid to the soil pollution issue. China's overall system for environmental protection policies, laws and codes was being created. The law on soil pollution prevention in China's legislation is the Environmental Protection Law of the People's Republic of China (For Trial Implementation) issued in 1979. Also provisions on rational utilization of land are included the Constitution of the People's Republic of China, issued in 1982, and Land Administration Law of the People's Republic of China, issued in 1986. Relevant provisions on soil pollution prevention and control were included in the Law on Environmental Protection of the People's Republic of China issued in 1989. Soil environment and pollution became a priority at this stage.

The third stage (1993-Present)

In this stage, more and more attention was paid to the soil pollution prevention and control. And risk management approach has been considered especially in recent years.

Since the United Nations Conference on Environment and Development in 1992, consensus of the world's nations is to implement a sustainable development strategy. In 1996, the State Council of the PRC issued a Decision of the State Council on Some Issues of Environmental Protection. This decision defined the orientation of China's soil environment protection in the age of sustainable development. In 2005, the State Council issued a Decision on Fulfilling the Concept of Scientific Development to Strengthen Environmental Protection, which requires a "focus on soil pollution prevention and control and the strengthening of environmental protection in rural areas". In 2006 the Ministry of Environmental Protection carried out a special investigation on current situation and pollution control of soil throughout the country jointly with the Ministry of Land and Resources (Ma, 2006). Through a lot of investigation work, information on current situation, scope, key pollutants and level of soil pollution throughout the country has been obtained. Currently the investigation result is in process of statistics and analyses. When finished, the project will lay a foundation for supervision of soil

environment in China. In 2008, the Ministry of Environmental Protection issued Opinions on Strengthening Soil Pollution Prevention and Control, which proposes measures for strengthening soil pollution prevention and control. To facilitate effective prevention and control of soil pollution, China has successively organized and carried out a series of fundamental investigations. These investigations include the national soil environment background value survey, soil environment quality assessment of "Vegetable basket"[36] planting bases, main wastewater irrigation areas, pollution analysis and an overall national soil pollution status report. In addition, a series of standards and technical codes were prepared, issued and implemented. These include Standard for Soil Environment Quality and Technical Code for Soil Environment Monitoring. Emphasis was placed on strengthening monitoring over pollution sources, control of pollution sources, research on assessment of regional soil environment quality, and soil pollution risk management. Organized demonstration pilots for restoration and comprehensive harnessing of polluted soil were initiated. International exchanges and cooperation were pursued.

2.4 China's Current Laws and Regulations that address the Soil Pollution Crisis

China currently has no national-level law or regulation to address the soil pollution crisis.[37] There are two national laws that mention the soil of contaminated sites (see in exhibit 13). As reported by Wang and Shan (2013), these national laws are the Environmental Protection Law of People's Republic of China (Environmental Protection Law) and The Law of the People's Republic of China on Prevention and Control of Environmental Pollution by Solid Waste (Solid Waste Law). Under China's Environmental Protection Law, a polluting enterprise "that has caused an environmental pollution hazard shall have the obligation to eliminate it and make compensation to the unit or individual that suffered direct losses."[38] The Solid Waste Law states that units

[36] In 1988, the Ministry of Agriculture started this project against a background that the country could not produce enough non-grain food with rich diversity. http://www.gov.cn/jrzg/2010-03/28/content_1566658.htm

[37] Sun Yinglan, 20 percent of cultivated land has been polluted in China: Agriculture is facing a serious challenge (Sept.19, 2010), http://news.hexu n.com/2010-09-19/124936104_1.html.

[38] Environmental Protection Law of People's Republic of China , art. 41 (1989) [hereinafter Environmental Protection Law].

where industrial waste is generated shall take measures to prevent and control pollution. This pollution includes soil pollution.

The only regulations that directly address soil pollution are at the provincial and city level. For example, in March 2006, the Standing Committee of the People's Congress of Zhejiang Province enacted The Regulations of Prevention and Control of Environmental Pollution by Solid Waste of Zhejiang Province (Regulations of Zhejiang Province). In September 2009, the Standing Committee of the People's Congress of Jiangsu Province enacted The Regulations of Prevention and Control of Environmental Pollution by Solid Waste of Jiangsu Province (Regulations of Jiangsu Province).

In the 2014, No. 1 Document, the central government put its top priorities as "improving rural environment and maintaining food security". Both are tightly linked with soil pollution. The government is currently drafting the "Soil Environmental Protection Law". Meanwhile, the MEP has announced on 3 March 2014 that the Soil Pollution Prevention & Remediation Action Plan will be issued in the time frame 2016-2020, with five key tasks including 1) to give priority to protect arable lands, 2) pollution sources control, 3) risk management of contaminated sites, 4) pilot sites for soil remediation, and 5) to strengthen monitoring and management of the soil environment. Furthermore, until now the following national standards on soil pollution testing methods have been published last year, which help to strengthen the monitoring of soil environmental quality.

Exhibit 13: China's current laws on protection of soil

National Laws	Currently no national law
National Regulations	Draft Provisional Rules on Environmental Management of the Soil of Contaminated Sites (Provisional Rules)
Local Regulations	The Regulations of Prevention and Control of Environmental Pollution by Solid Waste of Zhejiang Province The Regulations of Prevention and Control of Environmental Pollution by Solid Waste of Jiangsu Province

	The Regulations of Prevention and Control of Environmental Pollution by Solid Waste of Nanjing City The Regulations of Prevention and Control of Environmental Pollution by Solid Waste of Shenyang Province [Expired]
Policy	Directive on Completing Environmental Pollution Prevention and Control When Enterprises Move

Source: CCICED, 2015

China also has laws and regulations that tangentially address soil pollution. There are three categories of these laws and regulations. The first category includes general laws or regulations for environmental protection. The second category includes laws that prevent soil pollution by preventing other types of pollution. The third category includes laws and regulations that consider soil to be a resource. These laws and regulations, combined with provincial and city level regulations that directly address soil pollution, form a complicated legal patchwork that is not enough to solve China's soil pollution crisis. China needs a national-level law, or at the very least a national-level regulation, for the prevention and control of soil pollution.

2.5 New national and provincial policies and plans on soil remediation and protection

The future 5-10 years is a critical period for fulfilling the objective of building a well-off society by 2020. Currently China's soil environment is facing a severe situation. It's estimated that in the future 5-10 years China's population will continue to grow, with rapid development in industrialization, urbanization and agriculture integration. A balance between social and economic development must be struck in order to protect soil. In the future 5-10 years, China's soil environment protection will not face an optimistic situation if this balance is not achieved.

2.5.1 The 12th Five-year Plan on Environmental Protection

On 15 December 2011, the State Council officially released the 12th Five-Year Plan on Environmental Protection. The key objectives of this environmental plan are to[39]:

a. strengthen and expand total emission control of pollutants, b. further improve people's living quality and standards by enhancing environmental management and strengthening protection of drinking water sources, c. promote green development with environmental protection, and d. broaden efforts to address international environmental issues such as climate change. The draft plan could reasonably be described as a continuation of the more balanced development approach that had some success under the 11th Five-Year Plan, combined with some augmentations to address new and emerging issues. It is also noted that the environmental plan addresses many of the priority issues identified in the macro-environmental strategy.

The following programs that regard to the soil will be implemented under the general category of improving environmental quality of life:

a. Heavy metal pollution prevention and control.

By 2015, emissions of heavy metals in the major pollution prevention and control zones will be reduced by 15% compared to the levels in 2007 while, elsewhere, there shall be no increase. The proposed means for meeting the objectives will be increased environmental supervision of priority sources listed in the environmental plan and strict application of the principle of "treatment within a prescribed time limit." The plan will also identify enterprises or projects considered to have no potential to comply, and they will be closed down or ordered to suspend operation. The plan also includes provisions requiring compulsory cleaner production audits of selected enterprises as a basis for reaching the cleaner production standard.

[39] http://www.gov.cn/zwgk/2011-12/20/content_2024895.htm

b. Strengthen work on soil contamination.

The main objectives are to strengthen the national database on soil contamination, strengthen capacity, and strengthen the legal and regulatory frameworks. The scope of work will include

(i) Completing a nationwide survey of soil contamination;

(ii) Capacity building and gradual establishment of a national, three-level (national, provincial, and municipal) monitoring system, along with a system that periodically publishes information on national and regional soil environmental quality data;

(iii) Developing and strengthening of laws, regulations, and standards for the prevention and control of soil contamination; and

(iv) Under taking experimental and demonstration work to remedy contaminated soils, to assess the effects of using wastewater and sewage sludge for irrigation, and other related topics.

c. Strengthen rural environmental protection.

d. A series of measures will be implemented to support the dissemination and adoption of environmentally sustainable agriculture, and help control agricultural nonpoint source (NPS) pollution including:

(i) Increasing the dissemination of information on the use of soil testing and compound fertilizers in the main grain production regions and major watersheds;

(ii) Promoting the use of integrated pest management, biological pesticides, and high-efficiency, low-toxicity, and less-persistent pesticides, as well as information on the safe handling and storage of agrochemicals;

(iii) Encouraging crop production structural readjustment and pattern optimization to encourage the planting of crops that need less fertilizer and have more environmental benefit; and

(iv) Extending environmental monitoring, supervision, and control and/or treatment systems to rural areas.

At the same time this work was being written, the 13th five year plan for environment protection was being drafting by the Chinese government[40]. As for soil pollution prevention and remediation, the main targets of the plan will be:

- to assure at least a 82% compliancy rate for cultivated lands
- to assure a 100% safety rate for new construction areas
- to start 200 pilot projects for comprehensive soil pollution management
- to start 6 regional areas for comprehensive soil pollution management

2.5.2 Series of new Environmental standards about soil contaminated sites

The old Standard for Soil Environment Quality (GB 15618-1995) is applicable for soil environment protection management of agricultural land, but there is only a small number of pollutant items covered by the standard; in particular, it lacks standards of some organic pollutants, thus the standard can't meet the need for identification of all kinds of soil pollution in regions and specific sites; and the standard only specifies the national uniform values, which can't fully show differences of regional soil in background and nature.

Until now the following national standards[41] on soil pollution testing methods have been published in 2013, which help to strengthen the monitoring of soil environmental quality, they are:

- Soil and sediment- Determination of volatile organic compounds-Headspace-gas chromatography/mass method (HJ 642—2013) (published on 21 January 2013 and put in force on 1 July 2013)
- Soil – Determination of exchangeable acidity by potassium chloride extraction – Titration method (HJ 649-2013) (published on 3 June 2013 and put in force on 1 September 2013)
- Soil and sediment Determination of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) Isotope dilution HRGC-LRMS (HJ 650-2013) (published on 3 June 2013 and put in force on 1 September 2013)

[40] http://gov.163.com/14/1126/14/AC018OAS00234IK8.html
[41] For the content, can see : http://kjs.mep.gov.cn/hjbhbz/bzwb/trhj/trhjzlbz/200412/t20041229_63466.htm

- Determination of organic carbon – Combustion oxidation- titration method (HJ 658-2013) (published on 16 August 2013 and put in force on 1 September 2013)
- Soil and sediment — Determination of mercury, arsenic, selenium, bismuth, antimony — Microwave dissolution/Atomic Fluorescence Spectrometry (HJ 680-2013) (published on 21 November 2013 and put in force on 1 February 2014)
- Soil and sediment-Determination of acrolein, acrylonitrile, acetonitrile Headspace-Gas chromatography method (HJ 679-2013) (published on 21 November 2013 and put in force on 1 February 2014)

The introduction of these standards was marked the real beginning of soil remediation, because based on this first measurement standards, in order to begin the pollution research, and then based on these research draw the national plans.

2.5.3 Provincial policies and plans on soil remediation and protection - the case of Hunan province

Hunan Province, as we have seen in the previous chapter, is an important manufacturing area, amongst which heavy metal production is one of the main activities. In 2011 the province's 1,003 non-ferrous metal companies produced 2.66 million tons of ten different metals — the third highest production in China and worth $60 billion (He, 2014). In 2011, the Ministry of Environmental Protection identified 14 Key Provinces in the 12th five years plan for Heavy Metal Pollution Control. As expected, these 14 provinces account for the lion share of the country's heavy metal discharge in wastewater: Lead (90%), Mercury (88%), Cadmium (93%), Chromium (74%) and Arsenic (84%). These 14 priority provinces are listed in the exhibit below. Hunan is the worst offender by a long shot Further analysis into the five categories of heavy metals now monitored by the government in the 12th Five Year Plan shows that Hunan ranks as the province across all five heavy metal categories with the exception of chromium where Henan comes out top.

High levels of these metals have also been reported for rice grown in many parts of the province. [42]

Exhibit 14: Heavy Metal Discharge: 14 priority provinces

Rank	Province	Water Resources	Sown Area mn hectares	%
1	Henan	Extremely Scarce	14.3	8.7%
2	Shandong	Extremely Scarce	10.9	6.6%
3	Sichuan	Rich	9.7	5.9%
4	Hunan	Rich	8.5	5.2%
5	Hubei	Stress	8.1	4.9%
6	Jiangsu	Scarce	7.7	4.7%
7	Inner Mongolia	Stress	7.2	4.4%
8	Yunnan	Rich	6.9	4.2%
9	Guangxi	Rich	6.1	3.7%
10	Jiangxi	Rich	5.5	3.4%
11	Guangdong	Stress	4.6	2.8%
12	Shaanxi	Stress	4.2	2.6%
13	Gansu	Scarce	4.1	2.5%
14	Qinghai	Rich	0.6	0.3%
Total 14 Priority Heavy Metal Provinces			98.2	60.1%
Total Sown Land			163.42	

Source: China Water Risk, Ministry of Environmental Protection, CEIC

In 2012, Hunan alone accounted for: 39% of national lead discharged 50% of national cadmium discharged 42% of national arsenic discharged. Hunan is also the only province that is amongst the Top 5 in each category. Although Hunan is water rich, it accounts for 13% of China's total rice output producing 26 million tonnes of rice in 2012 adding to food safety concerns.[43]

In The 12 Five-Year Plan of Hunan Province in the environmental protection[44], there were some Key tasks that regard the soil protection:

a. Focus on the efforts to protect sources of drinking water, urban environmental improvement, integrated pollution prevention and control of soil.

b. Focus on solving water sources contaminated by heavy metals and organic

[42]Distribution of metals in soils from uncultivated land, soils from rice fields and in rice grown in the area of an industrial complex with metal smelting and processing facilities in Hunan Province, China. Greenpeace Research Laboratories Technical Report, April 2014. For the content see: http://www.greenpeace.org/eastasia/Global/eastasia/publications/reports/toxics/2014/Heavy%20metal%20pollution%20of%20China's%20rice%20crops.pdf

[43] Debra Tan, Heavy Metals & Agriculture, April 9, 2014

[44] For the content, see on the website: http://www.hunan.gov.cn/zwgk/ghjh/fzgh/201301/t20130125_819727.html

contaminant threat issues.

c. Soil pollution prevention. On the basis of the survey on soil pollution, the province divides the soil types based on the different functions. Focus on monitoring the sensitive areas; evaluate the risk assessment of contaminated sites. For those serious polluted areas that the pollution could damage to human health, must implement the relocation of residents and prevent pollution from spreading. For the sensitive areas like the nonferrous metals industry zone, have to focus on the full implementation of heavy metal pollution remediation.

d. Implementation of the "Xiangjiang River embodiment plan of heavy metal pollution" and "the 12th five years plan of comprehensive prevention and control of heavy metal pollution in Hunan Province"

e. Strengthen environmental supervision and law enforcement. Improve local pollution control laws, regulations and standards. Accelerate the development of integrated management of Xiangjiang River environmental regulations and the Management Measures of Solid waste that containing heavy metals of Hunan.

