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**1st Austrian Conference on International Resource Politics - Towards International Resource Fairness - Theories, Conflicts and Policies**  
 Vienna, 4-6 December 2014

### **The fire of the dragon – on the metabolism of the world factory - national framework and global implications**

#### Abstract

*China is expected to reach 2014 to overhaul economically the United States in 2014. However, the US has less than a quarter of the population of China. On the other hand, the huge potential of further catching up is made clear. China all in all is not a poor in total resources. It has significant shares in global production of many (mineral) commodities. China can meet the domestic demand in 2010 at only eleven of 45 mineral resources, probably in 2020 only at nine, and at only two to three in 2030. By the foreseeable higher dependence on foreign resources still higher cost will arise. This "will seriously effect economic security and may cause complicated international relations and endanger political security". Key factors for understanding the resource situation of China are the very high population density in most eastern parts of the country, the total size of the population, the sectoral dominance of the industry with a focus on export (world factory), rapid urbanization and the (time-compressed) rapidly industrialization and catching up together with other major emerging countries. Most resources that China buys and imports in general tend to rise in price, while the prices of most products currently sold and exported from China fall in general. However, the import dependence on raw material is somehow similar to other Asian countries, with the positive significant difference that China has a certain self-sufficiency for most commodities.*

*The development of steel production in China as a very important energy- and resource-intensive sector has shown previously unseen dynamics as from about 2000 with significant effects on the global input and output markets and may also apply to other industries in China as a paradigm. The Chinese share of global steel production in 2013 was 48.5%, which were 779 million tons. The quantitative development in the last 15 years is stunning (and breathtaking is also the air in steel regions). The balance of the steel export currently is small in relation to the Chinese production, but is top in the global comparison. These very different relations of the shares related to China versus to the World Trade reflect a more general phenomenon, which is found more often at commodity markets: changes in the export-import balance, which can be small to the total Chinese production or consumption can have a serious impact on the world market. Ultimately, however, the global message of the dramatic take-off of the Chinese steel industry is that this is the first major non-OECD country that could realize large-scale full-fledged industrialization. After this paradigmatic breakthrough lowering the dams for*

*other developing or emerging countries, further similar resource-intensive national development paths are highly probable.*

*Obviously, the major stakeholders in China envisage the broadest possible diversification of supply sources. Meanwhile, the foreign policy is actually heavily influenced by commodity interests. The fact is also that for many resource rich countries in South America and Africa the Chinese demand on the resource markets at least has reached the quantity of the western countries, and this has improved the market position of the resource rich countries considerably. The dominance of oligopolies in most commodity world markets has confronted large Chinese companies with severe price-setting behavior, e. g. in the market of iron ore, where three large corporations dominate.*

*The "resource curse" is somehow modified in China and in addition to the working conditions confronts the environmental foundations of human life. Calculations at the (monetary) valuation of the externalized damage to the natural resources and the environment in China cannot surprise: a significant portion of the GDP growth rates of recent decades is counteracted. There are even calculations that in an integrated approach only a very small portion of GDP growth would be left as a "real" economic growth.*

*In the current Chinese development after the (colonial) European and Japanese expansion in China, after periods of wars and after failed trials of catching up like the Mao-"Great Leap Forward" now we can see really see a great leap that likely will restore the global position of China as the former largest economic power. China is the main cause of the recent commodity boom since around 2003, but not the sole cause for it. The industrialization of China met a new historical context in relation to resources: During the industrialization and long afterwards the European countries have had resources at "colonial terms" available.*

*There had been a historical "inner expansion" in China. In China in comparison to Europe the focus has been more on the soil and resource productivity.*

*Indicators with Chinese characteristics were created for the use of resources - tailored to the specific conditions, also historically comparative indicators. "Cumulative use of resources per head" can show, inter alia, the level of industrialization.*

*Blocking factors for socio-ecological paradigm shift can be analyzed also for China with the concepts of "lock in", "vested interests", "path dependence", "sunk costs", rebound effects and oligopolistic market power. However, the strong momentum of China's development also seems to enable faster breakthroughs. From the analysis of the backgrounds of the current dynamic development of China it can be deduced that this dynamic process is likely to continue longer.*

