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Modeling sustainable development: India's strategy for the future

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Abstract

Purpose – The purpose of this paper is to understand the relation among the various enablers of Clean Development Mechanism (CDM) to know their degree of dependence and driving power. As there has been non-agreement among the various stakeholders regarding the benefits of sustainability brought about by CDM, this paper explores the viability of sustainable development in the Indian scenario.

Design/methodology/approach – This paper discusses a model to address the issues of sustainable development in the context of CDM. An interpretive structural model (ISM) has been used to model the various parameters of sustainable development in the Indian context. The relevant parameters have been considered as per the existing literature review.

Findings – The result shows that sustainable development is achievable if the nation emphasizes on strategic goals and mission because sustainable development is driven by the strategic parameters such as "employment creation" and "long-term economic goals".

Research limitations/implications – The ISM model developed is not statistically validated, therefore structural equation modeling (SEM), also commonly known as the linear structural relationship approach, may be used to test the validity of such a hypothetical model.

Practical implications – The government of India has to emphasize on education and inclusive employment to improve the quality of life, which would enable the sustainable development to be achieved.

Originality/value – This paper describes one of the few empirical studies conducted in India.

Keywords India, Sustainable development, Government policy, Modelling, Clean development mechanism

Paper type Research paper

Introduction

The challenges of how to respond to climate change and ensure sustainable development (SD) are currently high priority for the world's leading economies. According to model projections, developing country greenhouse gas (GHG) emissions are going to exceed industrialized country emissions sometime between 2010 and 2020 (Intergovernmental Panel on Climate Change (IPCC), 2001). At the same time, developing countries are struggling with immediate development concerns. The clean development mechanism (CDM) is the first type of climate change mechanism to take into account this challenge. It also explores the potential for integrating climate change and SD considerations in specific projects. Projects that qualify for CDM include the following: end-use energy efficiency, supply-side energy efficiency, renewable energy, fuel switching, agriculture, industrial processes, solvent and other product use, waste management and sinks (afforestation and reforestation). These projects also satisfy additionality and contributions to SD (Pacudan, 2005).The additionality condition states that projects must result in reductions in emissions that are additional to any

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that would occur in the absence of the project activity and the projects must lead to real, measurable and long-term benefits. The sustainability condition states that projects must assist developing countries in achieving their SD goals.

While CDM projects explicitly aim to bring dual benefits, in terms of climate mitigation and development in their recipient country, the development benefits are more hypothetical than real. The CDM has been subject to extensive discussion in academic literature during the last few years, and a common assessment is that the current structure of the CDM leads to a focus on cheap emissions reductions at the expense of SD benefits for the host countries. According to Chung (2007) and Schatz (2008), CDM is a mechanism that does not itself reduce emissions, but offsets the increase in emissions elsewhere. In response, there have been calls to move the CDM beyond an offsetting-only approach (Schneider, 2009). Cames *et al.* (2007) and Michaelowa (2005) opined that the additionality of CDM projects is questionable, even though the degree of additionality may be different for different project types. In the view of Rosales and Pronove (2003) determining which projects contribute to SD and which ones do not is context specific and subjective as countries and even regions or communities may have different views on what is sustainable, and what is development. This difficulty is part of the reason why the definition of SD is left up to the non-Annex I host countries. Olsen (2007) concluded that left to market forces, the CDM does not significantly contribute to SD. Sutter and Parreño (2007) believed that the greatest amounts of certified emission reductions are being generated by projects with the lowest or no contribution to SD in the host countries. Recently, the questionable additionality of many CDM projects has become a central issue (Paulson, 2009). According to IUCN (1980) and Markandya and Halsnaes (2002) in order to achieve SD in developing countries and with CDM projects in particular, there is a need to emphasize strongly on national development priorities such as poverty reduction, local environmental health benefits, employment generation, economic growth prospects, etc. According to Daly (2002) a few principles are required to achieve SD. They are limiting the scale of population size growth, taking into account the carrying capacity of the earth, ensuring that technological progress guarantees the growth of efficiency and finally balancing the relationship between the use of renewable natural resources and their supply, the level of emissions not to exceed the assimilating ability of the environment.