The 13th Five-Year Plan of Hunan Province for the environmental protection also addresses soil-specific issues, by outlining the following tasks:

a. promoting the construction of basic survey and monitoring network: starting from 2017 up to the end of 2018, a survey on soil condition will be carried out according to national standards.
b. the implementation of agricultural land classification management, in order to correctly set intervention priorities
c. the implementation of a construction land access management system: in accordance with the survey (see point a), determine which areas are suitable for new construction
d. building and implementing a soil pollution control and remediation system, with special focus on agricultural production, in order to manage the risk related to food safety
e. introducing measures to improve the control of the pollution of rural areas, with

the setting up or enhancement of needed infrastructures and facilities for environmental management

f. strengthen the management of industrial and mining pollution in rural areas, with priority to restoration of heavy polluted lands and waters

g. Strengthening environmental protection capacity in rural areas, enhancing information disclosure system and surveillance and law enforcement capabilities

CHAPTER III
THE AIR POLLUTION CRISIS AND AIR POLLUTION PROTECTION IN CHINA

As we have seen in the past chapter, the environmental protection of soil is a crucial issue within the whole environmental question, because of its gravity and its likeliness of affecting different spheres of society and economy. As well as soil, air pollution is also likely to impact to the same extent people daily life and the country economic efficiency, as we will see in this chapter. Air pollution is one of the most evident environment negative externalities, both for its impact on people lives and socio-economical indicators, both for its power of suggestion on the national and world audience, as happened during the 2013 crisis, when the images of Chinese cities surrounded by a tough blanked of haze traveled around the world and stimulate and intense debate in China and abroad on this issue. In other words, we can someway look at the air pollution as the *antonomasia* of the China pollution issue *tout-court*.

3.1 Main air pollution problems in China

3.1.1 The current situation: a historical perspective

The most important pollutant has been identified by the guidelines issued by the World Health Organization (WHO, 2005) in the following chemical elements: SO2 (solfure dioxide), NOx (Nitrogen Oxide), O3 (Ozone) and PM (Particulate matter).

The WHO has fixed in its guidelines security threshold values for these pollutants, both on a long termed average basis both on a short termed average basis.

Exhibit 15: WHO's security threshold values

	Annual mean	24-hour mean
PM10	20 µg/m3	50 µg/m3
PM2.5	10 µg/m3	25 µg/m3

	Annual mean	1-hour mean
NO2	40 µg/m3	200 µg/m3

	8-hour mean	
O3	100 µg/m3	

	24-hour mean	10-minute mean
SO2	20 µg/m3	500 µg/m3

Source: WHO (2005)

The Chinese government implemented its own guidelines for the same pollutants by means of the new standard introduced on 2012, as follows:

Exhibit 16: China's security threshold values

	Averaging time	Limit		Unit
		Class 1	**Class 2**	
SO2	annual	20	60	µg/m3
	24 hours	50	150	
	hourly	150	500	
NO2	annual	40	40	
	24 hours	80	80	
	hourly	200	200	
O3	daily, 8-hour maximum	100	160	µg/m3

	hourly	160	200	
PM10	annual	40	70	
	24 hours	50	150	
PM2.5	annual	15	35	
	24 hours	35	75	

Source: MEP, 2012 (GB 3095-2012)

As we can see, Chinese standards are divided into two different classes, Class 1 and Class 2, which refers to different zones: while Class 1 applies for special zones (like natural reserves, national parks and the like), Class 2 applies for urban areas. Within the previous standard there was also a further class, Class 3, with larger values, which applied for industrial zones. With the 2012 standard this class has been removed and industrial zones were harmonized with urban ones. At a first glance, it is possible to notice that only Class 1 standards match with WHO's guidelines, except for PM, that presents slighter higher values. Class 2 standards are less restrictive: nonetheless, on 2014, 90% of Chinese major cities failed to meet these standards[45] with several crisis, like that of December 2015, when 74 major cities failed to standards for two weeks[46].

These pollutants have been monitoring by the China's Ministry of Environmental Protection (MEP, formerly the State Environmental Protection Administration, SEPA) with variable effectiveness and precision (Wang, Hao; 2012).

The case of SO2 in the first half of the 2000-2010 decade is emblematic: by the 2000 the SEPA undertook, in occasion of the 10th Five-year-plan, some measures to monitor and reduce by 10% by the year 2005 the emissions, amounting to 20 Tons on 2000. However, despite this purpose, a low enforcement capability by the authorities, mirrored by the lag of introduction of new desulfurization devices and the scarce efficiency of the installed ones, could not prevent the emission by reaching and exceed the soil of 25T. Things went better after the introduction of new measures by the 11th five-year-plan (2006-2010), when all the new thermal power plants and the 81% of the existing ones were forced to adopt flue gas desulfurization equipments (FGD). This achievement was reflected by a

[45] http://www.reuters.com/article/us-china-pollution-idUSKBN0L606R20150202
[46] http://www.china.org.cn/environment/2016-01/25/content_37656896.htm

gradual and continued decrease of emissions over the second half of the 2000-2010 decade (Wang, Hao Ibidem).

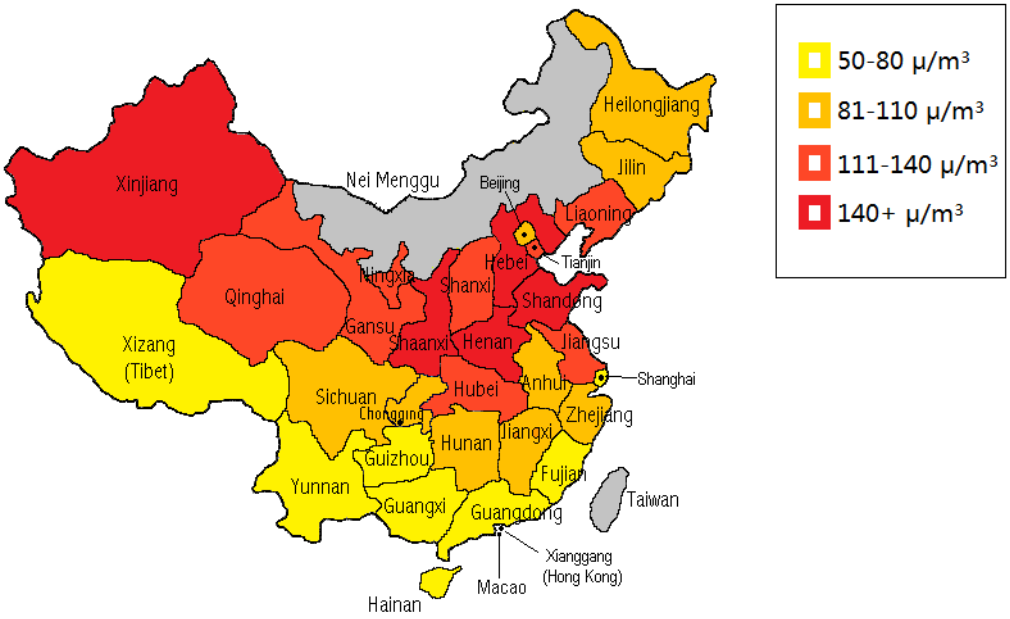
NOx emissions are a very important matter in the general situation of China air pollution, as they contribute to both O3 and PM pollution. On the historical ground there is a big lag of regulation on these emissions that have seriously tackled only by 2005. Existing literature (Streets et al., 2003; Wang et al., 2004, 2007; Zhang et al., 2007, 2009a, 2009b; Zhao and Wang 2009) reckons the NOx yearly emissions as slowly growing from 11 Mt in 1995 to 12.2 Mt on 2000 and then rapidly increasing to 26 Mt on 2010 (Zhao et al., 2013).
Low NOx combustion technology was the only control technology used in China before 2005, while more effective end-of-pipe control technologies like selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR) were installed by 2005 (Zhao et al., ibidem).

High level of O3 has been documented by many studies both in urban areas (up to 286 ppb) both in rural areas, like at the Miyun station, in the suburbs of Beijing, where it was tracked a concentration of 120 ppb in summer (Wang et al., 2011).

Amongst the most dangerous pollutant there is of course the Particulate Matter (PM), which is divided by the WHO into PM10 and PM2.5, on the basis of the diameter of the particulate.
Even though PM2.5 is according to the prevalent literature considered as a better predictor for PM-driven acute and chronic health effects than coarser particulate (Schwartz et al., 1996; Cifuentes et al., 2000), the most of literature focuses on PM10 (or on total suspended particulate –TSP- considering PM10 as either the 50% or 65% of total TSP) because of data availability.
Under an historical point of view, PM10 average concentration has been continuously decreasing in the last four decades, from an estimated level of 300-400 micron/m3 on 1981, to be slightly more than 100 on 2005 (Matus et al., 2012). However current concentration levels are still to be considered dangerous, as WHO considers 20 micron/m3 as the maximum acceptable soil level on a yearly basis.

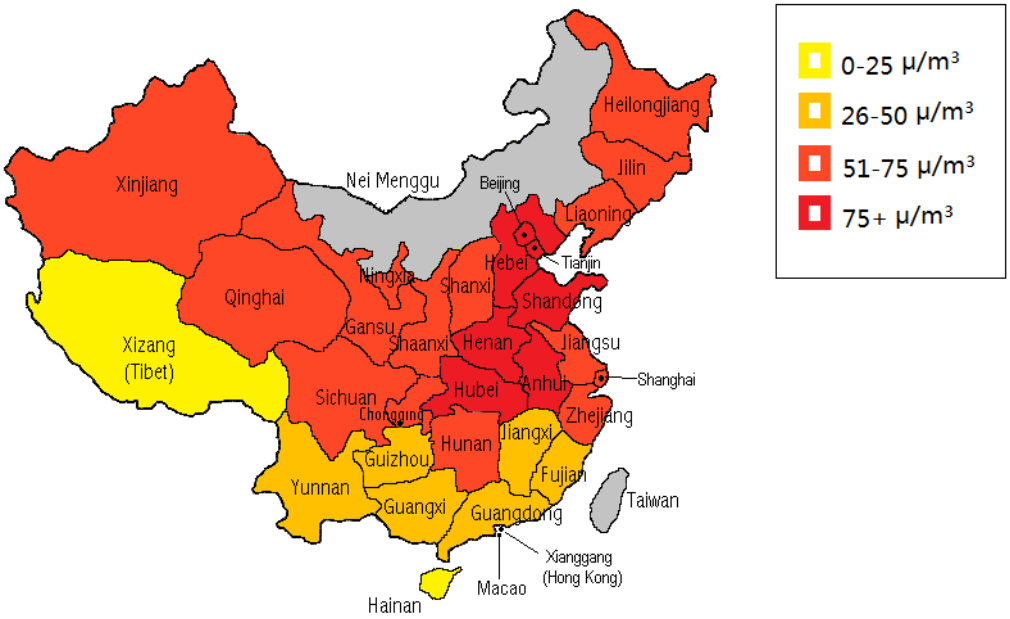
Moreover, PM concentration is likely to be diverse on a time and geographical basis. Since on 2013 a national air quality monitoring network has been introduced, with more than 900 stations in 190 cities, PM2.5 and PM10 concentration level are available on a real-time basis. The average level of PM on a 30 month basis highlights the following situation, as illustrated by Exhibit 17 and 18.

Exhibit 17: Average daily PM10 concentration on Province base (12/2013 – 05/2016)



Source: author's elaboration on MEP data

Exhibit 18: Average daily PM2.5 concentration on Province base (12/2013 – 05/2016)



Source: author's elaboration on MEP data

As it is possible to see on both Exhibits 17 and 18, the air pollution is mainly concentrated in the North of the country.

Exhibit 19: PM2.5 and PM10 less polluted cities

Province	PM2.5
Tibet	25
Yunnan	32
Fujian	32
Shenzhen	32
Guangdong	44

Province	PM10
Shenzhen	53
Fujian	60
Yunnan	61
Tibet	61
Guangdong	65

Source: author's elaboration on MEP data

Exhibit 20: PM2.5 and PM10 most polluted cities

Province	PM2.5
Hebei	101
Henan	93
Shandong	91
Beijing	79
Hubei	78

Province	PM10
Hebei	175
Shandong	171
Henan	164
Xinjiang	145
Shaanxi	143

Source: author's elaboration on MEP data

However, the same data highlights how only Shenzhen, Fujian, Yunnan and Tibet are fully meeting the national standards on air quality both on PM10 and PM2.5, Guangdong is meeting as for PM10 but it is still (slightly) beyond the PM2,5 security threshold (Exhibit 19). In the north, where the air pollution is more severe, Henan, Shandong and Hebei are the most polluted zones both for PM10 and PM2.5 (Exhibit 20), while other areas reveal a different situation for each category, like Beijing, where the most of air particulate pollution comes from PM2.5, while PM10 is more under control (though still beyond the security threshold).