*As a conclusion the following hypothesis can be formulated:*

*The chances of a basic socio-ecological paradigm shift are mid- or long term perspective are high in China, because there is hardly no other big region around the world, where the socio-ecological problems and the pressure due to the special population density and the density of economic activities within the existing development model will concentrate so strongly. The increasing pressure that results from this situation which will be continuously aggravating (politically rather from the emission side, in economic terms from the resources side), the existential necessity on the one side and on the other side comparatively favorable conditions for development of "human capital" (management of disasters in the history of China), the available options of macro control and the presence of*

*significant domestic markets can promote the emergence of a sustainable development paradigm. And – out from some “wave” analysis of Chinese history of the 20<sup>th</sup> century - maybe in a swing back after a capitalist dominated period a socio-ecological transformation and a new stage of socialism will be combined in some sort of eco-socialism because both are/were vitally important for the Chinese population.*

## **The fire of the dragon – on the metabolism of the world factory - national framework and global implications\***

China is expected to reach 2014 to overhaul economically the United States (Bank of Finland 2014) - quantitatively measured by traditional GDP in purchasing power parity (PPP) in 2014. However, the US has less than a quarter of the population of China. This on the one side clearly shows the big remaining gap per capita on: Even with continuing high GDP growth rates or significant differences in growth rates compared to the West, China is still far from catching up and thus obtaining the US level. On the other hand, the material dimension of the current GDP in China and especially the huge potential of further catching up is made clear.

China all in all is not a poor in total resources. It has significant shares in global production of many (mineral) commodities (Schatz et al. 2013). However, considerable problems of resource supply have been predicted since many years: "The recoverable reserves of major essential resources: such as fossil fuels, iron, manganese, chromium, copper, bauxite and sylvite will have big shortage to meet the needs in future and the shortage will become bigger as well as the dependence on the world market will become more bigger"(Wu and World Bank, Environment & Social Development Sector Unit (EASES), Eastasia and Pacific region 2006a: S 3).

China can meet the domestic demand in 2010 at only eleven of 45 mineral resources, probably in 2020 only at nine, and at only two to three in 2030. By the foreseeable higher dependence on foreign resources higher cost will arise. This "will seriously effect economic security and may cause complicated international relations and endanger political security" (Wang, Huang and Craig 2007). Key factors for understanding the resource situation of China are the very high population density in most eastern parts of the country, the total size of the population, the sectoral dominance of the industry with a focus on export (world factory), rapid urbanization and the (time-compressed) rapidly industrialization and catching up together with other major emerging countries.

### **Rising import prices, declining export prices**

This situation is symbolized by the fact that China until the early 1990s was oil exporter, and currently is about to become the largest importer of oil, although oil has an overall comparatively below-average share on total energy consumption. However, the import dependence on raw material is somehow similar to other Asian countries, with the positive\_ significant difference that China has a certain self-sufficiency for most commodities.

The special scale of the Chinese working force and the comprehensive possibility of realizing economies of scale (mass production) and economies of scope (advantages of compound production),

combined with a large integrated home market are key factors for the dynamics of the Chinese economy. But in the current global configuration and the actual positioning of Chinese production (still) mostly in lower levels of global value chains also are also disadvantages have mentioned: the lower levels of the value chains typically consume a lot of resources, but invest little in design, development and marketing. Most resources that China buys and imports in general tend to rise in price, while the prices of most products currently sold and exported from China fall in general. Within this general constellation the "Rare Earth" is a (temporary) exception although a strategic policy of building the option of market power in this sector has been pursued. But rather as a trump card in general conflicts over resources in order to be prepared for counter-actions. The basis for this option of market power were also lower prices until the mid of the last decade, implicating only small profits at the extraction of rare earths in the context of global accumulation. Additionally on the one hand China's orientation to cover as wide a range of economic sectors was relevant and on the other hand a competitive advantages through the wage level and last but not least at the expense of the environment. However, these benefits currently can be undermined by investments in this sector in other countries.