CDM practices in India

India is perceived as one of the most attractive non-Annex I countries for CDM project development. Even though more than 28.18 percent of the total CDM projects registered by United Nations Framework Convention on Climate Change (UNFCCC) (1997) are from India, it has been highlighted that a majority of the CDM projects have purely economic orientation and are not directed toward achieving overall SD (Sharma and Das, 2009). In the Indian context the goal of SD is inextricably linked to poverty, education and employment as much as to climate change and global governance response. These issues now hold the key to environmentally effective modeling that can show us the way to SD.

Since the establishment of the Indian Designated National Authority in 2003 it has approved a significant number of projects. A total of 420 projects have been registered by the CDM executive board, which account for close to 40 percent of all the registered projects (as of May 1, 2009). In the initial stage of CDM development in India, biomass utilization projects, waste gas/heat utilization projects and renewable energy (wind, hydro) projects were mainly being implemented. Other than those projects, India has registered CDM projects that include energy efficiency projects (cement, steel, etc.) fuel switch projects, hydro fluoro carbons reduction projects and transportation projects. CDM promotion cells have been established at a state level. They conduct supportive activities such as information dissemination on CDM and coordination between local and national governments. One of the features of CDM in India is its large share of unilateral CDM projects, CDM project developed by Indian stakeholders without the involvement (finance, technology) of Annex I countries. Indian project developers implement the project by bearing transaction costs of CDM and taking on the risks of the projects. Therefore, the price of credits issued by unilateral projects tends to be higher than bilateral or multilateral CDM projects (Okubo, 2009).

SD may become an elusive concept unless a holistic development including social, economic and environmental development is not taken forward. To evaluate performance of countries like India, several indicators have been considered to model the social, economic and environmental aspects of development.

Modeling SD

The challenges of how to respond to climate change and ensure SD are currently on the agenda of the world's leading economies. One of the aims of CDM is to achieve SD in developing countries, however, uncertainty prevails as to whether the CDM is doing what it promises to do. A large number of studies have emerged on CDM, but very few assess the state of knowledge on the contribution of CDM to SD.

According to the UNDP (2002), a fairly basic strategy for the fight against poverty consists of providing opportunities, i.e. the formation of human capital and increasing the capacity of the poor to take advantage of these opportunities, i.e. making use of the acquired human capital.

For the World Bank, providing opportunity means encouraging economic growth that makes use of the labor force of the poor, while increasing the capacity of the poor, which consists of providing basic social services such as education, health care and family planning. Poverty is considered to be a multidimensional problem, which indicates that income and consumption cannot be the only criteria to be taken into account. The UNDP has devised a human development index, combining income, education and life expectancy and a human poverty index combining health and education data, without income. The proportion of people with a high level of human development has increased from 55 percent in 1975 to 66 percent in 1997, while the proportion of people with a low level of human development has decreased from 20 to 10 percent in the world (UNDP, 2002).

The review of the employment processes in India over the last half a century has brought out the changing methodologies to address the global challenge of generating sustainable employment and eradicating poverty. At different points of time, different approaches were adopted.

The most conspicuous feature of the changing process to address the employment challenge has a mix of several components like multiple dose credit and skill development to support the income generation activity, social infrastructure components like health care and education to contribute for reduction of consumption expenditure, for upliftment of the quality of life, productivity and general well-being (Lall, 1994). Therefore, inclusive employment has been considered as one of the enablers of the SD.

Employment creation has received surprisingly little attention in the literature on environmental sustainability. There is a need for closer ties between SD and employment-creating development at both the global and the national levels of planning and policy (Mehmet, 1995). While conventional economic development leads to the elimination of several traditional occupations, the process of SD guided by the need to protect and conserve the environment, leads to the creation of new jobs and of opportunities for the reorientation of traditional skills to new occupations.