Exhibit 21: PM10 and PM2.5 yearly average levels comparison (2014 vs 2015)

PM10

Province	2014	2015	Variation
Hebei	207	148	-29%
Jiangsu	123	97	-22%
Anhui	111	95	-14%
Beijing	117	101	-14%
Yunnan	64	55	-14%
Shanxi	129	112	-14%
Shaanxi	147	128	-13%
Xinjiang	151	131	-13%
Hunan	89	78	-13%
Fujian	63	55	-12%
Guanxi	82	72	-12%
Zhejiang	95	83	-12%

PM2.5

Province	2014	2015	Variation
Hebei	118	88	-26%
Jiangsu	74	57	-23%
Shaanxi	75	58	-23%
Qinghai	61	48	-21%
Hunan	75	60	-20%
Tianjin	87	70	-19%
Guangdong	48	39	-19%
Anhui	80	65	-18%
Jiangxi	51	42	-18%
Guizhou	46	38	-16%
Guanxi	48	41	-15%
Hubei	80	69	-14%

Guizhou	68	60	-12%	Sichuan	73	62	-14%
Guangdong	69	61	-12%	Chongqing	63	55	-13%
Qinghai	116	103	-11%	Gansu	57	50	-13%
Tianjin	135	120	-11%	Shanxi	68	60	-12%
Shenzhen	56	50	-11%	Yunnan	32	29	-11%
Sichuan	117	105	-10%	Fujian	32	29	-10%
Chongqing	95	85	-10%	Zhejiang	61	55	-10%
Jilin	113	103	-9%	Shenzhen	33	30	-10%
Jiangxi	80	74	-8%	Beijing	85	80	-6%
Hubei	113	105	-7%	Heilongjiang	72	70	-3%
Liaoning	119	111	-7%	Jilin	65	64	-2%
Heilongjiang	109	102	-6%	Liaoning	71	71	1%
Shandong	172	162	-6%	Shandong	89	90	1%
Gansu	117	117	-0,4%	Xinjiang	63	65	2%
Shanghai	73	73	-0,2%	Shanghai	52	54	3%
Tibet	57	58	1%	Ningxia	47	48	3%
Ningxia	103	112	9%	Tibet	24	25	5%
Henan	150	167	12%	Henan	87	96	10%

Source: author's elaboration on MEP data

From the Exhibit 21 we can however see an interesting trend, clearly highlighting a reduction over time of PM concentration levels. From 2014 to 2015 Country's average levels generally decreased by 9% for PM10 and by 10% for PM2.5. Hebei (one of the most polluted areas, as we saw before) and Jiangsu enjoyed the biggest reduction for both PM10 and PM2.5. Nevertheless, there are also areas that followed an inverse trend: particularly negative is the performance tracked in Henan, where the PM concentration increased by 12% for PM10 and 10% for PM2.5, not an encouraging performance for one of the most polluted areas of the Country.

3.1.2 Air pollution: sources and driving forces

After the general picture offered by the paragraph 2, in which levels and geographical distribution of air pollution has been tracked and assessed on an historical perspective, another important step in describing the air pollution crisis in China is to determine and quantify the sources of air pollution, both under the geographical and the sectorial point

of view, and find the driving forces that will contribute to emissions in the following years.

Like Rohde and Muller (2015) suggest, SO2 and NO2 can be helpful to identify the pollution sources, as they are also amongst the main sources for PM. The source for NO2 is indicated as follow: transportation fuels (15-25%), fossil fuel burning in power plants (30-50%), industrial facilities (25-35%). SO2 is identified with coal burning in power plants and industrial facilities (about 90%).

For these reasons, it is not surprising that air pollution –as it comes out from satellite observations- tends to be concentrated in big urban areas, even though not every urban area has big pollution fluxes (like in the case of Wuhan, Chengdu, Chongqing), presumably following the Country's industrial geographical pattern (Rohde and Muller, ibidem).

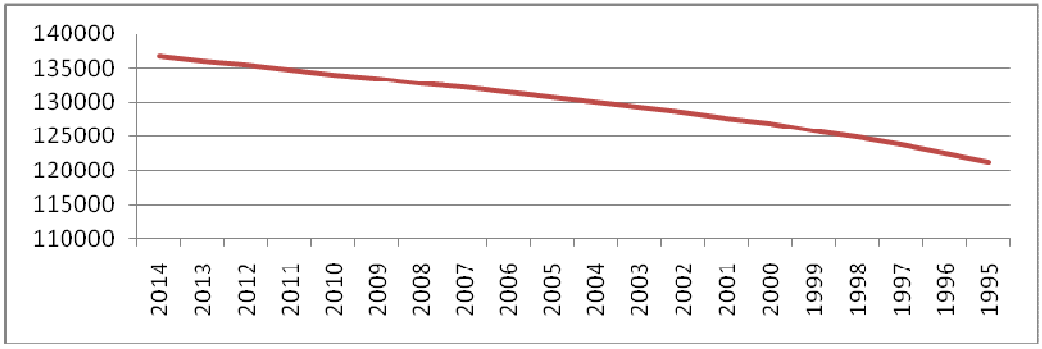
On the light of this pattern, the driving forces that are affecting the air pollution have been coherently pointed out by Zhao et al. (2013) to be the GDP growth rate, the population growth and the urbanization, since they could be considered as the independent variables of energy consumption, pushing it on the side of the demand, said that air pollution could not be simply taken as the result of a linear relation between energy consumption and emissions, but as a more complex process greatly affected by the technology mix, energy efficiency of each technology, and end-of-pipe control technologies (Zhao et al., ibidem).

GDP growth has unceasingly been positive and high in the last decades, since Deng Xiaoping reforms started on 1978.

However, GDP growth rate has been declining in the last years and there is a certain consensus amongst international scholars and analyst that even though China's economy will continue to grow in the coming years, its growth rate will gradually decrease, both as an effect of a general and somewhat natural tendency to fall, which would have in a middle-income trap effect its pathological implication (Ohno, 2009), both as a result of the policies carried out by the Chinese government on economic growth, aiming at a more sustainable and harmonic growth, as described in the 12^{th} and 13^{th} five year plans.

Population has being constantly growing over the last decades, despite the one-child policy (recently abandoned by the Chinese government). Anyway, the growth rate is decreasing (from 0,1% on 1996 to 0,5% on 2014) but this process is likely to undergo in the future, as the population is prospected to reach 1,393 billion (+3,9% on 2010) by the 2030, according to the United Nations Population Fund (UNFPA).

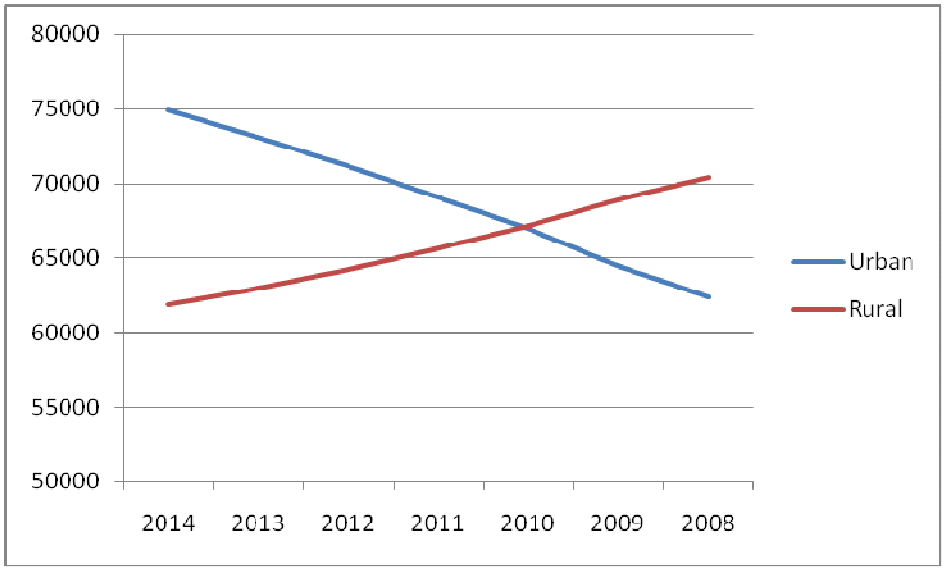
Exhibit 22: Population in China in the period 1995-2014 (thousands of people)



Source: National Bureau of Statistics of China, 2014

Urbanization is also tightly tied to energy consumption and thus to air emissions. Urbanization process in China has been rather astonishing, as it was characterized by a high pace that in few years brought a rural country like it was China after 1949 to an urbanized one. In particular, on 2010 occurred the historical overcome by the urban population on the rural one.

Exhibit 23: Urban and rural population in China (thousands of people)



Source: National Bureau of Statistics of China (2008-2014)

This process is not likely to invert and even though there was a slowing down of urban population growth rate in the last years (from 3,8% on 2010 to 2,5% on 2014), according to many analysts the urban share of population will exceed the 70% on 2030 (KMPG, 2013).

3.1.3 The socio-economical impact of air pollution and its indicators

There are generally two ways used in literature for the assessment of the socio-economic impact by air pollution. The first is in terms of public expense tied to acute and chronic diseases generated by high concentration of pollutants, the second is terms of human capital reduction caused by the increased mortality due to air pollution. Besides these two criteria, it would be useful to include in an overall estimation of the impact by air pollution on economy also the effect on the side of aggregate demand. While the first two criteria are likely to have a negative result on economy, as they represent a cost, the third can have also a positive effect, investments on research, technology, monitoring and implementation of mitigation solutions can have the effect of developing a wide and

diversified high value-added industrial sector. No definitive studies, however, are at now available in order to clarify -under a strictly economical point of view- whether and under which conditions the costs brought by air pollution would be higher than the supposed benefits brought by public and private investment for mitigation. Such a study would be useful for policy and tax planners.

According to a recent research carried out on 161 cities (Xiaoyu et al, 2016) reckons the direct and indirect effects of air pollution on public expenditure as 200 billion RMB, about 1,4% of 2015 GDP. According to the same study, more than 100.000 lives has brought away due to air pollution effect on human health.

The distribution of mortality and morbidity is of course uneven and has different impact on the side on human capital. Many studies focused on this facet on a local basis, like the research conducted by Xiaoli et al. on Beijing area (2016) and the research by Xingcheng et al. (2016) that assessed the costs of air pollution in the Delta of Pearl River. While the estimation given by Xiaoli is a loss equal to 0,03% of Beijing GDP, the evaluation performed by Xingcheng, performed by taking into account the Cost-of-illness (COI) and the Value of Statistical Life (VSL) highlights a more serious situation, where air pollution costs amount to a percentage ranging from 1,4% to 2,3% of the region's GDP.
As previously said, however, for a more thorough overview on the economical impact by air pollution, it is interesting to pay attention also on its impacts on the side of the demand. How is air pollution perceived and how does it affect the composition of the aggregate demand for goods and services? Which implications this perception brings to the policy makers, in order to give a response to this demand?

One of the most important indicators for this issue is the willingness to pay (WTP) for smog mitigation. In other words: how much is a citizen willing to pay on average for smog mitigation. This indicator offers a two-side perspective on the issue: on the one hand it tells us how serious is the air pollution is perceived by people and the related social pressure that such a perception is likely to exercise on the government for effective solutions for this problem, on the other hand it can be roughly taken as an indicator for

the sustainability of a fiscal planning aimed at leveraging taxes in order to gather the needed financial resources for mitigation programmes.

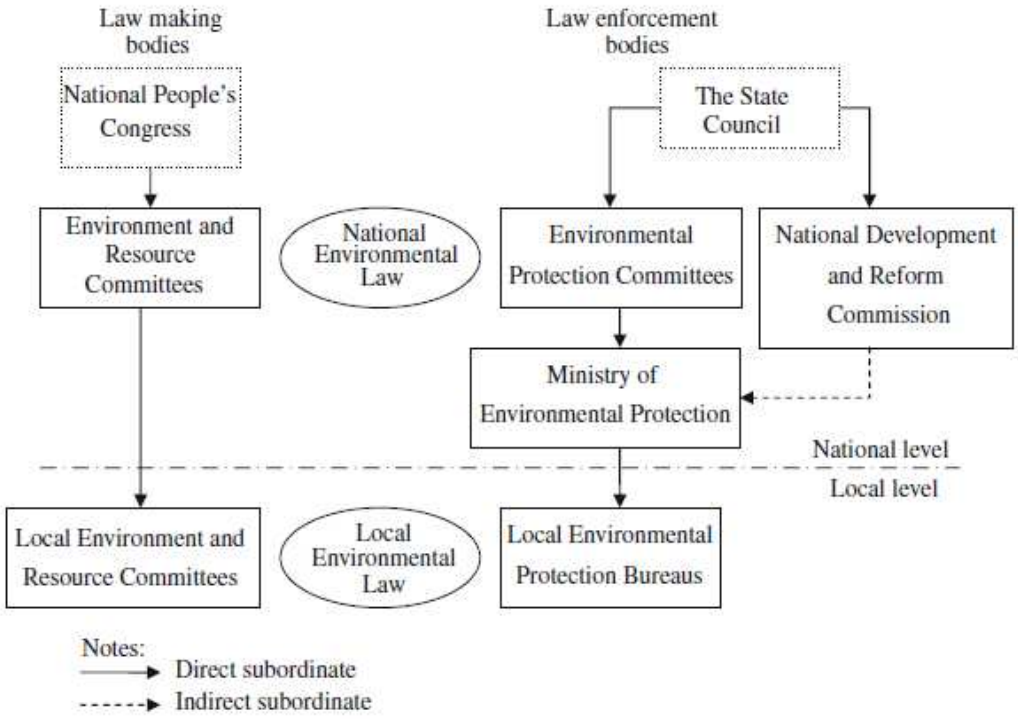
The research made by Sun et al. (2016), based on surveys, shows that the average WTP is about 1% of the income. Moreover, the same authors claim that this result could be underestimated because more than 14% of the surveys reported a protest response. Anyway, even though these results appears to be significant, other research suggest that the average WTP for preventing adverse health cases like a cold, a chronic bronchitis and a fatality are still from 10 to 1000 times lower than the same indicator in US and Taiwan. So it could be concluded that, even thought the public sensibility on air pollution dangers is growing and is likely to exercise stronger and stronger influence on government and policy makers, the current public perception is still probably underestimating the implication of air pollution of human health.

3.2 The Key Regulators in the management of the air pollution

During its nearly 70 years of life, as we have seen in Chapter 1, the People Republic of China has increasingly paid attention to Environmental protection. Within such a holistic legal framework, air pollution prevention and mitigation measures have of course an important space.