## **Steel production as a breathtaking paradigm**

The development of steel production in China as a very important energy- and resource-intensive sector has shown previously unseen dynamics as from about 2000 with significant effects on the global input and output markets and may also apply to other industries in China as a paradigm. The quantitative development in the last 15 years is stunning (and breathtaking is also the air in steel regions). The Chinese steel production from 2000 to 2013 multiplied about 6 times. The Chinese share of global steel production in 2013 was 48.5%, which were 779 million tons (million t in each case comparisons: India 81, Germany: 43, Austria: 7.4) (World Steel Association 2014). Note: During the failed "Great Leap Forward" in China steel production was intended to be doubled from about five to ten million tons.

China in 2012 was the world's biggest steel exporter with some 55 million t; regarding the balance with 13.6 million tons of imports China is also the biggest steel net exporter (World Steel Association 2013: 20-25); proportionately in relation to the total steel production in China this balance, however, in 2012 is only 5.6%. So the balance of the steel export is small in relation to the Chinese production, but is top in the global comparison. These very different relations of the shares related to China versus to the World Trade reflect a more general phenomenon, which is found more often at commodity markets: changes in the export-import balance, which can be small to the total Chinese production or consumption can have a serious impact on the world market.

Although China still has large reserves of iron ore, and the country in the production of iron ore has the global third rank after Australia and Brazil, but the majority of Chinese iron ore has low ore portion (average 28%) (cf. 65% in Australia or South Africa). So China imported 745 million tons of iron ore in 2012, this was 62% of the global total imports of iron ore; 2011, the share of imported iron ore on total use in China was at 68%. For 2013, these shares are probably still higher by the increase in steel production by 7.5% (World Steel Association 2013: pp. 20-25). Almost half of China's iron ore imports come from Australia. A resultant attempt by the Chinese to buy shares in the relevant production in Australia some years ago was prevented by the Australian government. Regarding coking coal, which also plays an important role in steel production, China has, however, the provision of domestic production is near to 90%; imports (especially from Australia) are mainly due to price factors.

## Who follows after the breakthrough?

If the steel production per capita in Japan or South Korea would be taken as a benchmark for China, China definitely would have still significant growth potential. But central political authorities since some years have been intending to limit steel production in terms of quantity because of many purposes but especially for the purpose of upgrading. But the decentralized decisions at the provincial level, however, run counter to this orientation. Of course, also the maintenance of the high current level of production of steel is by no means certain: reasons are supply problems with iron ore, no further expansion of commodity-intensive infrastructure investments after reaching a high current level, the orientation to higher levels in the value chain, higher raw material efficiency targets, not least the environmental and health problems and climate policy targets.

Ultimately, however, the global message of the dramatic take-off of the Chinese steel industry is that this is the first major non-OECD country that could realize large-scale full-fledged industrialization. After this paradigmatic breakthrough lowering the dams for other developing or emerging countries, further similar resource-intensive national development paths are highly probable. Thus, a similar development in India has a comparable potential, with further huge commodity flows. Because the steel production is one of the few industries, in which currently actually there are limited technological alternatives and so for the foreseeable future even with technological improvements, a very high amount of inputs of raw materials and energy is (with significant environmental effects) would be necessary. This also dramatically raises the questions of commodity and environmental limitations and fair global distributions of resources that are required by a modern infrastructure, which is existing in the global North.



From Ameling Dieter (20./21.9.07): *Die Rolle Südost-Europas im Umfeld globaler Stahlmärkte. Vortrag Stein/Nürnberg. Stahlinstitut*

## ***China dominates the nonlinear development of the world steel production - who's next?***

The political leadership of the PR China has an awareness of the potential problems arising from the volatility of this situation, and also of the threat to the stability of the development in China. The most relevant institution in this context, the National Development and Reform Commission (NDRC), obviously is coordinating comprehensive plans and measures to secure the supply of raw materials by (long-term) contracts and investment perspective - though not in transparent mode. - The NDRC since some years has also the responsibility for recycling and more generally the "circular economy" (Zhu 2008: S 2). However, there is only a limited coherence between resources policy and other policy areas - as in the EU.