Education is a key driver of a knowledge-based society. Education is directly linked to a country's ability to generate wealth and promote SD (Mallick, 2002). For India, a central challenge is to improve the quality of its education system. Long-term economic growth and SD hinge on improvements in human capital. To remain globally competitive, the quality of the labor force should be improved through better education. Microeconomic studies for numerous developing economies have found that individuals with higher levels of education tend to have relatively higher earnings (Levin and Raut, 1997). Educational investment may also contribute indirectly to economic growth by reducing fertility and improving health and life expectancy.

The concept of economic growth is the main focus for the policy strategies of most developing economies. India has started moving toward macroeconomic stability and created more stable long-term growth prospects. A consumer boom, increase in real wages, growth in exports, low inflation and transfer of jobs from the informal to the formal sector are indicative of the success of the financial structure and reforms. The global environment, both political and economic, is largely benign from India's point of view. There is an air of justified optimism about India's long-term economic prospects today. There are at least three reasons for this. First, savings and investment rates are rising and are presently at around 32-34 percent of India's gross domestic product (GDP). Economic analysts believe they may rise to somewhere between 37 and 40 percent of the GDP by 2013.

SD is closely related with the provision of an environment that promotes and supports health. Understanding the different environments within a community and how they relate to health is the first step. Engaging the various stakeholders in decision making on environmental and health issues promotes the idea of SD (Gupta and Asher, 1998). It also supports the healthy living and SD by encouraging equity in health in the community by providing clean water or safe housing for all members of the community. The principles of SD balance the population's entitlement to a healthy life with a consideration of the impact of economic growth upon the environment (Shellenberger and Nordhans, 2004).

Good corporate governance requires corporations to manage an organization's wider influence on society for the benefit of the society as a whole which results in good corporate citizenship. Good corporate citizenship is closely associated with the idea of sustainability. It is also synonymous with the concept of "corporate societal responsibility."

To ensure the sustainability of the natural resource base, the recognition of all stakeholders in it and their roles in its protection and management is essential. There is need to establish well-defined and enforceable rights (including customary rights) and security of tenure and to ensure equal access to land, water and other natural and biological resources.

SD is achieved through optimizing gains from several variables. This requires government departments to work together. For this joint planning, transparency and coordination in implementation are required. The richness of skills available in society must be harnessed through partnerships involving institutions in civil society, such as non-governmental organizations (NGO's), community-based organizations, corporate (including private) bodies, academic and research institutions, trade unions, etc. which must be made an integral part of planning and implementation for SD.

Climate change is one of the most important global environmental challenges facing humanity with implications for food production, natural ecosystems, freshwater supply, health, etc. There will be unprecedented increase in surface temperatures of the earth and is expected to have severe impacts on the global hydrological system, ecosystems, sea level, crop production and related processes. The impact would be particularly severe in the tropical areas, which mainly consist of developing countries, including India (Garg *et al.*, 2003).

The climate change issue is part of the larger challenge of SD. As a result, climate policies can be more effective when strategies designed to make national and regional development paths more sustainable. The impact of climate variability and change, climate policy responses and associated socio-economic development will affect the ability of countries to achieve SD goals (Climate Change, 2001).

India has a territory of 328 million hectares, which receives an average annual rainfall of 120 cm. This is among the highest for a comparable geographical area in the world. Despite India's vast water resources, droughts and famines are a common occurrence in many parts of country (Bobba *et al.*, 1997).

According to the Government of India (GOI, 2004) nearly 61 percent of India's GHG emissions in the year 1994 came from the energy sector. Two of the most important reasons are: first, India is poised for rapid economic growth (estimated GDP growth of between 8 and 10 percent per annum), which is likely to translate into a sense of greater well-being for her population and greater consumption; and second, 54 percent of her population of a billion plus currently have no access to electricity, while 42 percent have no access to clean cooking fuels (GOI, 2001).

The transportation sector is also expected to grow rapidly. These considerations suggest that India will be responsible for a growing share of global GHG emissions in the future. There is therefore a strong argument, articulated by countries like the USA that India ought to actively participate in any future emissions reduction targets.