The legislative and enforcing functions on Air Environmental Protection, coherently to the pattern of almost all China's Administrative system, is demanded to the so-called "one bureau, two committees" model (Jahiel, 1998).

Exhibit 24: Legislative and law enforcement functions governance system in China for Air Pollution



Source: Chang and Wang (2010)

As described by the Exhibit 24, on the National Level, the bureau is represented by the Ministry of Environmental protection, MEP (former SEPA), while the two committees are represented by the Environment and Resource Committees of the National People's Congress (legislative function) and the Environment Protection Committees of the State Council (enforcement function). In this scheme, an important role is played by the National Development and Reform Commission, due to its transversal –as well as indirect- control on all the government bodies, MEP included.

On the local level, the scheme is the same, with the People's Congress's local Environment and Resources committees and the State Council's local Environmental Protections Committees. The corresponding Bureaus are represented by a network of more than 2000 local Environmental protection bureaus (Chang and Wang).

3.3 Development of China's air pollution control regulations

Even though the legislative and enforcement functions are separate, as a matter of fact it is not unusual that government bodies have a wide range of law-making power (Alford and Shen, 1997). That is why the legislation on air pollution prevention and control is widespread into several pieces of legislation, regulations and departmental rules at all levels.

The main sources of legislation can be in fact summarized as follows: Constitutions, National Laws, National Regulations and Rules, Local Regulations and Rules. Besides these sources, it is worth to partially include plans and policies: even though they do not have a cogent and binding force, they are likely to address the legislative activity of both National and Local bodies, as well as the Country international relations and cooperation.

Exhibit 25: Main active legislation on Air Pollution prevention and control

Act name	**Effective**	**Revised**	**Type**
Article 26	1982		Constitutional
Vienna Convention for the Protection of the Ozone Layer	1985		International Treaty
Montreal Protocol on Substances that Deplete the Ozone Layer	1987		International Treaty
Environment Protection Law	1979	1989 2014	National Law
Air Pollution Prevention and Control Law	1988	1995 2000	National Law

Cleaner Production Promotion Law	2003	2012	National Law
Environmental Impact Assessment Law	2003		National Law
Energy Conservation Law	1998	2007	National Law
Forestry Law	1985	1998	National Law
Regulation on Levy and Use of Pollutant Emission Fees	2003		Administrative regulation
Regulation on Management of Ozone Depleting Substances	2010		Administrative regulation
Rules on Supervision and Management of Automobile Exhaust Pollution	1990		Departmental rules
Management Rules for Prohibiting Burning and Comprehensive Utilization of Straw	1999		Departmental rules
Rules on the Standard for Compulsory Retirement of Motor Vehicles	2013		Departmental rules
Ambient Air Quality Standards	2016		Departmental rules

Source: Feng and Liao, 2015

The environmental legislation development on Air Pollution Prevention and Control began with the promulgation of the Decision on Preventing Silca Dust in Mining Companies (1956), the first legal document on the issue. It is however on 1979, after the political paralysis imposed by the Cultural Revolution (1966-1976), that the legislation began to take shape. The Environmental Protection law (1979, revised on 1989 and 2014) was the mainframe for further development of environmental protection law system during the eighties with the Forestry Law (1985, revised on 1988) and the Air Pollution Prevention and Control Law (1988, further revised on 1995 and 2000). The latter was a real milestone, as it introduced monitoring system standard for emissions by country's

companies, under the control of the Environmental Protection Bureau. The nineties saw the shift from the central planned economy model towards the market economy system (ratified with the 1992 revision of the Constitution), but the 1995 revision of the Air Pollution Prevention and Control Law took a relatively small step towards a better understanding of the pluralization of stakeholders and interests in society, so it was rather a compromise with industry and government targets, especially those represented by the National Development and Reform Commission, that took the economic growth as the main goal (Alford and Liebman, 2001).

3.4 China's current Laws and Regulations that Address the Air Pollution Crisis

It was with its latter revision, on 2000, that many problems were addressed: besides introducing for the first time in China the idea of Sustainable Development, it adopted several important provisions like, more enhanced air monitoring systems, stricter regulation of emissions from vehicles and vessels, and harder punishments for non-complying polluters.

The rapid economic and social development, with fast urbanization and motor vehicle increase in number, as we have seen before, brought the air pollution challenge to a further stage. The response by the Authorities was the revision of the Environmental Protection Law, accomplished on 2014. The main and most interesting novelties introduced by this act are:

- Enhancement of responsibilities for polluters and related penalty mechanism
- Introduction of environmental performance goals within the public management evaluation system with severe penalties for those public manager who do not attain to those standards
- Enhancement of public opinion involvement grade
- Class action possibility for environmental issue
- Protection for informers who provide information on environmental law infringement cases

3.5 New national and provincial policies on air pollution

As we said in the first paragraph, the air pollution crisis in China is pulled by several drivers that need, for their nature, to be tackled by long termed measures.

Today's air pollution, in fact, depends mainly from smoke coming from coal combustion for energy consumption and vehicles exhausts. The main forces for both these trends are the economic growth, with the rising of a new middle-class, and the urbanization process. As these trends are likely to last of the next future, policy makers need to think how to mitigate as much as possible their impact on the environment and the health of population.

The main sources of air pollution have been identified in the energy matrix, too heavily relying on coal, and vehicles exhausts.

As for the energy production, there are three policies that have being carried out by the Chinese government in the last years in order to prevent and mitigate its effect on air quality. Two of them are regarding the energy supply, while the third concerns the emissions standards control. On 1998, the government promoted the use of low-sulphur coal in urban areas, with the encouragement by the State Council to the closure of small coal mines that produce high-sulphur coal and many inefficient electricity generation units. Between 1996 and 2000, about 800 small power plants have been shut down, with further plan by the Government to close more in the next years.

Moreover, during the 1990's, the government drafted plans requiring thermal power plants to install desulphurization equipments, by the end of 2000's every plant using coal whose sulphur content exceeds 1% should install desulphurization facilities. Another policy carried out by the Chinese government in the 1990's was the introduction of coal washing method, a process that can reduce many contaminants of the coal. It is reckoned that SO2 emissions can be reduced by 20% if coal is washed before consumption (Xu et al., 2000).

As for the emissions standards control policy, it is from the 1990's that the SEPA (former name for MEP) imposed to municipalities and cities emissions standards to be respected, with the introduction on 2013, as we have seen before, of 900 stations in the whole country, that offer continuous monitoring of key pollutants concentration in the air.

On the side of vehicles, as there are acknowledged as a growing driver for air pollution, the main policies, introduced by the Rules on Supervision and Management of Automobile Exhaust Pollution on 1990, and the recently issued Rules on the Standard for Compulsory Retirement of Motor Vehicles on 2013, reached good results in some areas of the Country that were able to translate the provisions into effective local regulatory systems, such as Beijing, Guangdong, Jiangsu (Liao, 2016), through a series of measures on declaration and registration of vehicles, emission fees, restrictions for highly polluting vehicles.

Despite all of these efforts over the last two decades, the results have been not completely satisfactory. The main reasons for this, more than in the lack of concrete pieces of legislation –that are in any case still likely to be improved (Liao, 2016)-, can be found in the lack of grip by the existing legislation. In other words, to put like Chang and Wang (2008) say, there is a huge gap between ideal and real practice, that is often the same gap existing between environmental purposes and economic targets, often in mutual conflict, above all if seen according to a short-term point of view.

It is very clear when we look at the above-mentioned policy for installment of desulphurization facilities in power plants. Many power plants are reluctant in installing these facilities and, once installed, to use them, in order to save on operational costs (Business Daily Update, 2009).

The conflict between economic and environmental purposes is also evident if we look at the result of the close-down policy of small inefficient power plants: many of those 800 plants were opened again due to energy shortage.

This conflict, as claimed by many observers, is deeply rooted within the governance system (Tang et. Al, 1997; Zhang and Jiang, 2002; Lang and Wang, 2003), where Environmental Protection Bureaus, that are government agencies, fails on the local level in coordinating with other government agencies: the main reason for this is that Local Environmental Protection Bureaus are not financially independent and relies on local government resources. The problem is two-fold: on the one hand, they often tend to prefer economic growth interests over environmental ones; on the other hand, the risk for corruption is very high (Pittman and Zhang, 2008).

The conflict between economic and environmental interests is difficult to be overcome, not only in China, and for this purpose there are several strategies that can be undertaken.

First, there is of course a ground in which environment and economic development targets are not in conflict: this is the field of green economy, as has been promoting since the 12th five-year plan by the Chinese government, with a planned investment of 300 billions of euro, to be covered both by public finance and both by a fines issued against the transgressors.

Enhancing the development in this sector, and more in general promoting a development model shift towards sustainability, will help to overcome the resistance by group of interest that still see a conflict between development and environment protection.

Another important point is the governance system reform: on the one hand, a major involvement by the public opinion with a major sensibility on environmental issues is likely to make pressure on local government for a more environmental-friendly attitude and ease the central government task in improve the law enforcement on a local level. A deeper understanding and sensibility by the public opinion on environmental protection issues is also probably likely to ease the public financial planning for mitigation and prevention policies, with an enhancing of the WTP willingness by the tax payer. The monitoring network introduced on 2013 and the new provisions on the environment are going in this direction. On the other hand, a major coordination by local committees and bureaus by the central government, by means of the cross-cutting introduction of

environmental responsibilities and goals within other important government agencies, both on the local and the national level, is likely to enhance the effectiveness of national rules on environment protection and the sharing of best practices between local administrations.

CHAPTER IV:
INVESTMENTS IN THE CHINESE GREEN MARKET.
THE CASE OF LOCCIONI

China environmental law development highlights, as we have seen in the previous chapters, a growing awareness by the authorities and civil society towards this very important issue, whose solution is of crucial importance for the country's future. At the same time, this growing attention and stricter regulations bring the need for new technology, know-how, management practices to be implemented. An important role can be played by those European small and medium enterprises that have in these facets their competitive advantage, being able to provide, thanks to their slim size and agility, quick response to market fast changing needs and tailor-made solutions to concrete issues. One of the most brilliant examples of this kind of players is Loccioni, Italian enterprise from Marche Region, already in China with a branch company.

4.1 European firms investing in China in the green sector

European investment amounted to the 20,97% of total foreign inflowing capital to China in 2014, on a total of 128,5 billion dollars (+3,7% on yearly basis). While traditional sectors like Manufacturing and Real Estate continued to attract the most of the inflow of foreign investment, the green sector attracted a share of 0,45% (0,57 billion of dollars) of total foreign capital (MOFCOM 2015).

Environmental sector, in which we can include sectors like environmental protection as well as renewable energies, in nevertheless more and more interesting for European small and medium enterprises, because of the growing interest by the Chinese government and the competitive advantage in sector technology owned by European enterprises.

The Chinese government, in fact, on the conclusion of the 12th five year plan, estimated the green sector contribution to national GDP to be up to 8% (740 billion euro), while the contribution given by the environmental protection, as strictly defined, up 2%. As for the 13th five year plan period, China banking system estimates that the national financial requirement will amount to about 2 thousands billion euro for the whole period. Based on

this estimation, the Chinese government has already assessed that its maximum contribution to this requirement cannot exceed the 15%. The remaining part shall be covered by private companies, both local both foreign, along with banking loans and innovative finance tools like Green Bonds (CeSif 2016).

An important sector within the green industry is of course the Energy sector: China is currently the second world energy consumer and its energy mix overreliance on carbon-fossil energy is pushing the government to shift the national energy matrix towards a more balanced mix, where clean energies will play an important role. The result of such a strategy is already visible, both under the facets of energy efficiency (-18% decrease of energy intensity over the 12th five year plan period), both on the side of carbon usage (decreased by 2,9% in 2014 on 2013 data). The opportunities for European firms are thus relevant, as well as relevant are the challenges: despite the fact there is not any explicit discrimination against private and foreign firms, the sector is still heavily controlled by the State and regulatory barriers affect the commercialization of hardware (*i.e.* machineries), while the sale of software (*i.e.* technology, know-how) should be carefully evaluated under the facet of potential technological spillovers that may affect the long term profitability of business not only in China, but on global markets too (CeSif, Ibidem).

4.2 Loccioni corporate background

Loccioni Group is an Italian family company established in 1968 by Enrico Loccioni. It's possible to define the enterprise as a "technological atelier"[47], where the positive outlook for the future and a persistent innovative spirit are the guidelines of its actions.

Just to give some useful numerical information so to have a more clear idea about Loccioni Group, the current number of employees is around 360 (indeed the Group is now classified as a Large-Company) divided in all the five business units. A relevant data is that during the world wide economical crisis, the company hired more than one hundred of employees (since 2008) and improved its turnover up to 64 billion of Euro in the last year. The perspective for the incoming year is to enhance the turnover about 10%, of course in this provision, is fundamental the growth of Chinese market, as well as, the

[47] The name came from the characteristic to project tailor made solutions for each customers.

other Loccioni sites around the world[48]. A characteristic that worth to highlight is the average age of the employees that is 33 years old, with the half of total employee graduates. It's possible to breathe this young working environment, and maybe it has significantly contributed to win, for the seventh time, the award "*Best Workplace 2014"* in Italy, among all the other participant Italian companies. The enterprise integrates people, ideas and technologies in developing measurement and control automatic systems to improve products, processes, quality and efficiency for the manufacturing and service industry.

A distinguishing feature of the company is to provide tailor-made solutions for each customer in order to respond to the individual needs of each. In such a way its market is global, with installations in more than 40 countries around the world. Another element that characterizes the company is a recruiting action focused on young people.

This philosophy of recruitment created by the founder allows the company to have collaborators full of energy, courage and initiative with the aim of contributing to the growth of the Company and give back to them the opportunity to enrich their own education and gain a strong experience in a large enterprise as Loccioni Group. Nowadays Loccioni has five different lines of business such as energy, industry, environmental, mobility and human-care. In the first steps of the company the main activities turned around the industrial electric plant engineering addressed towards the large companies of surrounding regional area, but currently the services and products that Loccioni does are used on the industry of the lines of business above listed. The first to analyse is Loccioni Mobility, one of the leading world department in the fields of testing and assembly technology in the automotive industry, specifically, in designing and manufacturing benches and assembly lines, create and integrate energy efficiency solutions, solutions for energy production from renewable sources, green IT, solutions for environmental monitoring, assembles, test and create the quality control systems for home appliances and health care. Continental, Magneti Marelli, Delphi, Faw-Volskwagen are just some of the important partners Loccioni invests with.