### **Diversification and fierce oligopolistic battles**

Obviously, the major stakeholders in China envisage the broadest possible diversification of supply sources. Meanwhile, the foreign policy is actually heavily influenced by commodity interests. The fact is also that for many resource rich countries in South America and Africa the Chinese demand on the resource markets at least has reached the quantity of the western countries, and this has improved the market position of the resource rich countries considerably.

One aspect of volatility is the development of prices. In the extractive industries we can see significant global economic concentration, both statically and dynamically. The dominance of oligopolies in most commodity world markets has confronted large Chinese companies with severe price-setting behavior, e. g. in the market of iron ore, where three large corporations dominate (BHP, Vale, Rio Tinto).

### **External extractivism and curse of the emissions**

It would be inaccurate to call the Chinese model extractivist, because its core is the industry. It is, however, triggering "external extractivism" and Chinese companies and shareholdings play an increasingly important role in this context – 2014 formal permissions for foreign investments for Chinese companies by Chinese authorities were lifted, and outward investment for the first time outperformed inward investments for some months. Different effects of Chinese investment in commodity industries are discussed increasingly in international debates.

Chinese companies abroad are confronted with social movements in the field of resources. Protest movements and social struggles in the environment and natural resources sector in China do not only regard harmful emissions (as there has been protracted resistance against incinerators), but especially the actually scarce resource land in China. Triggers are expropriations, low compensation and an often very rigorous approach of the authorities. Sometimes these conflicts are carried out militantly from both sides; the powerful tradition of peasant revolts in Chinese history is an implicit reference point for social movements and protests.

Ten years ago the number of casualties in accidents especially in coal mining were in the hardly imaginable range of a few thousands per year, but dropped in recent years due to health and safety

measures and technology development to about a thousand deaths per year. Coal currently accounts for about 70% of total energy consumption. Coal can be covered for the very most part from its own resources, and that will hold still for a long time. However, coal at the same time has caused the biggest environmental problems in China, mainly because of the impact on air quality. Spacious smog events observed over very wide areas reinforced further by the emissions from transport have led to a certain awareness of this problem in Northern China .

The "resource curse" is somehow modified in China and in addition to the working conditions confronts the environmental foundations of human life: The "world factory" requires enormous input and there are correspondingly enormous sized emissions (into the air, water and soil), which has devastating effects on nature and health - due to the already high-intensive use of nature, the density of the population and the extent of economic activities. Consequently, calculations at the (monetary) valuation of the externalized damage to the natural resources and the environment in China cannot surprise: a significant portion of the GDP growth rates of recent decades is counteracted (World Bank 2007). There are even calculations that in an integrated approach only a very small portion of GDP growth would be left as a "real" economic growth (Wen et al. 2008).

## **China's current development as a result of waves of history – now there is e real Great Leap Forward**

In general the Chinese development is difficult to understand without consideration of history in a world systemic view (see (Wallerstein, Arrighi, Amin; eg Arrighi 2007). It is hardly possible to evaluate comprehensively the high GDP Rates of growth in the last 35 years - unique in mankind's history - without adequate consideration of the last 200 years in China. In the current Chinese development after the (colonial) European and Japanese expansion in China, after periods of wars and after failed trials of catching up like the Mao-"Great Leap Forward" now we can see really see a great leap that likely will restore the global position of China as the former largest economic power (Maddison et Wu 2006). In addition, the dissolution of the Soviet Union has led to far-reaching conclusions in the relevant political circles in China, among other things, that China at a similar backlash like Russia in the 90s in contrast to today's Russia could not rely on raw material exports, so it must push the industry to avoid the formerly experienced daunting dependency.