To achieve the objective of sustainability it is necessary to establish a system of solid waste management, which harmonizes the technical requirements with the objectives of environmental protection and the needs and interests of different stakeholders especially the urban poor. As the city population increases and its economic profile changes, the quantity of waste and the resources requirement to manage it will increase. Therefore, waste minimization and a community-based waste management seems the only sustainable way to manage the waste (Jain, 2007).

Based on existing literature presented above, the following enablers of SD have been considered in the present research, which are exhibited in Table I.

Interpretive structural model (ISM): an overview

ISM offers a methodology for structuring complex issues and it is a combination of three modeling languages: words, digraphs and discrete mathematics. It differs significantly from many traditional modeling approaches, which use quantifiable variables. ISM provides a modeling approach, which permits qualitative factors to be retained as an integral part of the model.

Conventional methods like Delphi method is also a structured technique used for forecasting in various disciplines. Structural equation model (SEM) is a confirmatory

Sl. no.	Enablers
1	Long-term economic growth
2	Improved health care
3	Enhancing education skill
4	Corporate-government collaboration
5	Employment creation
6	Inclusive employment growth
7	Solid waste management
8	Managing climate change
9	Natural resource management
10	Land and displacement management
11	Water resource management
12	Effective corporate governance
13	Poverty alleviation
14	Greenhouse gas (GHG) reduction

Table I.
Enablers of sustainable development in India

statistical approach, which requires statistical data. It conducts the hypothetical tests to determine the extent of the proposed model (Wisner, 2003).

On the other hand, ISM has advantages over other methods. ISM was proposed by Warfield (1973) to analyze the complex socio-economic systems. Since then ISM is often being used to understand the complex situations and to make a strategy for solving problem. Sage (1977) defined that ISM is used for identifying the relationship between various factors, which define a specific issue or a problem. It is an interactive process, which also uses the notion of graph theory to explain the complex pattern of contextual relationship among a set of variables (Malone, 1975).

The steps of ISM have been described as a process within the present context. The process starts with the identification of the relevant elements to the problem. Group-solving techniques have been used to solve this step. In the next stage, a contextually relevant subordinate relation is chosen. Based on this relation, a self-structural self-interaction matrix (SSIM) is developed. In the next step, the SSIM is converted into a reachability matrix and its transitivity is checked. Once it is done, a well-defined representation system in a form of matrix model is obtained. In the final step the partitioning of the elements and the extraction of the structural model is done to complete the ISM. Deshmukh and Mandal (1994) presented the process in the form of flow chart.

Empirical analysis

The main objectives of this paper are:

(1) to explore the enablers of SD;

(2) to recommended strategies to achieve SD in India; and

(3) to identify the relationship between CDM and SD in India in the present scenario.

This research is based on 14 important parameters under the "enabler" category. The selection of parameters is done through the literature review and discussion with two experts from the academia.

Methodology

To collect the desired data, a questionnaire was developed and ISM has been used to achieve the research objectives. The methodology is being discussed in the next section. The initial step in this study is to facilitate experts in developing a relationships matrix. The survey included a structured questionnaire where the respondents are asked to indicate the importance of 14 enablers. These questions were scaled on Likert scale of 1 (no importance) to 5 (very high importance). The variables were selected through discussion with educators and from existing literature review.

Formulation of SSIM

In this research, the experts were consulted in identifying the nature of contextual relationship among the variables of technical education system. In order to analyze the relationship among the SD variables, a contextual relationship of "leads to" type is chosen. The following symbols are used to denote the direction of relationship between enablers (*i* and *j*) to analyze the enablers and barriers in developing SSIM:

V, enabler *i* will help to achieve enabler *j*; A, enabler *j* will help to achieve enabler *i*; X, enabler *i* and *j* will help to achieve each other; and O, enablers *i* and *j* are unrelated.

The following statements explain the use of symbols V, A, X and O for enablers in SSIM (Table II):

(1) Enabler 1 helps achieve enabler 13. Enabler 1, i.e. sustainable economic growth will achieve enabler 13, i.e. poverty alleviation. Therefore "V" describes the relation in Table II.

