ISSN 2305-8277 (Online), 2013, Vol. 2, No. 5, 170-188.

ROSTOW'S STAGES OF GROWTH MODEL, "URBAN BIAS" AND SUSTAINABLE DEVELOPMENT IN INDIA*

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ABSTRACT

The essence of sustainable development stresses the co-development of social, environment and economics. With the help from Rostow's Stages of Growth Model, we try to figure out the stage where India is now currently in. As many of the previous studies show that there are serious pollution problems alongside economic development in developing countries. We firstly study the relationship between India's economy and carbon dioxide emission by Granger Causality tests. We find that the development of India is not balanced, especially when we try to compare rural and urban areas. We finally propose that diversification in industries can strengthen sustainable development in India.

Keywords: Sustainable Development; Rostow's Stages of Growth Model; Granger Causality Test, India.

INTRODUCTION

Many critical social and environmental challenges such as poverty, climate change, ecosystem degradation, and hunger are "wicked" problems which defy simple solutions. These complex issues emerge from interdependent ecological, human systems and unfold across multiple interacting biophysical, political and social scales. Such challenges arise from complex social-ecological systems and cannot be addressed effectively with narrow command and control management, but instead of innovative approaches which incorporate scientific and other knowledge torecognize competing values, foster negotiation and communication to build collective capacity. Engagement of various stakeholders is therefore a critical to build adaptive capacity and it is essential to conduct effective science for sustainability (Johnson, Dana, Jordan, Draeger, Kapuscinski, Schmitt Olabisi, & Reich, 2012). As the essence of sustainability is to strike a balance between the social, the economic and the environmental (Li & Ah Pak, 2010; Li, 2011), one of the major objective of this paper is to study the stages of development that India is in according to Rostow's Stages of Growth Model. After that, we will examine whether India has attained the win-win-win situation for sustainable development. Finally, policy suggestions will be provided.

* The views or opinions expressed in this manuscript are those of the author(s) and do not necessarily reflect the position, views or opinions of the editor(s), the editorial board or the publisher.
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ROSTOW'S STAGES OF GROWTH MODEL

According to Rostow's Stages of Growth Model proposed by Walt Rostow in 1960, developing countries follow a growth path:

- Traditional Society
- Transitional Stage
- Take-Off Stage
- Drive to Maturity
- Stage of High Mass Consumption

Insert Figure 1 about here

In the first stage, agriculture is the major industry; most of the population engages in agricultural production, and the government has extensive political power. Exogenous shocks (e.g., climate change) play a major role in economic growth. In the second stage, the efficiency of agricultural production increases and trade activities increase. Other business sectors emerge. The growth rate of savings and investment is also increasing. In the third stage, assuming that the economy promotes capitalism, the rapid growth of the Gross National Income (GNI), provides the opportunity for entrepreneurs to use higher technology to strengthen the main sector of the economy. Political power is no longer fully in the hands of the government. The country tends to be more self-sustainable. In the fourth stage, new technology spreads to other industrial sectors. The efficiency of other industries also contributes to growth. It should be noted that the growth rate of savings and investment slows down. In the final stage, the economy completes the industrialisation process. The income of the labour force increases, so they demand increasing amounts of consumer goods (Anthony et al., 2009).

URBAN BIAS: UNBALANCED DEVELOPMENT IN DEVELOPING WORLD'S RURAL AND URBAN AREA

Urban and rural areas are the two entities which interact with and mutually influence one another in regional development. The maintenance of aninteractive relationship and a reasonable equilibrium and between them is the fundamental prerequisite of accomplishing coordinated development of rural and urban areas(Liu, Zhang, & Zhang, 2009). Theories of `urban bias' have a long but discontinuous history, dating back from the 1920s when policy makers in the former Soviet Union considered rural and urban sectorial balance in planned economic development (Pugh, 1996). In China, urban and rural areas have been viewed as two unrelated entities in Chinese economic development. Hence, the gap between rural and urban China gradually enlarges. For example, the income ratio of urban to rural residents was 2.37:1 in 1978, 2.79:1 in 2000. Itreached 3.33:1 in 2007(Liu et al., 2009).