Already in previous eras, the industrialization of larger countries was associated with (moderate) resource price increases, first in Europe and then in the United States. After the decline by the crisis in the thirties of the last century again increases of resource price came across by the postwar economy and the rise of Japan. From the mid-1970s, the industrialization of the Asian "tiger" countries gained momentum, but their dimension worldwide carried low weight. Commodity prices, in fact, more or less remained low despite evidence of global resource limitations since the early 1970s. But the process of industrialization of China featured quite different dimensions, which were still aggravated by similar processes in other "emerging countries". "China is the main cause of the recent commodity boom since around 2003, but not the sole cause for it," stated the Federal Institute for Geosciences and Natural Resources, the Fraunhofer Institute for Systems and Innovation Research and the RWI Essen (2005). So the industrialization of China met a new historical context in relation to resources

## **No more industrialization at "colonial terms"**

But China's development today also shows some peculiarities. On the one hand this is happening at a higher level of industrial technology with higher resource productivity. On the other hand, the material

dimension compared to the (old) industrial countries is much greater - with all the effects on prices, emissions and "waste". So long ago foreseeable limitations now have become widely perceptible and visible. In addition there are the destabilizing effects of financialization and speculation. The alleged miraculous effects of a free (but de facto oligopolistic) market system by pricing in also all the foreseeable environmental effects and resource limits are at least doubted.

Today China is "in the middle stage of industrialization. During this development stage most industrial countries around the world have been experienced the rapidly increasing growth of energy and mineral resource consumption even more than the GDP growth. The economic infrastructure establishment of industrial society is based on the large amount of resource consumption. After the industrialization the mineral resources such as iron, copper and aluminum could approach stability. In recent years China is experiencing the fast growth of heavy and chemical industries and meanwhile the energy and mineral resource consumption are increasing quickly. The transition is similar to that of most developed countries experienced during their industrialization" (Wu Z and World Bank, Environment & Social Development Sector Unit (EASES), Eastasia and Pacific Region, 2006a). And more importantly, so Wu further: during the industrialization and long afterwards the European countries have had resources at "colonial" terms available.

## **Resource optimization in the historic "inner expansion"**

In the long Chinese history there has not been something similar like the Western global expansion not to say the comprehensive colonial system - excluding the actions against immediate neighboring countries. An interesting question would be why Western historians often puzzle over this Chinese non-expansion despite wide sea-voyages before Columbus and so take the expansion of European powers somehow as benchmark.

But somehow in an analogous sense there had been a historical "inner expansion" in China, which resulted in deforestation, using marginal land and a comparatively land and labor intensive agriculture. In China, the focus was more on the soil productivity (nutrient cycles and energy were optimized in order to increase yields per unit area), while in Europe rather the productivity of labor has increased (by the earnings per unit to maximize labor force). The very long records of agricultural knowledge on the conditions of ecological cycles in agriculture also enabled the long continuity of Chinese agriculture over 5000 years. Because of this specific use of labor China structurally came into a "cheap labor trap" (Elvin 1973), and so cheap labor slackened the driving forces for an industrial revolution in comparison to Europe in earlier centuries.

Arable land per capita in China now is less than a third of the global average. Nevertheless the feeding of the population is largely secured. The water resources per capita account for about a quarter of the world average. The forest area per capita is 0.13 hectares, a quarter of the world average, the annual growth of wood about one-sixth of the world average. These figures reflect on the one side the land use efficiency of Chinese agriculture, but on the other side the environmental limitations raise dramatically the problem of sustaining the natural production bases. So e. g., 18 Chinese provinces suffer from the advance of deserts.

The arable land of China has decreased only from 1996 to 2005 from 130 to 122 million hectares. The loss of (scarce) soil in the Chinese context has serious multiplied consequences. The soil is in distress on different fronts: by losses due to settlement and economic activities; by desertification and erosion; as a result of degradation by chemicalization, emissions and lowering of ground water by irrigation; by



the increasing meat production requiring a multiple of the territory in relation to plant nutrition; by increasing risks of droughts and floods due to climate change.

## **Urbanization and motorization as usual?**

China has been starting from a low rate of urbanization (so 2000 still only 36% of the population was living in cities) in a very rapid urbanization (now the rate is higher than 50%) - with high resource and energy consumption (high material input of steel, aluminum, cement) (Veeck et al 2007: S 233f).