(2) Enabler 3 would help to achieve enabler 2. If proper emphasis is given on enhancing education skills (enabler 3), it would help achieve the improved health care. Hence the relation is "A."

(3) Enablers 3 and 10 are unrelated. Enhancing education skill and land and dispute management does not share any relationship. Thus "O" represents their relation in SSIM (Table II).

Sl. no.	Enablers	14	13	12	11	10	9	8	7	6	5	4	3	2
1	Sustainable economic growth	O	V	X	O	O	X	O	O	X	V	V	V	X
2	Improved health care	O	X	O	O	O	O	O	O	A	A	A	A	
3	Enhancing education skill	O	V	X	X	O	V	O	O	V	X	X		
4	Corporate-government collaboration	O	V	X	X	O	X	O	O	V	X			
5	Employment creation	A	O	O	O	O	O	O	O	X				
6	Inclusive employment growth	O	X	O	O	O	O	O	O					
7	Solid waste management	O	A	O	V	X	X	X						
8	Managing climate change	A	V	O	X	X	X							
9	Natural resource management	X	A	O	V	A								
10	Land and displacement management	O	V	O	X									
11	Water resource management	X	V	O										
12	Effective corporate governance	A	X											
13	Poverty alleviation	V												
14	Greenhouse gas (GHG) reduction													

Table II. Self-structural self-interaction matrix (SSIM) of the enablers in sustainable development

(4) Enabler 9 namely, natural resource management and enabler 14 namely, GHG emission reduction would help achieve each other. Therefore "X" depicts the relationship.

Reachability matrix

The SSIM is transformed into a binary matrix, called the reachability matrix by substituting V, A, X, O by 1 and 0 as per the case. The rules for the substitution of 1s and 0s are as follows:

(1) if the (i, j) entry in the SSIM is V, then the (i, j) entry in the reachability matrix becomes 1 and the (j, i) entry becomes 0;

(2) if the (i, j) entry in the SSIM is A, then the (i, j) entry in the reachability matrix becomes 0 and the (j, i) entry becomes 1;

(3) if the (i, j) entry in the SSIM is X, then the (i, j) entry in the reachability matrix becomes 1 and the (j, i) entry also becomes 1; and

(4) if the (i, j) entry in the SSIM is O, then the (i, j) entry in the reachability matrix becomes 0 and the (j, i) entry also becomes 0.

Table III also shows the "driving power" and the "dependence" of the enablers. The driving power of a particular variable is the total number of variables (including itself), which it may help achieve while the dependence is the total number of variables, which may help achieving it. For instance, enabler 1 (sustainable economic growth), enabler 3 (enhancing education skill) and enabler 4 (corporate-government collaboration) having the maximum "driving power," which has been calculated as 9. Similar justification is given for dependence too. Enabler 9 (natural resource management) and enabler 13 (poverty alleviation) are having the maximum dependence, i.e. 10.

These driving power and dependencies of variables will be used in the MICMAC analysis, where the variables will be classified into four groups of autonomous, dependent, linkage and independent (driver) variables.

Sl. no.	Enablers	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Driving power
1	Sustainable economic growth	*1*	1	1	1	1	1	0	0	1	0	0	1	1	0	9
2	Improved health care	1	*1*	0	0	0	0	0	0	0	0	0	0	1	0	3
3	Enhancing education skill	0	1	*1*	1	1	1	0	0	1	0	1	1	1	0	9
4	Corporate-government collaboration	0	1	1	*1*	1	1	0	0	1	0	1	1	1	0	9
5	Employment creation	0	1	1	1	*1*	1	0	0	0	0	0	0	0	0	5
6	Inclusive employment growth	1	1	0	0	1	*1*	*0*	*0*	*0*	0	0	0	1	0	5
7	Solid waste management	0	0	0	0	0	0	1	1	1	1	*1*	0	0	0	5
8	Managing climate change	0	0	0	0	0	0	1	1	1	1	1	*0*	1	0	6
9	Natural resource management	1	0	1	1	0	0	1	1	1	0	1	0	*0*	1	8
10	Land and displacement management	0	0	0	0	0	0	1	1	1	1	1	0	1	*0*	6
11	Water resource management	0	0	1	1	0	0	0	1	0	1	1	0	1	*1*	7
12	Effective corporate governance	1	0	1	1	0	0	0	0	0	0	0	1	1	*0*	5
13	Poverty alleviation	0	1	0	0	0	1	1	0	1	0	0	1	1	*1*	7
14	Greenhouse gas (GHG) reduction	0	0	0	0	1	0	0	1	1	0	1	1	0	*1*	6
	Dependence power	5	7	7	7	6	6	5	6	10	4	8	6	10	4	