Automotive components and testing are what Loccioni offers in a wide range of products, balanced by a mix of innovation, efficiency and high-quality performances. In the energy

[48] Loccioni has other two sites: one is placed in Washington D.C. (US) and the second in Claw, (GE).

market, the belief is “be lean”, measuring and understanding consumption and waste, “be clean”, optimizing energy efficiency with a minimal environmental impact, and “be green”, producing energy from renewable sources, “gain comfort”, managing energetic flow through innovative technologies. Support for saving consumption and maximize energy have been implemented through new solutions of being pro-environmental innovative. Solar tubes as a new way to manage internal illumination, data centres for natural cooling together with solar automatic screens let plants get the most from environment; collecting and re-utilization of rain water, geothermal and water pumps, combustion through biomasses, photovoltaic methodologies, are all well-conducted challenges lead to the future of renewable energy.

The second department to discover is Loccioni Human-Care. It was born inside the company as a project of innovation in the medical field where to test and import all the competences grown up within the automation, sustainability and connecting field and developed thanks to the collaboration with the world leader for more than 40 years. In September 2009 it became a real division of the Group with the aim of developing the core issues in the human being’s life: health, nutrition and wellness. The last goal is to encourage and plan healthier and more sustainable lifestyles. The main project brought out from the department is Apoteca Chemo[49], it is the first fully automated system for the preparation of cytostatic drugs in total safety for technicians and patients, it trainers to prevent and avoid any form of contamination. The manual preparation of cytotoxic drugs has a high possibility of dosage errors with serious consequences for the patient and high professional risks for those who remain exposed to carcinogens of cytotoxic drugs.

Patients are protected by human-care high-tech solutions that recognize the active ingredients and control all the weightings. The tracking system of all phases, based on barcode, allows a perfect integration between the department and the oncological pharmacy service thus ensuring the proper administration to the patient gives value to both a continuous innovation process coming from R&D and the entire healthcare market which need of even more reliable solutions able to look beyond of our time.

[49] ApotecaChemo was originated from humancare research and thanks to the forty-year experience in automation and measurement, developed by Loccioni Group. Human-care solutions are the result of the laboratory of ideas, Lab@AOR, instituted at the *United Hospitals of Ancona* to share knowledge and clinical experience, technological and human-relationship in order to generate continuous innovation.

The third department is Loccioni Energy, it represents the new frontier of the Group in the fields of renewable energies and energy efficiency.

It was born with the desire of making available to its customers the experiences gained by the Group in more than ten years, as it began to engage in the path toward business sustainability.

This process started within its buildings and continued with the creation of the Leaf Community. It is the result of the strong ambition to create a positive meeting field between technology and nature. The main idea, in coherence with more than 40 years of activity in technology, is proposed by Loccioni which, in collaboration with a network of excellence companies[50], has defined and created the first eco-sustainable completely integrated community in Italy, indeed in the Leaf Community it is possible to live in a carbon neutral house and move with electrical or hydrogen cars, bring children to a solar energy school and work in eco-compatible buildings. Energy is provided by renewable sources, granting the highest level of comfort and modernity.

Trying to summarize the key principles of Loccioni Energy, what arise are quality, innovation and service. These are the core values of this department always focused on the needs of its customers and able to offer the best technological solution in the fields of energy efficiency and energy production.

The fourth innovative department is Loccioni Environment. It is the partner of energy manufacturers able to identify and solve the problems of productive processes inefficiency and related environmental impact. In synergy with Loccioni Energy, Loccioni Environment style is recognizable not only thanks to the technological value, but also to the cultural aspect capable of developing Energy re-generation projects: regenerating the environment from polluting elements and generating energy with respect to nature.

The mains competences of Loccioni Environment team is to take care of air and water emission monitoring, focusing its attention on the development of tailor – made solutions aimed at industrial processes management and automation. Its attention is on the most polluting processes offering bigger challenges in terms of environmental, economic and social sustainability.

[50] The most relevant are: Enel, Samsung, IEA (International Energy Agency), Kyoto Club, LegAmbiente.

The last department and one of the most proficient is Loccioni Industry. The team mainly composed by specialists and researchers, take care of customers particular requirements, designing and developing innovative solutions and entire customized technological fields.

For more than 40 years our researchers have been creating and carrying on testing solutions about electrical and electronic components (motors, pumps, compressors, sensors etc.), home appliances, sustainable energy, glass industry, wood and food&beverage, always supporting our customers and partners in the optimization of production processes and in the improvement of products' quality and aesthetics. Loccioni Group is not only a technological atelier enterprise.

The company offers various social activities addressed to development of territory and to improve the personal skills of employment, in this view, it worth summarize the training assets currently underway in the Company.

Ages taken into account for this type of activities ranging from the youngest to the older, in fact there are three different areas of intervention: BlueZone, RedZone, SilverZone. BlueZone[51] is the physical and metaphorical area that in Loccioni represents the interface between the School world and job, its goal is to offer an area of integration between these two different fundamental sides of the society planning the future together. The most coherent guys with the activities of the Group, after a training that allows the guys to come in contact with the job world, are first attracted, then trained and finally "self selected".

The Virtual Class is an example of this described training path. It allows an extra-school activity targeted to the managerial studies and to the realization of complex projects to get competences to stream within the company.

Every year more than 1000 students, both Italians and foreigners, are hosted in BlueZone. The RedZone is the training courses activated within the Group addressed to the collaborators, they provide: language course, managerial training masters, meetings with interdisciplinary topics and activities lead by experts.

[51] In the BlueZone, the main activities involved are *Classe Virtule* and *Grow on Loccioni* (GOL). The first one is a program addressed to the High School of the territories, where the most talented students are invited to follow a specific course within the Group. The second one is an opportunity gives to the most talented students in Economy, Engineering and starting from 2014 also Agricultural. After a tough selection, to the recruited students are invited to spend several months at Loccioni Group and the company pays for the University fees of the last year.

Another relevant asset is the SilverZone. A virtual area gathering the experience of people who have made the history of the Group and the young talented guys currently enrolled in the company that, throw common activities, manage to achieve excellent result and realize particular projects.

The key concept taking into account as background of this activity is *tradinnovation*, the union of tradition and innovation, that means learn from the past to build together the future. In conclusion is interesting to list the main principles used from the company as ethic guideline of its actions: obstinacy, will, parsimony and sense of proportion.

4.3 The motivations for investing in the green sector in China

The environment is the heart of Loccioni values and culture: Corporate Social Responsibility, the attention paid to a sustainability are cross-cutting processes that characterize all the activities of Loccioni, both core and peripheral, upstream and downstream, in each Business Unit. The Leaf Community[52] project is a key example for Loccioni environmental approach, as it stands for high-commitment in favor of environment. The Leaf Community is the first fully environmentally sustainable Community in Italy where buildings, transports, production are all powered through renewable sources of energy.

As a leader in Energy and Environment industries, Loccioni is the privileged partner for those firms which aspire to innovate towards a more environment-friendly layout, both in Italy and worldwide, throughout a methodology that strongly combines new legislations and policies against pollution with high-reliability emission analyzers which help industries to be within the required standards.

The main domains in which Loccioni presents a sound competitive advantage are: emissions - continuous monitoring systems for industrial emissions (CEMS), air quality - network of cabins for air pollutant and dust monitoring and meteorological parameters surveying, water quality - measurement and control systems for the chemical and physical parameters of process steam and water, process optimization and control,

[52] The Leaf Community is the result of the strong ambition to create a positive meeting field between technology and nature. The idea, in coherence with more than 40 years of activity in technology, is proposed by Loccioni which, in collaboration with a network of excellence companies, has defined and created the first eco-sustainable completely integrated community in Italy.

customer care & services center, environmental remediation, integrated systems for decontamination of soil and underground water, global service, maintenance, customized assistance, data certification and management.

As a consequence of its thirty-year long rise as the main manufacture center of the world, China today is one of the widest potential market for energy and environment industry.

The China energy demand is a core topic in Loccioni perspective, taking into account that the world coal production and consumption is dominated by China. In 2010, China accounted for 45 percent of the world coal production (by volume) and 48 percent of the world coal consumption (by energy content). In 2010, world coal production was 7,273 million tons,1 ton of coal = 0.5 ton of oil (Facing China's Coal Future, 2011, International Energy Agency).

In the past decade, China has experienced accelerated industrial and urban development, with strong growth of GDP. This has led to an unprecedented demand for energy in concentrated population and industrial centers. China is the largest energy consumer in the world. China's economic growth is projected to continue and to drive increasing energy consumption for several decades. By 2035, China is likely to see a large increase in demand for primary energy, perhaps up by nearly 70% from the present levels.

This demand is likely to be met by increasing use of fossil fuels along with other sources, such as nuclear and renewable. As a result of this rapid economic development, China faces significant environmental challenges.

In its development planning, the Chinese government is placing greater emphasis on scientific development and consideration for environment and sustainability as noted in the December 2011, National 12th Five Year Plan for Environmental Protection (2011-2015).

China's five year plans and related industrial and energy policies increasingly focus on developing a low carbon economy and set out relevant targets. In practice, this has led to significant investment across a range of clean technologies and resource efficiency measures. Related policy development and planning has demonstrated that future development objectives and technology considerations will take into account climate change mitigation efforts and other environmental impacts and, critically, will acknowledge China's stressed resources.

China’s energy supply has been based on increased use of coal, both domestic and, to some extent, imported. Over the last decade, more than 80% of the global increase in coal demand came from China alone. In 2010, coal supplied nearly 67.1% of China’s total primary energy supply. It is utilized across key sectors including power generation, chemicals and transportation fuels. In the power sector, 78.7% of China’s electricity was produced from coal in 2009.

Coal is also expected to remain the dominant fuel source in China for the coming two or three decades, driven largely by demand in the power sector. It is, however, projected that the demand for coal in both industry and power will stabilize after 2020. The Chinese government’s strategic goal to reduce dependence on expensive imported natural gas and petroleum has been a major factor driving this reliance on coal. China’s energy security concerns have accelerated coal power plant expansion, with large investments in more efficient, centralized new generation coal power plants.

China is also investing heavily in renewable energy, including the world’s fastest growing wind energy sector. Given the increase in alternatives to fossil fuels, increased energy efficiency, investment in new nuclear facilities and the switch to lower emissions fossil, China may significantly reduce its energy intensity and emissions over time. The great economic growth of China is definitely one of the most studied and biggest phenomena of the last decade. Economic evolution brought China from a marginal to a central position in the economic world puzzle. Besides the enthusiasm of becoming a new economic leader in the world stage, China has to face the trouble of sustain the economic growth and save the environment from its negative impact. Within just a few years China has emerged as a global green-tech leader by a number of indicators, but more importantly, China stands at the center of almost every green-tech market. While these five reasons can be applied to the Chinese green-tech market in general, the specifics differ within each green-tech sector.

The 12th five-year plan clearly underlined energy issues as being a key area for government policy. The latest FYP indicated seven strategic areas which would receive investment of up to CNY 10 trillion: alternative fuel cars, biotechnology, energy-saving and environmentally friendly technologies, alternative energy, high-end manufacturing

and advanced materials, and new- generation information technology. New energy and energy saving technologies are slated to get more than 50% of the planned investment.

Moreover, the plan sets some key targets to be met by 2015: decreasing energy intensity (energy consumed per unit GDP) by 16%, decreasing carbon intensity (carbon emission per unit GDP) by 17%, increasing renewable energy as proportion of primary energy to 11,4%, increasing R&D expenditures by 2,2% of GDP, decreasing water intensity (water consumed per unit of value-added industrial output) by 30%, increasing forest coverage rate to 21,7%, decreasing sulphur dioxide and chemical oxygen demand by 8%, and reducing nitrogen oxide and ammonia nitrogen by 10%.

The country's booming green tech markets represent a huge social and technological shift, and have real potential to solve serious energy and environmental problems, but would not have been possible without government policies. China seeks to address its own and the world's energy and environmental problems while promoting its domestic industry. Thanks to the virtue of market's size, China's leaders recognize early on that the country had the chance to capture markets not only at home but also abroad. The energy sector is among the most capital-intensive industries, and China had the possibility to spend trillions of RMB on new energy equipment on a scale never before seen. Relying mainly on foreign technologies not only gives foreign companies a boost over domestic players, but doing so could also leash China to foreign parts and services for decades to come. The government's aim is now to ensure most energy equipment, especially in wind, solar and biomass will be made in China, based on domestic home intellectual property, using Chinese standards.

It is clear that domestic policies and practices aim to favor Chinese players (Chinese SOEs[53] can take advantage from their close relations with local government, accessing contracts and very advantageous banks loans) unless the foreign companies can prove substantial advantages in terms of technology, know-how, performance and pricing. In this fast growing and changing green tech market, the vast market size does not necessarily translate directly into opportunities for European SMEs[54].

[53] A state-owned enterprise (SOE) is a legal entity that is created by the government in order to partake in commercial activities on the government's behalf.

[54] Small and medium enterprises (SMEs) or small and medium-sized businesses (SMBs) are companies whose personnel numbers fall below certain limits.

The main market opportunities for SMEs will be found in areas where large SOEs or multi have not invaded and where SMEs can leverage their know-how and technology.
Advanced products/services for niche demand, close monitoring of green tech policies and good relationships with provincial governments are key to success in this challenging market, which Loccioni as all foreigner companies cannot underestimate to have success in Chinese market.

4.4 Loccioni's China business development targets

Loccioni began on 2013 its strategy to enter the Chinese market in the Environment industry, with the redaction of a Four-year plan, which will define the pace of the activities that will bring the company from the start-up to the a speed phase. The four year – plan is arranged as follows:

2013	2014	2015	2016
| Law and policies analysis | Market Analysis | Partner identification	| Key target account identification | Fulfillment of an experimental project	| Repetition of the experimental project on 3 further accounts | Integration of a dedicated figure	| Turnover target set at 1.5 MLN (coal sector) | Integration of 1 further figure

The 2013 has been intended as the year in which the company has gathered all the information needed as a preparation for the concrete go-to-market strategy. Environmental laws and politics developed by the Chinese Government have been analyzed in a forecasting perspective, as a indicator of those markets more likely to offer business opportunities.
Then all the national and global competitors and potential partners have been mapped, in order to reconstruct the industry structure as the business environment where Loccioni will have to compete and build its relations. Some key players have been pointed at as potential partner and a networking activity has been started up. After the examination of the industry, the 2014 is the year for market analysis. This phase could be subdivided into two different steps.
The first is the identification of potential key accounts, while the second consists in the planning and the fulfillment of an experimental project. On 2015 the experimental project

will be checked and evaluated and will be then replicated on three different accounts. A dedicated figure will be trained and integrated, in order to support the sales and post-sales activities. The last year of the plan (2016) is intended as the speeding up phase, in which 1.5 million of euros are set as a minimum turnover target for the coal sector and an additional supporting figure will be included.