Similar to the case of creating industrial capacity also the rapidly advancing urbanization accumulates and binds raw materials for a long time ("anthropological stocks"), and these stocks recycled after the end of their function. This implicates that the potential for recycling currently is comparatively low in relation to the total demand for materials in China, although this share will become larger because the current stocks are depreciating and will probably be then renewed.

The decision to comprehensive start of car production in the 90s can be explained in the context of the dynamics of global capital accumulation. The currently rapidly increasing car mobility and passenger car production is increasing resource and energy consumption, land use and air emissions. Under context of density in China this causes enormous stress and strains and recently for the first time there were significant discourses and growing awareness triggered by the giant smog situations in the north.

In China currently there is pragmatic approach to the resource question before. The challenges are usually taken seriously, however, until now there is no coherent policy: Muddling through, trust into the market forces and coexistence of different approaches : "But so far, there has been no uniform understanding on the concept and connotation of the resource-conserving society" (Yuan, 2010: p 141). Essentially, the resource prices (world) market-driven with some indirect subsidies; incentives through taxes or other steering systems are minimal. Overall, the incentives for resource productivity beyond market incentives are modest. Rough guidelines for evaluation- and development of cadres have a certain effect. The very rough targets in the last five-year plan (2006-2010) were mainly defined by intensity targets per unit GDP (such as 20% reduction in energy intensity, 30% reduction in water consumption per unit of value added in the industry, 10% reduction of SO<sub>2</sub> and COD emissions). In contrast to the GDP targets these relative targets were not achieved in main parts.

The circular economy development plan that implements the circular economy promotion law of 2009, was decided only at end of 2012. Nevertheless there are significant progress in resource productivity mediated primarily by investments with recent technology. But the simultaneous extension of accumulation and production exceeds these effects by far. The huge accumulation dynamics outperforms the usual rebound effect by far.

## **Indicators with Chinese characteristics**

2007 an attempt was made to improve the monitoring of resource usage, especially for levels of industrial parks. Indicators of resource productivity have been introduced (including coal, oil, iron ore, nonferrous metal ore, rare earths, phosphorus, sulfur, etc.) regarding mainly the value on the consumption of non-renewable resources (Zhu 2008: 5). The National Development and Reform Commission developed more specific indicators with support from the World Bank. A special set of indicators for the situation in China was constructed on the basis of existing indicators of the EU and Japan.

Tailored to the specific conditions of China a DMI (Direct Material Input) indicator was defined in a

way that mass materials such as sand are not included and there is a focus on 15 core resources. In contrast to Europe, the water resource has been integrated according to the specific Chinese problems. Fossil fuels (coal, oil and natural gas), iron, copper, bauxite, lead, zinc, nickel, chromium, manganese, potassium, tin, titanium, gold, rare earths, phosphorus, iron pyrite and limestone are involved in physical units (Wu and World Bank, Environment & Social Development Sector Unit (EASES), Eastasia and Pacific Region, 2006a). Like many other (proposed) institutional innovations introduced before the global economic crisis also this tool either has not effectively implemented or it has not been used transparently.

Wu Zongxin describes a historically comparative indicator for the use of resources. The "cumulative use of resources per head" can show, inter alia, the level of industrialization: For example: steel: UK 22 tons, USA 20 tons, Japan 17 tons; Copper: US 400 kg, Japan 220 kg. By 2005 for China the cumulative steel consumption per capita was only at 2.35 tons, and 26 kg at copper (Wu and World Bank, Environment & Social Development Sector Unit (EASES), East Asia and Pacific Region, 2006b: S 5f), Compare: in an average car 26 kg of copper are installed, in an average European one family house altogether there are 200 kg of copper (Rechberger 2009).