Table III. Reachability matrix of the enablers of sustainable development

Level partitions

The reachability and antecedent set (Warfield, 1974) for each variable are obtained from final reachability matrix. The reachability set for a particular variable consists of the variable itself and the other variables, which it may help achieve. The antecedent set consists of the variable itself and the other variables, which may help in achieving them. Subsequently, the intersection of these sets is derived for all variables. The variable for which the reachability and the intersection sets are the same is assigned as the top-level variable in the ISM hierarchy as it would not help achieve any other variable above their own level. After the identification of the top-level element, it is discarded from the list of remaining variables. Table IV represents the level partition of the enablers of SD.

From Table IV, it is seen that improved health care and effective corporate governance. Variables (1 and 12) are found at level I. Thus, they would be positioned at the top of the ISM hierarchy. This iteration is repeated till the levels of each variable are found out. The identified levels aids in building the digraph and the final model of ISM.

Formation of ISM-based model

From the reachability matrix, a structural model is generated. If the relationship exists between enablers *j* and *i*, an arrow pointing from *j* to *i* shows this. This resulting graph is called digraph. The digraph without removing the transitivities as explained in the steps involved in ISM. The ISM model for the enablers of SD is shown in Figure 1.

MICMAC analysis

The objective behind this classification is to analyze the driving power and dependency of the enablers. Based on driving power and the dependence; the enablers have been classified into four categories by MICMAC analysis (Mandal and Deshmukh, 1994):

(1) autonomous enablers;

(2) dependent enablers;

(3) linkage enablers; and

(4) independent enablers.

Enablers	Description	Level
1	Sustainable economic growth	III
2	Improved health care	I
3	Enhancing education skill	III
4	Corporate-government collaboration	III
5	Employment creation	II
6	Inclusive employment growth	II
7	Solid waste management	IV
8	Managing climate change	IV
9	Natural resource management	IV
10	Land and displacement management	IV
11	Water resource management	IV
12	Effective corporate governance	I
13	Poverty alleviation	IV
14	Greenhouse gas (GHG) reduction	III