4.5 The main business areas of investment in China

The twelfth 5 years plan of China, which will cover the period from 2011 to 2015, shows that thermal power is still the main power supply. The National Energy Board Energy Saving and Science Equipment Department states that the "Twelfth Five" period aims at reducing the use of coal (that accounts for more than the 70% of the overall primary energy national consumption), down to about the 62%.

As China is a coal-rich but tight power resources country, the thermal power generation will continue to occupy an important position in the electric power industry for a long period to come.

Although the current pace of thermal power growth slowed down, in the long term power generation costs are likely to increase the demand for electricity -which is per se a positive factor in promoting environmentally friendly technologies- and the future prospects for the development of thermal power industry is more optimistic.

In recent years, environmental protection and energy conservation become an important direction of China's electric power industry restructuring. The Government, with its “big pressure” policy-oriented actively promotes the optimization and upgrading of the industrial structure. A large number of low energy efficiency, heavy pollution and small thermal power units has speed up the upgrading of thermal power equipment, pulling the market demand of thermal power equipment. In the short term, China will carry out the “optimization” policy of developing thermal power positively. To achieve that, the state will work hard on five aspects.

Firstly, environmental protection. With the construction of ecological civilization and beautiful in-depth history of the most stringent environmental protection policies - thermal power plant air pollutant emission standards, as well as focus on control of total regional emissions budget management and fuel consumption total control approach

constantly promulgated and implemented, clean environment will be the first factor restricting the development of thermal power, which also brings greater pressure to the thermal power enterprises to put forward higher requirements. Control during coal combustion process, desulfurization, denitrification and dust, seeking clean coal power generation technology will be coal-fired power generation companies the most urgent and the most realistic way. Secondly, large scale and high efficiency.

Large efficient units not only meets the needs of building an energy-saving country and an environment-friendly society, but also the most effective means for power generation companies to reduce production costs, improve profitability, and enhance the core competitiveness of enterprises.

Currently, the 600,000 kilowatts and above level of coal plants in the top five power generation groups accounted for 45.3% of the total plants, which is more than 296 units. Huaneng's[55] 600,000 kilowatts and above level of units percentage reached 48%. Guodian[56] determined to optimize the installed structure, focusing on the development of 600,000 kilowatts and above thermal power projects, thermal power units of new investment 600,000 kilowatts or more units accounted for 72.3%. Inter the individual commissioning-effective projects, in principle, no other new construction of 300,000 kilowatts level and fully shutting down small thermal power units. With the rapid development of China's power plant equipment and technology and the further implementation of the energy conservation policy, large-scale and efficient environmental protection unit will become the general trend of the development of thermal power.

Thirdly, high degree of intelligence. Achieving a lean and efficient, highly intelligent, intensive, systematic management has become the inevitable requirement for the development of thermal power. Highly intelligent unit retired all the information of the full life cycle, from design to achieve three-dimensional visualization and online control, production and operation of the information should realize intelligent. Huadian Laizhou Power Plant No. 2 million kilowatts ultra-supercritical unit was put into operation in the

[55] China Huaneng Group Corporation is one of the five largest state-owned electric utility enterprises in China, administrated by the State Council of the People's Republic of China, engaging in the investment, construction, operation and management of power generation assets and the production and sale of electricity power. In 2012, the company ranked #246 on the Fortune 500 list.

[56] China Guodian Corporation, is one of the five largest power producers in the People's Republic of China, administrated by SASAC for the State Council of the People's Republic of China.

end of 2012, marking the building of China's first intelligent power plant. The plant uses three-dimensional digital design operations, a computer will be able to production, management control of the whole process; currently the world's most advanced field bus control technology, can achieve unattended.

Fourthly, site selection address scientifically. Thermal power projects should continue to be based on "pithead, intersection and port", along the coast, the national coal base, developed areas, load centers, but also extended to UHV starting point, the national coal channel, the Group's logistics channel, and to break past a single thermal power development, give priority to the development of multiple integration projects, such as large coastal ports - coal blending - power generation base project (i.e. port electricity integrated), inter-regional power transmission, coal and electricity integration project, the joint ALUMINUM project, cogeneration project, cold, heat, electricity trigeneration distributed energy projects, the "big pressure on the small" project.

Fifth, excellent technical and economic indicators and strong value creation ability. Implement the principle of "multi-point, preferably selection, essential building", strict control the cost of thermal power project construction, energy consumption indicators, unit capacity of the marginal contribution, and strive to achieve the "industry best practices", and enhance market competitiveness, value creativity.

On the basis of these market trends and Loccioni core and peripheral businesses, it is possible to point at the following sectors as the most interesting. Coal: without any doubt the energy production will not slow down on the short term. Products like Powder[57] and Cineris have thus a big potential in China.

Even though the market share of CEMS seems to have almost achieved its full potential, its life-cycle could be extended if it would be able to measure the mercury (as expected to be stated by the next Government five-year plan) and the plumb (a sector currently sub-sized). The potential for CEMS in mercury monitoring sector can be assessed up to 300-400 tools per year. Possibility to integrate FT-IR[58] with slippometri for process monitoring, cooperating with the EPCs that design DeNOx and abatement system.

[57] POWdER is the system designed by Loccioni research@environment able to monitor fineness of coal powder flowing within feeding ducts of a coal-fired power plant.

[58] FT-IR is the multi-component analyser designed from the research@environment developed to guarantee high quality, accuracy, reliability and strength. FT-IR analyser work with Fourier-Transform InfraRed spectroscopy measurement principle.

4.6 Normative provisions that supported Loccioni move to China

Loccioni Group moved to China in 2012 with a *Delegation office,* useful to build a potential market and to stay near to customers providing service activities, but more important, to try to strengthen the relations, with the scope to the creation of a strong network. Starting from this year, Loccioni became a company (Loccioni China Ltd)[59], so now it has more commercial chances and legal advantages. One of those is the availability to directly hire Chinese employees without any intermediary as *Employment Center*, chance before prohibited for a Delegation Office.

In this way is now allowed to *Loccioni Ltd* to freely select and then recruit the suitable employees for the specific needs of the company and, moreover, to have a Chinese staff that lower the impact of the critical issues previously listed.

Looking from a more general point of view, the most relevant Chinese normative provisions of abroad investments, *Foreign Investment Catalogue,* is more energy-saving, environmental-friendly than the previous. This choice aims to encourage foreign investments and focusing them more on quality rather than quantity of investments. These changes show a wide transformation in the economic strategy of the China that could be a greedy opportunity for the foreign companies.

There are some major amendments of the Catalogue that arose interest in light of business chances and, by Loccioni Group side, the manufacturing provisions are those favorite.

In the manufacturing industries the foreign investments in the form of a *joint venture* are welcome on manufacturing of certain components for wind turbines and parts for new energy automobiles, equipment for re-cycling and water treatment facilities, in addition, is request the exploration of unconventional natural gas resources and equipment for prevention of certain types of pollutants. In this last field, as well as in the others, Loccioni has strong and proved competences with its monitoring system of air and water quality, which are any of its core business.

In other words, all the activities which facilitate sustainable development and environmental protection, such as the recycling of waste electrical appliances, electronic

[59] The birth date, or rather the day of the registration, is 25th December 2013. It takes place in Shanghai, as well known as one of the main industrial pole of China.

products, mechanical and electronic equipment and the above mentioned, are fundamental for Loccioni and fortunately are included under the *encouraged items* in the Catalogue.

On the other hand, complete automobiles, polycrystalline silicon and coal chemicals, a number of chemical materials and chemical products, and some pharmaceutical products have been removed from the list of encouraged items. Moreover, the Catalogue also emphasizes on certain industries such as certain kinds of research and development in relation to aviation, automobile and the certain parts for high-speed railways and automobiles.

In addition, the China's National Development and Reform Commission (NDRC)[60] and the Ministry of Commerce (MOC)[61] jointly released the "*Catalogue of Priority Industries for Foreign Investment in Central and Western China*" on May 14. It worth to highlight the provincial criteria used to split up the industries, thus to have a clear landscape where the key industries, or rather business, are boost by China's government. The list below shows the most considerable areas related to Loccioni Group's competences.

Local Authority	**Areas of Interest**	**Other Information**
Chongqing Municipality	- Development and application of water-saving irrigation technology - Manufacturing of solar power	The municipality was created on 14 March 1997, succeeding the sub provincial city administration that was part of Sichuan province. Chongqing is the largest direct-controlled municipality in China, and comprises 19 districts, 15 counties, and 4 autonomous counties.
Gansu Province	- Construction of high-quality wine grape bases	Gansu has a population of 26 million (2009), covers an area

[60] The NDRC is a macroeconomic management agency under the Chinese State Council, which has broad administrative and planning control over the Chinese economy. Since March 2013 the Commission has been headed by Xu Shaoshi.

[61] The Ministry of Commerce (MOFCOM) of the Government of the People's Republic of China, formerly *Ministry of Foreign Trade and Economic Co-operationis* an executive agency of the State Council of China.

	- Cultivation and processing of high-quality beer raw materials	similar sized to California. The capital is Lanzhou, located in the southeast part of the province.
Heilongjiang Province	- Natural mineral water production - Medical and senior care institutions	Heilongjiang is a province of The People's Republic of China located in the northeastern part of the country. The name literally means *Black Dragon River*, which is the Chinese name for the Amur

A particular focus is addressed by Loccioni Group on the *New Standards for Power Plants*, the Government's effort to cut down the emission of power plants. The new standards came into force from 1th July 2014. Moreover, starting in 2015, all power plants (new and existing) will be subject to mercury emission standards. Since most of China's power generation comes from coal, the coal standards are the most relevant to addressing China's air pollution challenges.

New standards not only are very strict, but they are even more stringent for new plants in large regions that have the most serious air pollution problems. In regions designated by China's Ministry of Environmental Protection (MEP) as having severe air pollution problems, the limits will be 50 mg/m3 for SO2, 100 mg/m3 for NOX, and 20 mg/m3 for particulates. These new regulations are a major commitment to environmental investment by China.

To pay for the investment, on 1th December, China's National Development and Reform Commission raised electricity prices for industrial users, this both supports the costs of the environmental investments and operating costs, and it raises the price of coal-fired power, increasing the incentives for efficiency and making renewable energy more competitive.

Shortly, the new standards and their effect can be summarized in two points: one is the China's new emissions standards for power plants, they are comparable to standards in the developed world in important respect these standards are being phased in quickly, the second is that the standards include provisions for even greater stringency in highly polluted areas.

4.7 Main obstacles and challenges of operating in China

Investing in China is not easy for firms; the reason lays down several aspects. One of the reasons is the regulation that disciplines Foreign Directs Investments, adopted in China during the last decades.

Among this political action by China's government, the most important emanated act is the *Catalogue of Industries for Guiding Foreign Investments*[62], a document issued by China's National Development and Reform Commission (NDRC) and the Ministry of Commerce (MOFCOM) which rules foreign investment in Chinese industries. Trying to briefly define the different categories, what arise are four different kind of category: *permitted* category (the standard, with no particular restrictive or favourable treatment), *encouraged* category (investment in activities in this area is subject to less strict administrative requirements and may enjoy certain tax and other benefits), *restricted* category (investments in activities in this field are subject to higher levels of scrutiny and stricter administrative requirements, and may be denied at the discretion of the approval authorities), *prohibited* category (foreign investment are not permitted).

This act represents a jar of both advantages and disadvantages elements for the investors, difficult to item by item explain. It is important to notice that the Catalogue has been recently modified in 2011, trying to adopt an "opening up" policy. Between the most important additions, it worth to underline the *newly encouraged activities*: vocational training venture, capital enterprises, construction and operation of vehicle, charging stations and battery changing stations, construction and operation of water treatment plants, new types of high-technology and glass and optics products.

[62] The first Catalog was issued in 1995, after that, it has seen a various amendments, to be precise in 1997, 2002, 2004, 2007 and the last update has been in February 2013.

Restrictions still remain anyway. In last update version, despite the additions above mentioned, items within the lists of *Encouraged* and Items *Restricted*, are subject to the rule that if a foreign investor wants to undertake these activities, then a Chinese party shall be the controlling shareholder or, in some cases, for the investment form, it's required that any foreign investment shall be in the form of a Sino-foreign cooperative joint venture or Sino-foreign equity.

In addition, it's possible to note that there is a clear categorization but non-transparent treatment, indeed the Catalogue only provides general guidance for foreign investment in China and lists specific items as Encouraged or Restricted without specifying the detailed treatment, such as taxation and other incentives. Moreover, the policies for foreign investments are adopted by local governments and as a result, it's a quite hard work to identify what kind of treatment may be applied.

Following the world's market trend, Loccioni Group is nowadays in China. The first approach of the company, in 2012, has been to set up a *Delegation Office* in Shanghai, which is the most important mobility production pole in China. On the last December 25th, was born a real Loccioni society in China, in this way, there will not be a Delegation Office anymore, because of the replacement by Loccioni China Ltd.

The main following purpose by Loccioni, is to support the international customers already placed in the entire Asia, proposing itself both as the principal commercial interface and as a strategic support for all the service activities of the products already sold in the area. As written above, this has been the first approach, and as often happens in the primes steps, some problems can often arise. A relevant issue is to try to define these hitches that a company as Loccioni faces, and has faced, during its approach to China's market environment. The first and most evident issue is the language. Cultural misunderstandings arising from miscommunication are one of the biggest challenges which foreign companies face in China.

Although there are an increasing number of Chinese people highly proficient in English, it is uncommon to find someone who understands the subtleties of the language and possesses a strong enough understanding of both Chinese and western culture to navigate delicate business negotiations. While communication between the foreign and Chinese companies goes smoothly at first, things start to break down as business issues get more

complex and the Chinese side has difficulty explaining to the foreign company business practices that are unique to China in a way that is understandable to a western audience.