RESEARCH HYPOTHESIS, QUESTIONS AND METHOD

Based on the above literature we now propose the hypothesis and the research questions are established as follows:

The Hypothesis:

- H_1: India's economic development pattern can be explained by Rostow's Stages of Growth Model
- H0: The development of India is not balanced, especially when comparing rural and urban areas

Research Questions:

Specifically, two research questions are developed:

- Which stage is India currently in?
- Does India strike a balance in the development of social, economic and environmental factors?

To answer the two questions, qualitative and quantitative method will be used. The data are collected from the DataStream of the Chinese University and the World Data Bank's official data. Most of the data used in this study represent development indicators.

STAGE THAT INDIA IS NOW IN

We establish this relationship in India's case. Figure 1 show that at the beginning of 2002, total savings and investment is increasing. The growth rate is generally increasing before 2002, but it slows down after 2002 according to the polynomial function. In Figure 2, despite the fluctuations in the growth rate, the polynomial function shows that the growth rate generally slows down. Thus, we can conclude that India is in the "Drive to Maturity" Stage.

According to the World Bank Data, 2000 and 2005 show a drop in total agricultural employment, fewer people are engaging in this sector. More obviously, the Proportion of Agriculture Production in the Gross Domestic Product from 1960 to 2010 fell quickly whichimplies that the economy no longer primarily depends on the agricultural sectors (only 16% of GDP).

(Figure 2 near here)
(Figure 3 near here)

In addition, the Gross Agriculture Product per Worker (using the value added approach) in $US from 1980 to 2009 is increasing. More importantly, both fertiliser consumption (Kilograms per hectare of arable land) from 2002 to 2008 and the adoption of agricultural machinery from 1961 to 2003 increase considerably. We can conclude that the marginal productivity of workers increases because more and more high-technology capital goods are used.

(Figure 4 near here)
(Figure 5 near here)
(Figure 6 near here)

Accordingly, the first hypothesis has been supported by empirical evidence and we can conclude that India is in the "Drive to Maturity" Stage".

DOES INDIA STRIKE A BALANCE IN THE DEVELOPMENT OF SOCIAL, ECONOMIC AND ENVIRONMENTAL FACTORS?

Economic development

According to the previous section, India is in the "Drive to Maturity" Stage". This stage implies that the growth rate will be increasing at a declining rate. India has seen rapid growth in recent decades. According to the India Central Bank, India's growth rate was approximately 7.5% in 2010 (The Central Bank of India, 2011). Nevertheless, 2011 saw a great drop in Indian's economic growth. In the second quarter of FY 2011–12 (July to September) with manufacturing growing at only 2.7% (against 7.2% in the previous quarter), mining contracting to 2.9%. farm output expanding by only 3.2% (against 3.9% in the previous quarter)(Chadda, 2012). Besides, the growth rate of the total savings and investment fluctuates over time so as the per capita nominal GDPin terms of purchasing power parity (US dollar).

(Figure 7 near here)

This fluctuation is a signal that India's development is not stable. One can attribute this condition to the external economic crisis and downturn, but this argument is not valid. The experts at the International Monetary Fund (IMF) note that the external influence on

India is quite small because India is less open to international trade. Graph 9 shows that the export diversification of India is at high level. Moreover, the financial market is not very mature. Therefore, the influence of these external shocks is very small.

(Figure 8 near here)

Environmental Development

India is an industrialised country with high economic growth. However, environmental problems in India trigger concerns in the global stage. Since the Kyoto Protocol, India has become one of the developing countries that need to further consider emissions reduction. To this end, the Clean Development Mechanism (CDM) was introduced. The CDM required developing countries to reduce their emission of greenhouse gases (Alexeew, Bergset, Meyer, Petersen, Schneider, & Unger, 2010). Disch (2010) notes that under the CDM, developing countries are allowed to reduce part of their carbon dioxide emissions. However, CDM has not been as effective as expected. Disch emphasises that the benefit to developing countries of the CDM is not significant. He also reckons that we should focus on how the money is actually used in investments to promote low carbon projects. However, other scholars have introduced the 'development dividend' to measure the gain from the CDM (Cosbey, Parry, Browne, Babu, Bhandari, Drexhage, & Murphy, 2005). In general, the CDM is not really effective. Indeed, many experts agree that the two aims of the CDM are not strictly followed in practice. The political reasons for defining these aims weaken the results (Disch, 2010). Developing countries will chase after a minimum reduction of emissions by manipulating the definition of the two aims (Alexeew et al., 2010).