Table IV.
Level partition of the enablers of sustainable development

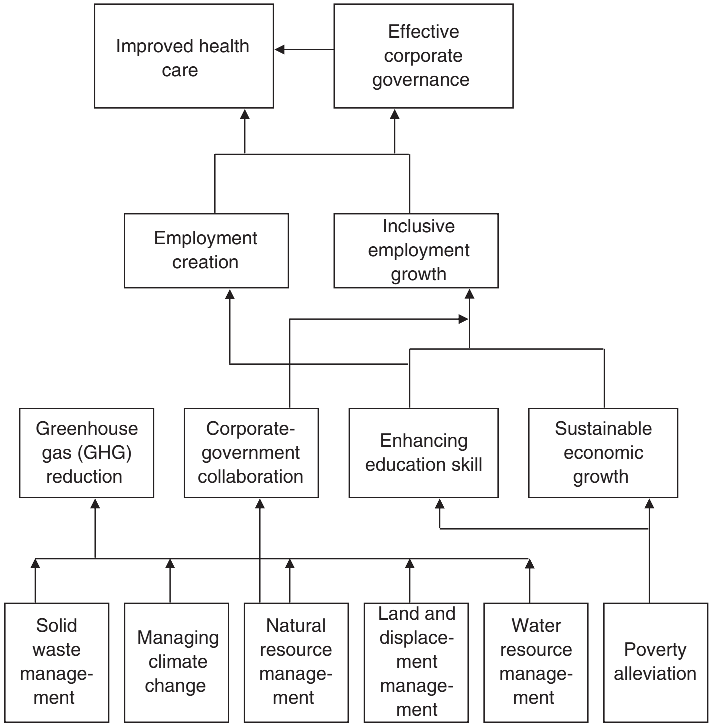

Figure 1.
ISM-based model for the enablers of sustainable development

The first cluster includes "autonomous enablers" that have a weak driving power and weak dependence. These parameters are relatively disconnected from the system. In the present study, seven enablers are in the first quadrant and they are enablers 5, 6, 7, 8, 10, 12 and 14. These enablers have few links, which may be strong. The second cluster consists of the dependent variables that have a weak driving power but strong dependence. In the present case, enabler 2 is in the second category. The third cluster includes linkage variables that have a strong driving power and also a strong dependence. Any action on these variables will affect others and there would be a feedback effect on them. It has been found that a variable with a very strong driving power called as the key variable, falls into the category of independent or linkage variable. In the present context, there are five linkage enablers and they are 3, 4, 9, 11 and 13. Finally the fourth cluster is known as independent variables with a low dependence and a high driving power. There is only one enabler that is enabler 1 in this section. Figure 2 exhibits the categories of the various enablers of SD.

The dependence is plotted on *X*-axis and the driving power is plotted on *Y*-axis. As an illustration, enabler 3 has a dependence power of 7 and the driving power of 9 as same as enabler 4. Therefore, in Figure 2, both have been positioned in the third quadrant corresponding to high driving power and high dependence power. Similarly, enabler 10 has dependence power of 4 and driving power of 6, hence it is in the first quadrant (autonomous enabler).