What started as a promising prospect for both sides often breaks down due to misunderstandings. To avoid such problems, it is essential to have an international team in place which can bridge Chinese and western cultural differences, so to provide the right and fundamental advices. This is the first, and maybe most evident problem that foreign company has to copy once arrived in China, moreover when you want to entry in a high – tech market where is requested to have a deep technical terms mastery for the native also. Another relevant issue Loccioni Group meets in China is the cultural approach to business. It's well known, a business needs to understand local culture influences in order to built good helpful relationships in both social and business sectors.

The culture is blended in the Chinese society and business affairs, so the different methods to conclude a business, to interface with intermediary as public administration, to approach with customers and the size of local potential market, are any of the difficulties identified. It worth to highlight the importance of *guanxi*[63] (relationship) in the business affairs, indeed, the relevance of building strong networks in business is not a novel concept for western businesses, however, in China, *guanxi* plays a far more important role than it does in the West, or rather, it is necessary to spend time getting to know your Chinese counterparts outside the boardroom during tea sessions and dinner banquets. So, to succeed in China, is fundamental to realize that it's not more possible to have the same business model which may have served you well in your own country.

What is needed it's to be flexible and adjustable towards a country that practices business according with "Chinese characteristics" deeply related to its traditions. Due to these differences, many business practices in China do not always conform to commonly adopted international standards. Without a presence and close supervision in China, it will be difficult for companies to ensure that their best interests are being advanced by their agents and employees.

The last and more technical obstacle arise in the legislative field. Is one of more affecting issues of doing business in China for Loccioni, but in general, for majority of the firms.

[63] The word translated into English means, roughly, relationship. While in the other parts of the world, you may be able broker a deal just through formal business meetings, in order to develop such relationships, it is important to have the patience to build them.

The reason is lay down on the *not – transparent* framework of Chinese legal system, but mostly, on the changing of normative application which occurs region by region, and the importance of local laws and administrative officers in the business affairs.

This side puts the foreign enterprises in an uncertain and dangerous situation and has, as a consequence, the fact to make sure that the business carrying on adheres to the local laws. A critic key role is played by the bureaucracy also, specifically, the burden struggle needed to obtain licenses and permits (e.g. license sales). Everything from opening a bank account, to registering your company, to gaining product approval, can drag on for months. Moreover, many procedures that normally would be handled electronically in the West, require reams of paperwork which need to be filled in and stamped by hand. The time required to complete these efforts can be unexpectedly length. A related problem is that China's regulations are often vaguely worded and open to interpretation, which can be unsettling for foreign companies used to a more transparent regulatory environment.

In conclusion, Government regulations can very often impact significantly on the timeline and costs of market entry, so it is critical to spend time researching and understanding the regulatory environment, prior to making any decision to enter the market this leads to say that Chinese regulatory bodies often operate in a quite opaque manner, making it difficult to anticipate regulatory changes before they happen, being instead useful to previously know them.

This uncertainty about the regulatory field, both under provision and application, is also harmful for China. It lost more than three billion of Euros of investments due these entry market barriers laid by commercial regulatory. The more harmful from this situation is the private sector; almost the 84% of the whole losses is upon their shoulders, in particular on the mechanic and electronic firms.

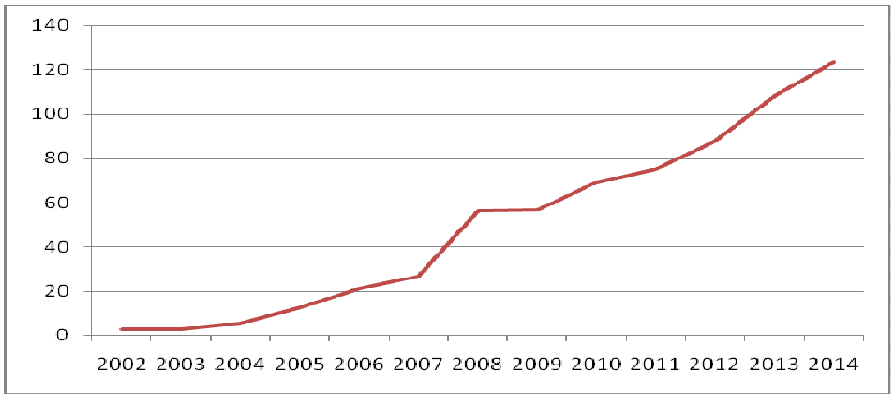
CHAPTER V:
INVESTMENTS IN THE EUROPEAN GREEN MARKET. THE CASE OF ITALY-INVESTED CHINESE ZOOMLION

In the past chapter we have seen the case of Loccioni, an Italian enterprise entering the Chinese market. In the present chapter, we will look at the case of Zoomlion, Chinese giant entering the European market. Of course, cases are different: on the previous chapter we have studied a direct investment by a small-medium sized European company attracted by the dynamic market situation in China, which chose the opening of a commercial branch as its entering strategy. In this chapter, we are talking about a huge structured Chinese company, attracted by European technology, brand and knowhow, which acted by acquiring the Italian leader company CIFA.

5.1 Chinese green firms investing in Europe

Emerging market multinationals is an increasingly important phenomenon within the international scenario (Hennart, 2012) and in particular China, which is an ever growing source of direct investments (Atherye and Kapur, 2009).

Exhibit 26: China OFDI from 2002 to 2014 (billion of US dollars)



Source: MOFCOM, 2015

As we can see from Exhibit 26, outward investment flow has been unceasingly growing from 2,7 billion USD to 123 billion in 2014.

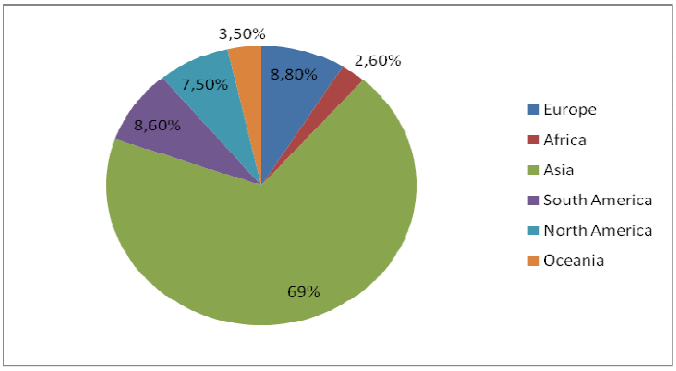
A growing specialized literature is addressing such an astonishing trend, which cannot be fully explained by the traditional motivations for FDI, as far as the long-standing literature on this theme was initially focused on explaining the location choice determinants of investment by western multinationals (McDougall, 1960; Kemp, 1960; Hymer, 1974; Kindleberger, 1969; Buckley and Casson, 1976; Dunning, 2002).

Usually, in fact, OFDI from emerging economies tend to target developed economies assets with the aim to leverage new technological capabilities (Wright et al., 2015).

Such an asset-seeking motivation, anyway, is not sufficient to explain as a whole the motivations behind the choice by Chinese multinationals to "go global". The choice to invest abroad, in fact, can be the result of a concurrence of push and pull factors, where the former are represented by home factors -such as government support in going abroad-, while the latter refer to host country's factors -such as specific assets- that embody the opportunity to invest (Wei and Alon, 2010).

As for the Chinese OFDI the support by government is a crucial "push" factor over a four decade history that goes from tight control in the pre-opening reform era to the "going global" policy, which was officially embraced by the Chinese government at the dawn of the new millennium (Yang and Stoltenberg, 2012).

Exhibit 27: Geographical distribution of China OFDI (2014)



. **Source**: MOFCOM 2015

Chinese OFDI were addressed, in 2014, mainly towards other Asian countries (69%), while the remaining quota was distributed for the main part amongst America (Northen and Southern) and Europe, which received a 8,8% of the total investment. Africa and Oceania close the list.

The European member States that received the largest amount on China OFDI are UK, Germany and Holland, which in 2014 accounted for the 48% of the whole European quota (MOFCOM 2015).

As we stated above, the main reason for emerging economies –like China- direct investment towards western economies is the exploration of technological assets in specific advanced industries. Green sector, more than a specific industry, should be assumed as a transversal category that can be applied to each process and industry which complies with environmental friendly practices (Lynn et al., 2014). Energy, construction, manufacture, food processing are just examples of sector that may be highly influenced by such an approach. The cooperation in this field between China and EU has then a vast potential, being China and EU the world top investors in many of the green related sectors, like renewable energy (Lv and Spigarelli, 2015).

5.2 Zoomlion corporate background

Zoomlion Heavy Industry Science & Technology Development was founded in 1992[64]. The main sector of engagement is related to the development and manufacturing of high-tech equipment for infrastructure construction in the areas of building, energy, environment and transport engineering. Since its foundation, the company showed a strong growth performance (with a more than 50% yearly growth rate), arising as the world's fastest growing construction machinery producer. Born as a public-owned research institute, Zoomlion moved towards a mixed ownership structure, becoming the world's sixth largest and China's biggest player in the construction machinery industry and one of the world's top performers (on 2013 was ranked as 779th on the Forbes Global 800).

With its 12,8 billion USD turnover and its almost 1,4 billion USD profits on 2013, Zoomlion is thus one of the world leaders in concrete machinery and hoisting machinery

[64] For a thorough reconstruction of Zoomlion corporate history, refer to Zoomlion institutional website http://en.zoomlion.com

segments, employing nearly 30,000 people, owning property rights in 13 major categories and distributing nearly 800 products over the global market.

One of its main competitive advantages could be found in the quality of its organizational structure that effectively and dynamically combines finance strategy, mostly by mean of strategic M&A -both in China and worldwide- with enhanced R&D capability. One of the most important examples of this strategy is the acquisition on 2008 of the third world biggest concrete machinery producer, CIFA of Italy.

It is thus clear that the internationalization process constitutes *per se* a competitive advantage. By the acquisition of strategic asset throughout the world, Zoomlion not only enhances its know-how and technology equipment (asset-seeking purpose of outward investment) but also achieves the access to international markets (market-seeking purpose), by an ever-increasing capability in expanding and integrating manufacture, sales and service processes. This can be made by both exploiting the already existing business relations within the acquired units and by the constant enrichment and innovation of the corporate culture consequent to the integration of overseas resources.

At now, Zoomlion accounts for 13 industrial and technological parks in China and subsidiaries in more than 40 countries serving customers from more than 80 countries. While manufacture of spare parts follows a resource-seeking logic of investment, production of advanced components leads to asset-seeking investments: the first is thus more located in West, South, South-east Asia, while the latter is more concentrated in North America and Europe. As for R&D, the international structure is more market-oriented by placing research centers as closest as possible to customers. Global expansion goes all along with business development, through the opening of new business lines. On 2013, Zoomlion planned to move its focus from the mere development of construction machinery to further sectors, namely agricultural machinery, sanitation, heavy trucks and finance.

Within the whole company process, safety, reliability and green technology are key purposes: as R&D is at the core of the organizational structure, manufacturing, logistics, sales and services are centered around the leading orientations of being green, smart and reliable, in order to fit as much as possible with customer expectations and values. Thanks to its expertise, Zoomlion plays an active role in international standardization,

performing key roles in some ISO technical committees. A concrete example of corporate orientation towards efficient, smart and green processes can be found in a recent product that Zoomlion developed in collaboration with its Italian subsidiary CIFA. On 2013 they have jointly developed a carbon-fiber reinforced polymer boom pump truck; by 40% lighter (and then energy saving) than previous technology-based tools, it is a perfect example of Zoomlion's idea of how innovation, leading to technical efficiency, can be naturally consistent with environmental compliance.

5.3 The motivations for investing in the green sector in Europe

Generally speaking, there are several reasons for which a big-sized Chinese company could find interesting the investment in Europe. First of all, Europe is a big destination market. With more than 504 million inhabitants, spread over 28 member states, Europe is one of the world widest countries, the biggest within the so called developed countries. Its market is diversified, as well as its resources, ranging from mature and emerging areas. Europe, namely the EU, is thus a very interesting solution for those Chinese firms who are willing to invest abroad in order to enter new market and/or escape domestic saturation[65].

Another reason that may lead Chinese firms to going to Europe is related to the strategic aim to sourcing intangible assets, like new technology and know-how[66].

According to the literature on Zoomlion acquisition of CIFA, Zoomlion entered the European market for both reasons. Especially for what that concerns the green sector, Europe has a big international competitive advantage, while China has one of the world biggest potential demands for green technology and solutions. Especially Zoomlion headquarter province, Hunan, is one of the most polluted areas of the country and growing attention and resources placed by the government for environmental protection and remediation (both at national and local level, see Chapter 2) will constitute a prospective huge business opportunities, worth to bet on. According to Zoomlion's top

[65] Francesca Spigarelli, Ilan Alon, Attilio Mucelli (2015). "Chinese M&A in Europe", Journal of Global Competitiveness 07/2015; 25(4), pp. 346-370.

[66] Rui, H. and Yip, G.S. (2008). "Foreign acquisitions by Chinese firms: a strategic intent perspective", Journal of World Business, Vol. 43, No. 2, pp. 213-226.

manager Kenny He[67], there are several technologies, within the green sector, that the Group is interested to develop.

1. Waste differentiation line systems

2. Heavy metals recycling systems

3. Urban garbage disposal systems

All of these technology and know-how can be found in Europe, according to Kenny He. Beyond technology and know-how, the acquisition of Italian CIFA by Zoomlion brings to the Group another important asset. As an article of the Economist puts it[68], this M&A has brought Zoomlion also a benefit in terms of a internationally well recognized brand, extremely expendable both in China and worldwide. This is a relevant asset and strategic point, common to many Chinese outflow investment69. However, the importance of the acquisition of such an important asset is supposed to benefit the company not only with reference to international development strategy, but also with regards to China national market. These two targets are not separated but are to be analyzed as two faces of the same coin, where national competitive advantage are maximized within the operation structure. The concrete proof of this intention is given by the internationalization pattern experienced by Italian CIFA after the acquisition by Zoomlion, when, in 2009, it ran a controlled NewCo in China for the assembly in China of Italian designed machines (as if it was a factory in the factory). This pattern was pursued in order to combine and maximize the competitive advantages from Italian technology and brand with China low-cost and high-efficiency operations. The NewCo, in fact, which from its factory in the factory status turned to be a separate company -CIFA Hunan-, although is technically speaking a Greenfield investment was supported by Zoomlion during the entry phase and operates in the Chinese market with the double brand Zoomlion-CIFA (with exception for some products that target to European market bearing only the brand Zoomlion). This

[67] Kenny He is Zoomlion's Vice-President, statement released during on-field enquiry.
[68] Streaks of Red, Capital and companies from China are sidling into Europe, Jun 30th 2011
[69] Morck, R., Yeung, B. and Zhao, M. (2008). "Perspectives on China's outward foreign direct investment", Journal of International Business Studies, Vol. 39 No. 3, pp. 337-350.

reverse internationalization pattern is not intended to end its effects within the Chinese market but it lays at the core of Zoomlion development strategy towards international markets, as we will see in the next paragraph.