TABLE 1

Major international technology transfers in India(Dechezleprêtrea, Glachanta, & Ménièrea, 2009)

Type of technology	NOP	Percentage of PIITT	APZ	
Biomass energy	78	8%	38	2926
Energy efficiency (industry)	54	17%	85	4595
Hydro power	30	0%	34	1030
Wind power	26	23%	29	763
Reduction of the share of clinker in cement production	13	0%	119	1544
Biogas (other)	7	0%	32	224
HFC decomposition	3	100%	2589	7766
Fossil fuel switch	4	25%	43	171
Energy efficiency (services)	1	100%	3	3
Energy efficiency (supply side)	6	0%	6	38
Solar power	1	100%	1	1

Note.
NOP refers to Number of Projects
APZ refers to Average Project Size (annual ktCO2eq)
PIITT refers to Projects Involving International Technology Transfer

In India's case, at the very beginning, India's CDM policy regulation was not very strict. Project proponents need to contribute at least 2% to sustainable development per year according to Indian Designated National Authority (DNA). This requirement implies that India has been paying attention to sustainable development (Disch, 2010; National CDM Authority Ministry of Environment & Forests Government of India, 2013). Some scholars still find that the CDM in India is not in a mature stage. The main problem is the incentive for

people to support the CDM. Alexeew, et. Al. (2010) find that many people support cost-effectiveness rather than sustainable development .

In fact, India has introduced policies to improve the environment, but mainly as regards urban development, especially in the capital city of Indore. The Urban Management Programme (UMP) is a good case in point. The UMP is a project to improve the social and environmental problems in Indore with the assistance of the United Nations Development Programme, the World Bank, the Indian Government and local private institutions. The UMP promotes communication to stakeholders so that private institutions can know more about the benefits of environmental protection. Moreover, the UMP provides a consultation process to further mitigate pollution and improve education, networking and health (Gupta, Gupta, Singh, & Sharma, 2006). However, the conditions in rural India are not the same: (1) the scale of rural policies is not as large as that of similar urban policies; (2) the consultation processes between the parties in different projects is oversimplified so that it loses its effectiveness (Disch, 2010).

The wide use of automobiles worsens air pollution. The air quality in urban areas does not achieve National Ambient Quality Standards. This serious air pollution is abetted by the lack of vehicles emission limits. India regulates peak hours, road facilities improvement and highway management and encourages the use of bicycles. The effectiveness of these efforts, nevertheless, is not really significant and, again, these policies still primarily focus on urban areas, especial capital cities. In addition, the government in India should focus on wood consumption (Gupta et al., 2006). In rural and even urban areas, majority of people still use wood as their primary fuel source. A significant portion of CO_2emissions is from wood fuel (Leena & Rehman, 2006).

The development of imbalances (between both sectors and regions) also leads to externalities, leading to market inefficiency. A total of 45.3% of India's GDP is from the agricultural and industrial sectors, implying that India still relies on these two sectors. As mentioned above, an increasing number of Indian farmers adopted higher-technology machines and fertilisers. These technological and industrial activities will undoubtedly generate significant green house gases (GHGs), polluting the environment.

We considered approximately 5 types of GHGs to support this viewpoint: carbon dioxide (CO_2), nitrous oxide (N2O), SF_6, PFC gas and other gases (Refers to the figures below). Per capita CO_2 is rising over time. The emission of N_2O, sulphur hexafluoride (SF_6) gas, perfluorocarbon (PFC) gas and other greenhouse gas emissions (1990, 1995, 2000, 2005) are also increasing.