Wu Zongxin considers further the "per capita annual consumption peak level" on an annual basis. In 2004, steel consumption per capita in China was 230 kg and for copper consumption 2.5 kg. In the US and UK, the steel consumption reached peak between 1950 and 1970 at the range of 440-680 kg, and at copper peak was 1940-1960 at about 10-11 kg. In Japan and Korea steel reached peak levels between 1970 and 1990 from 600 to 900 kg, and the copper peak was between 1999 and 2000 at 12 to 29 kg. (Wu and World Bank, Environment & Social Development Sector Unit (EASES), East Asia and Pacific Region, 2006b: 6)

Against these comparisons in terms of the principle of "common but differentiated responsibility" can be argued that for a late industrialization due to the technical development today's resource productivity has increased so engulfing", and less consumption is necessary for the same purpose. Conversely, resources are now significantly more expensive.- And as a specific Chinese characteristic due to big exports resource consumption in China could be recorded also for the countries of the final consumption..

This shows at any rate that the current high level of western resource consumption and emission intensity and the historical accumulation of resources in the global north not only attracts considerable potential for conflict with China, but also with most other non-Western countries. If equal rights to resources are granted to every person in the world, this has enormous consequences for the distribution of the use of raw materials (apart from the distribution of the discharge of emissions).

Generally for comparisons with China, a large reservation to territorially-based statistics should be made, because China currently is a "world factory" and is situated at the lower levels of global value chains. Only few metrics such as the ecological footprint account for this situation. With a topical adjustment in data of raw material and energy consumption, when the raw material consumption of China's export balance or the end-use is accounted for other countries, the Chinese raw material and energy use would be reduced by at least 20% (Watson and Wang 2007), and the Western would be increased significantly.

## **Plan B or C?**

Zhu and Wu (2007) justify the Chinese resource strategy as follows: On one side the per capita "natural capital" in China is far below average; on the other hand, it is becoming increasingly difficult due to the ecological and political limitations, to obtain resources from other countries. This distinguishes the

present situation from earlier periods of industrialization, when the dominant forces solved the problem by economic or military cross-border activities. Moreover, it is more difficult to restore or to substitute or supplement the "natural capital" (such as land). Since the "natural capital" is the most important barrier for China's economic and social development, China's development path of the earlier industrialization must distinguish significantly.

Zhu and Wu outline three possible models:

Plan A: Business as usual - is the model with high resource consumption and high pollution. This scenario is considered to be not feasible anymore for China.

Plan B: A kind of ideal model of development with rapid increase in resource productivity, and thus decoupling resources and orientating to sustainability. This, too, is estimated by the authors as not feasible for the next few years given the current technical and management opportunities.

Plan C (Zhu 2008) is to improve resource productivity considerably by 2020. The GDP is expected to quadruple between 2000 and 2020, but by control of resource consumption emissions should only double. This requires a special kind of further industrialization and a new type of urbanization. The whole society should be involved for achieving this goal. Starting with 2020, an absolute reduction of resources and emissions should be undertaken in a green development strategy. "Plan C" shows some similarity to actual policy objectives but with a postponed time frame and without binding obligations

As in other similar countries in the Mao period there were comprehensive recycling systems – especially stemming from economic necessities. These later were regarded as outdated and as a sign of poverty. The far-reaching privatization brought a big boost in the interruption of material cycles and so also an increasing resource consumption. On from the 90s the maxim has been self-regulation by the market: "The current recycling system in China is a typical profit-driven recycling system. It has been created wholly by market mechanisms with little government intervention." (Mo et al 2009: 418).

The course towards further deregulation and privatization with general decisions in 2013 reflect the logic of driving forces on capital accumulation in China. Whether the now introduced partial privatization of Sinopec, the major Chinese oil company, will be a contribution to alleviation of the problems of resources in China remains to be seen.

### **Chinese military interventions to secure FDI in commodities?**

China presence abroad often is seen as controlled uniformly and centrally: The fact is, however, that in addition to public institutions relatively independently operating migrants, small businesses and companies play an relatively autonomous role. However, for larger companies in the basic sector there is significant state influence.

Increases in military spending and a growing maritime military presence in no way and for a long time could not be comparable with US global activities aside from conflicts with neighboring countries and disputed boundaries.