5.4 Zoomlion's international development targets

Zoomlion, just like the most of big Chinese enterprises, undertook its global expansion starting from a leading position in its country, thanks to the high reputation obtained through its involvement in many national infrastructure construction works and engineering projects in the energy, environmental and transport sectors. According to Spigarelli's analysis[70], however, managerial skills, distribution and service network are the main disadvantages if measured in relation to the highest global market standards. Product portfolio and brand value, prior to the acquisition on CIFA, were also insufficient to meet the demand from the world most advanced countries. In other words, international business development potential was somewhat low, in spite of financial capabilities (Zoomlion on 2009 was ranked as the world tenth biggest construction machinery manufacturer).

The acquisition of CIFA is supposed to be beneficial under many points of view. Before being acquired by Zoomlion, CIFA was the third world most important concrete machinery manufacturer, with leading position in pump and mixer segments. The most important asset of CIFA, moreover, was a top-class R&D department, that acted as the core for business innovation and company competitiveness. A delocalization strategy brought CIFA, over years, to build up an international network in those markets in which it operated, such as Europe, Middle-East and North Africa.

Internationalization, thus, appears as a strategic key point for Zoomlion, that relies on increased international brand value, wider product range, managerial skills and international network acquired by CIFA. Anyway, it is worth to point out again, as introduced in the past paragraph, that the acquisition has not only the aim to further the company international development path in a fast changing world, but also to face the dangers coming from the China internal situation, where the gradual shifting of China national system towards a new and more sustainable paradigm, by means of measures

[70] For an in-depth SWOT analysis of Zoomlion and CIFA, refer to Spigarelli et al., ibidem.

–amongst the others- like the promotion of a stronger internal market and the introduction of environmental protection rules, will generate new costs and erode the base of past group competitive advantage. Low raw materials and low manufacture costs, depreciate national currency and indulgent environmental regulations are likely to not last on the long run and cannot be taken for granted as a matter of fact on which a long-termed strategy can rely on.

All of this is, of course, very clear to Zoomlion top management eyes, as we can understand from their international and financial targets that aim to make of Zoomlion one of the top five world leading players by 2015 and to diversify the group turnover, contributing by 40 percent through international sales. These international development targets are intended to be pursued by a strategy that includes some key actions, which will be carried out by means of CIFA Hunan. Amongst these actions, we can list:

• entry of Zoomlion into the Indian market, steered by CIFA;
• opening of a factory in Brazil, to support Zoomlion. Plans are underway to set up a factory for the production of Zoomlion and CIFA branded machinery;
• strengthening of operations at the CIFA Latin America branch, which works as an assembly plant;
• opening of branches in Germany, Russia and Turkey;
• launching of an R&D centre in Germany to more closely monitor the German competitors.

5.5 The main business areas of the investment in Europe

Zoomlion has stated as its corporate targets to achieve, by 2015, the following aims:

- drive the concrete business unit to be No. 1 in the world;
- be in the top five players in the cranes business;
- be in the top ten players in the sanitation and road machinery;
- develop a significant presence in the earth moving machinery;

In order to make these targets come true, the role of corporate strategy in Europe, to be carried out thanks to the asset contribution from CIFA, will be critical, both on market share improvement and technology capability enhancement.

As for concrete machineries market share, CIFA –at the time of the acquisition from Zoomlion- had the 70% share on the Italian market and approximately the 20% share in Western Europe[71].

5.6 Normative provisions that supported Zoomlion move to Europe

When Zoomlion acquired CIFA, on 2008, the investment regulations were disciplined, as it currently still is, by the China-Italy Bilateral Investment, signed in Rome on the 28th January 1985 and come into force two years later, on 28th August 1987. Such a treaty, signed more than 20 years before the acquisition, can hardly constitute in itself a key factor in Zoomlion strategy towards Italy. Nevertheless, some of its statement, if read along with further epochal events (like the China accession to WTO on 2000), can be considered as relevant for a Chinese enterprise investing in Italy. The China-Italy Treaty, in facts, in spite of its shortness, provides some basic tools, like investment protection, MFN (most-favoured-nation) clauses, profit repatriation and a controversies settlement framework.

MFN treatment, in particular, is important under the light of China accession to WTO on 2000, as it includes and strengthen what is provided by the first article of the General Agreement on Tariffs and Trade (GATT), the Article 2 of the General Agreement on Trade in Services (GATS) and the Article 4 of Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), that put together, cover all three main areas of trade handled by the WTO.

Anyway, if no important incentives to invest are introduced by the above mentioned bilateral Agreement between China and Italy, it would be useful to spend a couple of words on the implications related to the absence of a China-EU bilateral investment treaty.

China and EU are negotiating, in facts, during the last three years, a bilateral investment

[71] CIFA USA press release 24 feb 2009.

treaty that should replace all the national bilateral agreement now running between EU member states and China. The Lisbon treaty states that foreign investment regulation is an exclusive matter of EU:

> *1. The common commercial policy shall be based on uniform principles, particularly with regard to changes in tariff rates, the conclusion of tariff and trade agreements relating to trade in goods and services, and the commercial aspects of intellectual property, foreign direct investment, the achievement of uniformity in measures of liberalisation, export policy and measures to protect trade such as those to be taken in the event of dumping or subsidies. The common commercial policy shall be conducted in the context of the principles and objectives of the Union's external action. (Lisbon Treaty, art. 207, clause I)*

The direct implication of this regulation is that member states cannot close any similar agreement with China or any other foreign country, nor amend to the existing ones. This could be seen as a big limit to EU-China economic relations, when considering that national agreements are dated, like in the case of Italy, even decades back and often are not anymore adequate to regulate the current situation, that is completely different in quantity and quality with respect to just few years ago. On the other side, its absence could paradoxically play a positive incentive for investment from China, from a country-level perspective: once it is taken for granted that investment are protected by member states treaties and by WTO regulations, China would likely to be preferring to dialogue with single national states, instead of EU as a whole, because of the bigger bargaining power that it would be able to exert. Anyway, the emergence of a series of big deals, such as the Transatlantic Trade and Investment Partnership (TTIP), seems to have changed this situation, as China's long-termed go-global strategy shifts from resource producers to developed markets and -as the RMB gets stronger – China increasingly needs to invest in Europe. Such an important agreement is expected to be coming to its closing in a not far future, as negotiations are proceeding well, according to recent official declarations by the two parties involved[72].

[72] Xinhua, 5th May 2015, Article on China-EU negotiations for a bilateral investment treaty.

5.7 Main obstacles and challenges of operating abroad

A study by KPMG International dated 1999 shows that 83% of M&A fail to create the intended value[73]. Mergers and acquisitions are intended to create value, by mean of the matching of companies' respective competitive advantages, technologies and by eliminating competition. Nevertheless, many companies underestimate the problems that can come from an acquisition process, resulting in a "2+2=3" effect, whereas the initial plan was rather aimed to obtain a "2+2=5" effect[74] [75] [76].

In any acquisition there is the risk of a cultural conflict between the two existing organizations, as largely discussed in the literature, whereas two different corporate cultures are induced to fuse[77]. In the case of cross-border mergers and acquisitions, these problems can be even doubled, because of the double-layered nature of the process of acculturation[78] as beyond different corporate culture, many generic barriers can intervene within the process, such as cultural barriers, language problems, different legal systems[79].

This is of course the case of 2008 acquisition of Italian CIFA by Chinese Zoomlion: the 1° Chinese concrete machineries manufacturer, 5° in world raking, acquires one of its most important competitors, ranked 3° in that world market segment, with the clear and somewhat consequential aim to gain a world leading position.

Anyway, as previously discussed, it is not just an arithmetic sum game: two different corporate cultures, different scales, coming from extremely distant cultural, institutional and business environment, cannot simply amalgamate just by changing the corporate logo on personnel business cards. Concretely speaking, there are several business processes within the new organization that should integrate together for a successful merging of the two different original entities. Amongst them, we can identify as the most important for

[73] KPMG. (1999). Mergers and Acquisitions: Global Research Report 1999. London: KPMG

[74] Appelbaum, S.H., Gandell, J., Shapiro, B.T., Belisle, P., Hoeven, E. (2000). Anatomy of a merger: behavior of organizational factors and process throughout the pre-during-post-stages, 670-684

[75] Cartwright, S., & Cooper, C.L., (1993). The psychological impact of merger and acquisition on the individuale: A study of building society managers. Human Relations, 46, pp. 327-347

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[78] Barkema, H. G., Bell, J. H., & Penings, J. M. (1996). Foreign entry, cultural barriers, and learning. Strategic Management Journal, 17(2), 151-166.

[79] Shimizu, K., Hitt, M. A., Vaidyanath, D., & Pisano, V. (2004). Theoretical foundations of cross-border mergers and acquisitions: a review of current research and recommendations for the future. Journal of International Management, 10(3), 307-353.

the new corporate soul: R&D, marketing, sales and communications[80].

R&D, as we analyzed before, is placed at the core of the strategic intent by Zoomlion to acquire CIFA, so we can state that is the most important process to be integrated. Differences between the two companies were enormous: on the one hand the knowledge gap that existed in different business areas (while Italian side had more knowledge about international markets, Chinese side was technologically more advanced in selected areas), on the other hand the deep disproportion in size between Zoomlion personnel (400 engineers) compared to CIFA's (10 times lesser than the Chinese counterpart). Throughout a redefinition of the organization charts and frequent meetings eased by the introduction of expert engineer profiles charged to act as a both linguistic and technical interface, the integration of this business area has been successfully achieved.

As for marketing, while a double strategy was at the initial phase agreed between Zoomlion and CIFA, where they respectively addressed the low-end and the high-end of the market, in a second phase and for Chinese market, a double brand strategy has been undertaken. Coherently with this strategy, the sales process has been organized by charging CIFA of the coordination of international markets, even for Zoomlion branded products, with the exception of Asian countries and –of course- China, where Zoomlion continues to manage the sales department, even for co-branded and CIFA branded products. All of these processes described above have been pursued by means of the redefinition of the internal communication, through an intense flow of reports, on a weekly base, and a weekly newsletter, translated into Chinese, from CIFA to Zoomlion.

[80] Daniela Grancini, Vito Minunni, Attilio Mucelli, Francesca Spigarelli, "CIFA, The winning anomaly, From the American seed to the "Chinese Century", Tecniche Nuove, 2012.

CONCLUSIONS

In the first three chapters of this work we have seen how environment protection has been becoming a more and more key priority within the Country's policies. From the early stages of People's Republic of China foundation, during which environmental protection legislation was not developed at all (or nearly) and ideology excesses conditioned the overall existence and effectiveness of the rule of law, to the reform era, from late seventies, in which environmental protection normative developed alongside (and sometimes despite of) the economic development, until nowadays, when the country's shift towards a new economic and social paradigm is putting the environment protection as one of the most important challenges for the future. The analysis of the evolution of the normative over time, moreover, teaches us to never forget its relation with concrete political, institutional and social environment: facets like the rule of law, conflicts on law production and enforcement competencies amongst organs and departments, between national level and local level government institutions, that often reflect the conflict and problematic coexistence between opposite interests and objectives (like in the case of economic growth and environment protection) are likely to dramatically impact the final outcome of policies and the actual impact of normative on real life.

For a small or medium European enterprise is of vital importance to have a full understanding of these dynamics when evaluating its strategy to China and planning its entrance to the market. Just as have we seen in Chapter Two, the production of a thorough normative that compel monitoring of pollutants will have no or few effect if implementation measures are not effective, just like in the case in which misbehaviour costs are lower than compliancy costs.

In chapter two and three we understood that it is important to keep in mind that all the above listed facets are likely to vary the intensity according to the geography. There is not one only China and one of the possible shortcomings of a strategy to China is to not consider the peculiarity of each region, as for both opportunities and obstacles.

The institutional barrier is in fact one of the most important, as reported in the case of Loccioni (Chapter four): overall institutional and normative structure is rapidly changing in China but slow bureaucracy, lack of transparency, uncertainty, low rule of law are all

facets likely to affect and harm the business of foreign companies in China, and should be enumerated as factors of risk, above all for small and medium enterprises with relatively short financial resources.

The case of CIFA acquisition by Chinese Zoomlion highlights also that the opportunities are not only limited to Chinese local market but also more complex schemes, in which Chinese side financial strength and interest in European technology, know-how and intangible asset –backed by the State- can represent an opportunity for European companies international development, by providing them privileged access to Chinese market and financial resources.

A shared point that links Loccioni and Zoomlion cases is the identification of cultural and linguistic barrier as one of the most important obstacles in EU-China cooperation projects, no matter if we are talking about the activity of a small-medium sized European invested branch devoted to business development in China either if we are talking about a Chinese giant carrying out an acquisition of one of the most important European enterprises of its sector: cultural and linguistic misunderstanding are always a threat to success that can hardly be overestimated both during planning and during implementation.

An important role can be played by the institutions. Today it is possible to observe a growing activism by decentralized institutions as international diplomacy players. With a better understanding of local reality and local-level related issues, they can be give a precious contribution in reducing the cultural gap and prepare the ground for business development, by establishing relevant and friendly relations, that are crucial –as we have seen- in the peculiar context of Chinese culture and business environment, which need for a long-timed commitment.

The cases of Loccioni and Zoomlion in particular, and the study of environment law formation and administration in China, conducted in the first three chapters of this works, highlights also how important is having a long termed strategy. Policies in China are set on the medium and long term, as we have seen in the first three chapters, and the business environment heavily rely on the building of relational network, with an important role played by the institutions, as the case of Loccioni teach us. In such a context, it is impossible to figure out a strategy on the short term. After all, the world's biggest market represents an opportunity that is probably worth the time and effort.

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