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(Figure 10 near here)
(Figure 11 near here)

The correlation coefficient of the gross national product by expenditure approach and total CO_2 emissions from fossil fuel is 0.9299, indicating that economic growth and CO_2 emissions are highly related. In addition, according to the U.S. Environment Protection Agency, the sources of Nitrous Oxide emissions are primarily industrial and agricultural activities (U.S. Environmental Protection Agency, 2011). SF_6 is used in the metal and chemical industry. PFC emissions are from the production of aluminium. It can be generally concluded that GHG emissions mostly derive from the industrial and agricultural sectors.

To confirm this argument, the Granger Causality Test has been adopted to test the relationship between CO_2 emissions from fossil fuels (representing energy consumption) and GNP at factor cost (GNP_{FC}) to represent economic growth (We choose "at factor cost" because it can better represent the growth from production activities). The data of CO_2 (1951-2008) is obtained from Carbon Dioxide Information Analysis Center (2013) and GNP (1951-

2008) is obtained from DataStream in Chinese University of Hong Kong(2013). The quantitative analyses include descriptive statistics and a Granger Causality test. In this test, the data will be transformed into natural logarithmic form and first-level differentiation will be used to avoid the problem of heteroscedasticity and non-stationarity. The unit root test is used to test for stationarity.

This research uses Augmented Dickey-Fuller test for testing the stationarity or the integrated order of the variables. Consider the following AR (p) model:

$$\Delta Y_t = \alpha + \rho Y_{t-1} + \gamma_1 \Delta Y_{t-1} + \cdots + \gamma_{p-1} \Delta Y_{t-p+1} + \varepsilon_t \ldots\ldots\ldots$$

Where t =1…, T as the time period, p refers the maximum lag length and ε_t represents a white noise. The Augmented Dickey-Fuller test is carried out according to the above equation. The null hypothesis of the test is $\rho = 0$ which assumes the time series Y contains a unit root. The alternative hypothesis is $\rho \neq 0$, showing that the time series Y is stationary(Li & Ng, 2012).

When we select the lag period, we use the lowest Akaike Information Criterion value (AIC). After taking the natural logarithm and the first differentiation, the unit root test result shows that the p-value is 0.0064 for the GNP data and 0.0000 for CO_2 emissions from liquid fuel.Finally, the result from the EVIEWS shows that the growth rate of CO_2 emissions from liquid fuels Granger causes the growth rate of the GNP at factor cost, and vice versa (with p-values = 0.00031 and 0.01420, respectively). This result means that the two variables show "two-way" causality at 5% significance level (Table 2-3).

TABLE 2
Unit Root Test Results

	Augmented Dickey-Fuller test statistic	
	Level	1st difference
Gross National Product at Factor Cost (DLNGNPFCEP)	3.864518 (1.0000)	-3.712344 (0.0064***)
CO_2 Emissions from Liquid Fuels (DLNLFE)	3.453923 (1.0000)	-6.979252 (0.0000***)

TABLE 3
Granger Causality Test Result

Null Hypothesis	F-Statistic and p-value
DLNLFE does not Granger Cause DLNGNPFCEP	9.54233 (0.00031***)
DLNGNPFCEP does not Granger Cause DLNLFE	4.63760 (0.01420**)

Theoretically, the higher the country's GNP, the higher the citizen's income, the greater the consumption of electricity (because a higher living standard leads to more economic activities and greater energy use). Thus, it is valid that GNP (growth rate) Granger causes the CO_2 emissions from liquid fuel (growth rate).

More importantly, CO_2 emissions from liquid fuel (growth rate) Granger causes the GNP at the factor cost (growth rate). Liquid fuel (e.g., crude oils, petroleum) is mostly used in industrial sectors and in some agricultural machinery. We find that there is Granger-causality, which means that it is mostly the industrial and agricultural sectors that contribute to GNP growth because the industrial and agricultural machines need significant energy from fossil fuel (e.g., oil).

Therefore, the more liquid fuel that a country consumes in the industrial and agricultural sectors (and, simultaneously, the more CO_2 emissions), the more GNP growth

that country sees. This relationship means that most of the economic growth in India is from the industrial and agriculture sectors. We have now proved that India's development is imbalanced.