However, there is some nationalist tendency in China that promotes matching with the US, and it is not completely inconceivable that this direction, which is not mainstream today could prevail some time when the revival of Japanese militarism will continue, the containment policy of the USA will be deepen or when with ongoing privatization of basic industries and investments abroad Chinese capital could ask for "security" in a global accumulation process. In the foreseeable future this is very unlikely, because this would not be only a break in Chinese history but mean also a fundamental change in the policy of development of the last decades, in a model, which consistently is rated successfully, and which is based on an essentially peaceful environment along with globalization and trade. And there is a striking difference to the Soviet Union: China until now never has been engaged in a harmful arms race blocking valuable resources and capital.

### **Basic socio-ecological paradigm shift most likely in China- a concluding hypothesis**

From the analysis of the backgrounds of the current dynamic development of China it can be deduced that this process is likely to continue even longer, although fluctuations and crises are possible. But the biggest barriers in this context are raw material and environmental problems: Also Wu identifies resource scarcity and environmental limitations as "decisive factors" for further socio-economic development: "Due to the population, resources and environmental conditions, the resource shortage and environmental restrictions become the vital factors constraining the economic-social sustainable development in China (Wu and World Bank, Environment & Social Development Sector Unit (EASES), Eastasia and Pacific Region 2006a).

By the widespread adoption of the Western model of development and the special use of the existing globalization regime China faces also severe challenges: on the one hand, the continuous supply of very large and still growing amounts of input for the industry is difficult and subject to considerable risks. China on the other hand is near ecological boundaries and in some cases also near tipping points (desertification, availability of water in the north, as mentioned air emissions lead increasingly serious smog situations).

In counterweight to these problems China exhibits also many innovative activities for resource productivity and for example a dynamic increase in renewable energies.

It may sound trivial and can be easily misunderstood in a Malthusian mode, but from a social-ecological perspective the one-child policy (connected with many hardships and problems) in the Chinese context of population number and density probably until now was the biggest contribution to China's long-term resource and climate policy.

Blocking factors for socio-ecological paradigm shift can be analyzed also for China with the concepts of "lock in", "vested interests", "path dependence", "sunk costs", rebound effects and oligopolistic market power. However, the strong momentum of China's development also seems to enable faster breakthroughs (as currently seen in solar thermal systems or electric mobility).

So as a conclusion the following hypothesis can be formulated:

The chances of a basic socio-ecological paradigm shift are mid- or long term perspective are high in China, because there is hardly no other big region around the world, where the socio-ecological problems and the pressure due to the special population density and the density of economic activities within the existing development model will concentrate so strongly. Moreover, China is expected to be affected above average by climate change - partly this is already the case (see desertification).

The increasing pressure that results from this situation which will be continuously aggravating (politically rather from the emission side, in economic terms from the resources side), the existential necessity on the one side and on the other side comparatively favorable conditions for development of "human capital" (management of disasters in the history of China), the available options of macro control and the presence of significant domestic markets can promote the emergence of a sustainable development paradigm. And there are considerable arguments suggesting that genuine sustainable development will have a similar function like "socialism" for China's national existence when after a hundred years of semi-colonial humiliation "socialism" was a prerequisite or at least very important aid of an existential national renewal. And – out from some "wave" analysis of Chinese history of the 20<sup>th</sup> century - maybe in a swing back after a capitalist dominated period a socio-ecological transformation and a new stage of socialism will be combined in some sort of eco-socialism because both are vitally important for the Chinese population

But is an indispensable radical increase in resource productivity realistic, one might ask. In fact, the labor productivity since 1850 has been globally increased by 20 times. Why should it be impossible to increase resource productivity radically – also in China? And what was the driving force for the historical increase in labor productivity? It was the rising price of labor: the increase in wages (Weizsäcker 2009). And just now by the pressure and action of the working class the wages in the more developed regions are increasing significantly....

\* Along the contribution „Das Feuer des Drachen - Ressourcenfragen in Weltfabrik“ for the book „Kritische Rohstoffe in der Großen Transformation - Metalle, Stoffstrompolitik und Postwachstum“ (forthcoming)

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