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Creating a new socio-technical regime in China: Evidence from the Sino-Singapore Tianjin Eco-City

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ABSTRACT

The Sino-Singapore Tianjin Eco-City (SSTEC) in China was designed to leverage Singaporean expertise in top-down city planning, systematic management, and water treatment technologies and act as a replicable hub-and-spoke model. This study shows that an expansion of the scale of urbanization, and its transformation into the focal point of the hub-and-spoke eco-city model will enable China to advance as an international pioneer, by the creation of a new socio-technical regime dependent on green and ecologically sustainable systems. In particular, the potential capacity of China's new socio-technical regime, built on eco-cities, is based on its capability to (1) create a vision for a smart energy system; (2) drive down the cost of renewable energy equipment and devices; (3) support local industrial clusters for socio-economic development; (4) implement effective policies for city-level solutions; and (5) standardize and replicate these strategies in the new regime as a whole. In the top-down landscape approach, the public authority's integrated administrative capability and capacity is important as a means by which to link the various types of stakeholders. This has to be done, in the process of managing a city's transition and reducing the risk of transformational failure, by reinforcing the four types of capital assets – namely manufacturing capital, natural capital, human capital, and social capital.

1. Introduction

China has experienced astonishing economic growth over the past three decades and is expected to overtake the United States as the world's largest economy by 2020. The high-speed growth of the Chinese economy was achieved at a great cost to the environment. Unbreathable air, polluted and undrinkable water, loss of soil, a build-up of heavy metal contamination, and many other such problems must now be addressed for sustainable development to be achieved, and can only be accomplished as a result of significant changes to both social and technological systems. In particular, the roles of the central, regional, provincial, and city governments are integral to the promotion of eco-cities that take sustainability as their development model, and the setting of performance goals regarding the conservation and circulation of resources, and the utilization of renewable energies in the process of urbanization.

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A number of policy initiatives have aimed to battle these problems since the 11th Five-Year Plan, as well as the congress setting emission reduction and energy conservation goals for the sustainable economic development of China as a whole. To that end, the Chinese government has implemented a series of macro level controls and stepped up their support for the creation of a new socio-technical regime, achieved by industrial upgrading. Taking the Sino-Singapore Tianjin Eco-City (SSTEC hereafter) as an example, this paper aims to examine how China is taking advantage of rapid urbanization to create a new socio-technical regime that relies on green, ecological systems. Specifically, we intend to provide an overview for what has been the experience so far, and what might be the result of the broader policy environment that is driving China's socio-technical transformation in 2015 (the end of the period of the 12th Five Year Plan), and beyond that to 2020 (the end of the subsequent 13th Five Year Plan, now already under discussion).

The current technological regimes in many knowledge-intensive industries were initiated by and are dominated by technological leaders in advanced countries (Hu, 2014). In latecomer nations, the focus strategy lies instead on applying new generations of technology in existing regimes (such as in Korea and Taiwan) or on efforts to shift the focus of industrial dynamics away from the existing technological regime (such as in China). The latter is argued to occur in China where the emergent 6th techno-economic paradigm is driven by the technology surge associated with renewable energies, following the 5th where IT and ICT are closely connected and applied (Mathews, 2013).[3] By taking advantage of the huge domestic market, China's extensive governmental support of a large number of public projects has provided the opportunity for the growth of numerous small Chinese firms focusing on the domestic market (without intellectual property issues). This has helped indigenous Chinese firms to build their innovation capabilities and patent portfolios based on new domestic industrial standards, product specifications, and application systems. This effect has been demonstrated by the rapid growth of China's urbanization using green energy technologies (e.g. the integration of photovoltaic and geothermal energy in construction) and environment engineering (e.g. waste and water treatment) (World Bank, 2009). Hence the goal of China's strategy has been to shift the foci of industrial dynamics away from existing technological regimes built by international leaders and to mitigate the latecomer disadvantage by creating a new technological regime. An example is the development of Chinese eco-cities such as the SSTEC. We illustrate this intended development through the case of the SSTEC. The building of the eco-city was started in 2008 and the government expects the project to be finished by 2020. While the plan and goals of the SSTEC are to demonstrate the viability of a new socio-technical regime, some uncertainties such as lack of public participation, neglect of residential needs, and weaker stakeholder networks have already been presented as concerns for a top-down approach (Si, 2013). Nevertheless, the SSTEC exemplifies the long-ranging plan of the Chinese government. At this stage it presents as one of the great 'uncontrolled' social experiments, of the 21st century, with regards to conducting a process without a 'control group' for comparison. In this respect, as Woetzel (2011) notes, the outcome is anything but determined.

The paper is organized hereafter as follows. Section 2 presents scenarios for China's eco-city urbanization, followed by Section 3, which discusses China's ambitions for eco-cities. Section 4 presents the example of SSTEC, which required the leveraging of internal social capabilities and external technological resources. Section 5 explores the driving forces behind the building of SSTEC. Section 6 addresses how the various types of green technologies are leveraged to create a new regime in the SSTEC. Section 7 discusses the top-down business model applied in the SSTEC. Section 8 concludes the paper with the idea that the creation of a new socio-technical regime in China needs to be dependent on a green and ecologically-sustainable system.

2. Scenarios for China's urbanization

China currently has a population of 1.3 billion spread across 33 provincial regions, 333 prefectures, 2862 county-level regions, and 41,636 township-level regions. Migration into urban areas is a clear driving force behind the rapid urbanization that is forecasted for the near future. According to the McKinsey report in 2010, more than 350 million people will migrate and move into urban areas by 2025 (a number roughly equivalent to the total population of the United States at the date of writing), and approximately one billion people will live in China's cities by 2030. Rapid urbanization has both advantages and disadvantages. It creates large domestic demand for the construction of public infrastructure, the provision of transportation, housing, education and medical services (World Bank, 2014). This rapid rise in domestic demand also creates problems related to land availability and spatial development, and creates energy and water shortages, pollution and other social problems. Given the impact and problems that arise from urbanization, there are thus four key possible directions that could be taken to achieve sustainable urbanization in China as a whole (McKinsey, 2009). These are (1) mega-cities (a small number of very large cities such as Beijing and Shanghai), (2) hub-and-spoke regions (i.e. clusters of medium and small-sized cities that develop around larger ones), (3) distributed growth (a large number of medium-sized cities spread throughout China), and (4) the growth of towns and smaller cities.

The McKinsey report (2008) defines cities by size with Megacities 10 m+ population, Big Cities (5–10 m), Mid-sized cities (1.5–5 m), Small cities (0.5–1.5 m), and Big Towns less than 0.5 m population. A breakdown of the urban population projections by city size class for each of the four scenarios is provided in the report. McKinsey forecasts that the most likely

[3] The argument of Mathews (2013) is based on the rolling 10-year yields on the S&P 500 Index, whereas the Allianz Global Investors have demonstrated five clear industrial cycles (so-called Kondratieff cycles) since 1814. The 1st cycle is driven by steam engines, the 2nd cycle by railways and steel, the 3rd cycle by electrification and chemicals, the 4th cycle by automobiles and petrochemicals, the 5th cycle by ICTs, and the beginnings of the 6th cycle is seen as starting in 2010 and driven by renewable energy technologies.