It should be noted that this "two-way" causality also shows a vicious cycle. The industrial and agricultural sectors grow and improve living standards. The increase in living standards leads to greater demand for residential, industrial and agricultural products. This increased demand triggers more production and energy consumption. Finally, more fossil fuels are then used for energy consumption, implying that there are also more GHG emissions.

The causality further notes the "over-development" of the industrial and agricultural sectors because the emissions and economic growth are primarily from these sectors. This overdevelopment creates the imbalance between industries.

(Figure 12 near here)

The sources of water pollution are also from agriculture and wine, paper and pulp production. More importantly, the pollution of rivers and lakes cannot be ignored. Apart from the air pollution problem, poor water and waste management in India leads water pollution in river, lakes and waterways. There are also cultural concerns, such as poor sewage management and rubbish that pollutes rivers and lakes, generating health problems (cholera and jaundice). To confront this problem, India established policies to improve the water quality and industrial waste management with the help of Canada and local environmental institutions. However, these policies primarily focus on urban areas (Gupta et al., 2006).

Chemical pollution is another pollution problem. In 1984, the release of methyl isocyanate in Bhopal was a tragic accident that led to many deaths and injuries along with serious pollution of the land, air and water. There was another similar case in 1999 (Orissa). However, by 1999 in Orissa, India had established an Emergency Response Center (ERCs) which could quickly provide accurate information and first-aid assistance (Gupta et al., 2006).

Social Development

With the development of urban areas and a growing population, urban sprawl triggers increased land demand. The rural-urban migration increases the urban population. An increasing amount of forest and cropland has been destroyed for other land uses (Gupta et al., 2006). The intensive development of urban areas creates more of a problem than the development of rural areas. The infrastructure in rural areas is generally at a less-developed level. Leena and Rehman (2006) note that 30% of rural citizens lack access to fresh water; there is a similar issue with access to the electricity network in rural areas. Over half of India's citizens cannot access electricity and use kerosene lamps for lighting. India has developed the Millennium Development Goals (MDGs) and joined the World Summit on Sustainable Development (WSSD) to solve these problems. Although India provides subsidies for the use of hydroelectricity for agriculture, these subsidies benefit the higher-income groups in rural areas. Moreover, the policy planning in rural areas is not as complete as in urban areas. Even given the biogas programme and the cook stoves programme, which were both introduced in rural areas, the distribution and quality of electricity between urban and rural areas is still imbalanced. The crux of the problem is the mismanagement of the government's internal framework and coordination (Leena & Rehman, 2006).

Industrial and agricultural sector growth leads to economic growth. Urbanisation occurs and improves the living standard for urban citizens. Infrastructure is developed and cities become well established and further developed in urban areas. This development triggers a positive externality that encourages rural citizens to move to urban areas, that is, a

rural-urban migration occurs. However, rural development is then ignored, worsening the imbalance.

In India's case, the situation is more serious. Because India is in the "Drive to Maturity" Stage, the emergence of different sectors implies that more types of goods are being produced. The consumption choices therefore increase. At the same time, more job opportunities and a higher rate of return will then trigger positive externalities. However, when increasing numbers of people move to urban areas and ignore the development of rural areas, the poor rural infrastructure and living conditions will generate negative externalities, driving more citizens out of rural areas. The divergence of the "externalities" between rural and urban areas leads increasing numbers of people to move to urban areas and worsens the imbalance.

(Figure 13 near here)

Sanitation facilities and availability of clean water sources in urban areas showed increasing improvement from 1990-2008.These findings support the imbalanced development (of infrastructures) between regions. The rural-urban migration and the increase in living standardsin urban areas can also be observed as positive externality in the declining urban poverty headcount ratio and the increasing urban population.

(Figure 14 near here)
(Figure 15 near here)
(Figure 16 near here)
(Figure 17 near here)

At the same time, the conditions in rural areas are not as good as they are in urban areas. Although the government has developed rural water access, its improvement is very slow. It should be noted that the water access quality is at a low level organically. The government should have spent more in this area. Therefore, we can strictly conclude that India's development is imbalanced both between industries and between regions and that rebalancing is necessary.

Policy Suggestions

As India is in the "Drive to Maturity" Stage, there should be more emphasis in private institutions. At this stage, the government cannot tackle a majority of the problems. What then should India do?First of all, the previous section shows that environmental and social problems trigger many positive and negative externalities. Because there is less political power at this stage, India should provide more freedom to the private sector. According to the Coase (1960), when private property rights are well-defined, externalities are no longer a market failure. The market will function well independently. During this stage, if India intervenes too much, it is not healthy for economic freedom or for long-term development. Foreign direct investment, or even domestic investment, will decrease if there is a dictator.

At the same time, we can see that some private sectors are doing a good job. Increasing numbers of private institutions participate in energy production (Graph 20-21). More importantly, the private education sector has become increasingly efficient. The government expenditure on education (as a % of GDP and GNP) has declined over time, but the literacy and enrolment rates have increased. When better private property rights (commercial laws) are defined, businessmen will place more confidence in India and in their investments in India.

(Figure 18 near here)
(Figure 19 near here)
(Figure 20 near here)
(Figure 21 near here)
(Figure 22 near here)

In addition, "Diversity" is important. India should develop more different industries to be sustainable. India has the potential to develop new industries well because of her educational efficiency and her research and development ability. High-technology exports are increasing rapidly, but the cost of R&D remains at approximately 2% every year. (World Data Bank 2011) (Graph 25). If the government can further make a good use of private education and R&D, it can create more diversity by developing different sectors. The imbalance between industries can then be addressed.

(Figure 23 near here)

On the other hand, with an increasing demand for energy, promoting renewable energy (biomass energy) is preferable because it is environmentally friendly and can fulfil the increasing energy demand. In the case of Japan, scholar estimates that the biomass energy can reduce 64% in energy intensity from 2000 to 2050.For the imbalance between regions, the government may invest more in transport, sanitation and water access, which the rural areas lack. These investments should be made with a low level of private participation. If the government improves these infrastructures, it can generate positive externalities that will encourage people to return to rural areas and it will strike a balance in the infrastructure development between regions.

SUMMARY

To conclude, India is now in "Drive to Maturity" Stage. Development in urban and ruraldevelopment is not balanced and there are still room for improvement in social, environment and economic area. As knowledge can now be shared via internet (Li & Zhang, 2010), there may be faster and quicker information spread, bring changes to India sustainability. The table below shows India's current situation.

TABLE 4

India's current development under different categories of sustainable development (Agarwal & Nisa, 2009; Balachandra, 2012).

Development	Implications	Remarks
Economic Development	Employment, income generation	It enables enterprise development, utilizes local resources. Employment increases due to more new jobs. With better economy, citizens can use better preservation method to reduce post-harvest losses through better preservation.
Human Development .	Education	There are 407 Universities and institutions which are of national importance. Due to time saved on fuel collection and ill health, children will have more time for education. Educated professionals, such as doctors, nurses, and teachers,are more willing to remain in villages. Access to media and communications increases educational opportunities.
	Health	Lighting in health clinics extend hours of operation. There are healthier conditions for domestic work and study. There is better access to better medical facilities for maternal care.
	Information & knowledge	Access to health education, rights and duties. media is now available.

Development	Implications	Remarks
	management	Television, information/internet kiosk, radio creates access to relevant information.
	Gender empowerment	Time saving in cooking time deal to more efficient devices allowschild care productive endeavors and adult education.
		Eliminating fuel collection far from home reduces the risk of assault and injury for girls and women.
		Involving women in household energy decisions promotes gender equality.
		A soot-free kitchen environment raises a woman's prestige.
Social Development	Safety and Security	Lighting streets, increased security in public spaces and walkways improve women's safety.
	Clean environment	Clean environment enables local recreation.
Environmental development	GHG emissions	Reducing deforestation for traditional fuels reduces erosion and desertification.
	Black carbon Mitigation options	Reducing greenhouse gas emissions by using renewable energy and energy efficient devices decreases greenhouse gas emissions.
	Climate adaptation & resilience	Energy-efficient devices based on renewable sources enhance building climate change adaptation capabilities and hence climate resilience.

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