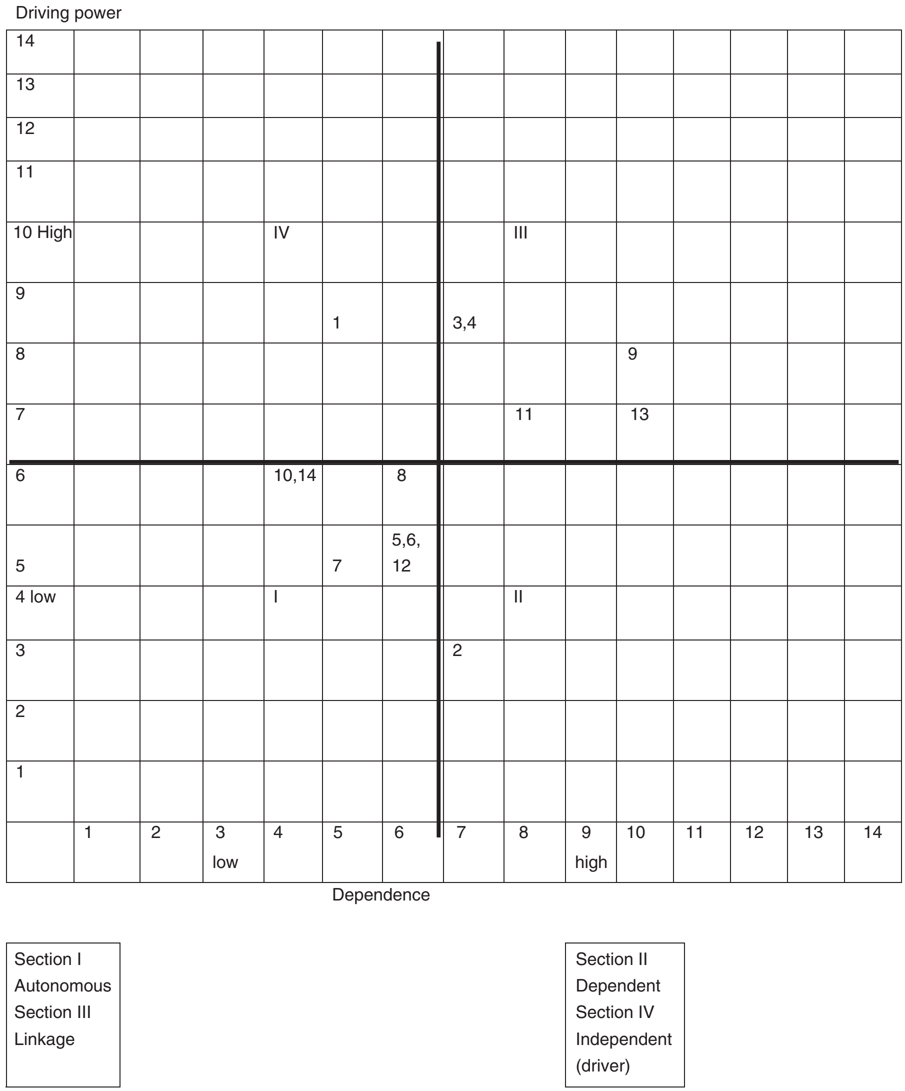

Figure 2.
Driving power and dependence matrix of the enablers of sustainable development

Results and discussion

The term SD has been used extensively by economists, policy makers and other social researchers. It has been found that there is a very close and positive relationship between environment and development. Though India is growing at a fast rate, the growth may not necessarily lead to SD unless it is accompanied by environmental protection. Since the protection and conservation of the environment is one of the key factors to achieve the SD, the result shows that the bottom level, comprising of various factors like natural resource management, managing land displacement, effective water resource management, poverty alleviation, solid waste management and managing climate change can lead to SD.

Early attempts to model SD were undertaken by Forrester (1971), Meadows *et al.* (1992) to examine the impact of population growth, pollution and resource use on the planet. An overview of neoclassical models of SD was given by Toman *et al.* (1995) and Heal (1996). A broader perspective on models for SD, with special attention for integrated models, was presented by Bergh (1996). Evolutionary models addressing SD issues were discussed by Clark *et al.* (1995). Faucheux *et al.* (1996) also offered a variety of formal modeling studies in the context of SD. Presently, two modeling approaches namely computable equilibrium modeling (CGE) and input/output (I/O) analysis have emerged. CGE modeling has been used intensively to study the economic implications of environmental policy (Hazilla and Kopp, 1990). I/O models have been used for pollution generation, pollution abatement (Miller and Blair, 1985), requirements for emission reductions and energy conservation sectors (Hafkamp, 1991). On examining models for SD, a large number of differences are found, due to distinct theoretical starting points and, consequently linked to these, alternative demarcations of the complex problem associated with the overall objective of SD. Some models focus on technology, while others extend upon natural process description, and again others address social or evolutionary processes. At present there is no one preferred modeling approach. Each approach has its merits and limitations.

About 27.8 percent of India's total population of more than one billion lives in urban areas. The annual quantity of solid waste generated is expected to increase from six million tons in 1947 to 300 million tons by 2047. As the population is increasing at a very fast rate and the migration of people from rural to urban areas is contributing to this factor, it is likely that enormous quantity of solid waste would be generated. Recycling the wastes to benefit the ecosystem would be an effective way to achieve SD.

The potential for poverty alleviation with the help of economic growth is widely accepted. However, in India, economic growth has not been successful in reducing the poverty and that there is a strong link between the ecosystem and the poverty is clear. It has been estimated that natural resources provide about 12 percent of household income to poor households in India – worth about US$5 billion a year or double the amount of development aid that India receives. Hence, to achieve the SD, one of the first steps to alleviate the poverty is to be initiated. Poverty is generally considered to be a barrier to education. Poverty alleviation would cause an enhancement in education and also it would lead to economic growth.

Under-pricing nature's resources like air, water and environmental services has led us to believe that they are free goods and this has been a major factor in the world wide degradation of the environment and alarming supply of the natural resources. SD requires an efficient management of natural resources. Without exhausting them prematurely, conservation of the same would lead to SD. Therefore, an efficient management of natural resources would require an environmental assessment to quantify the costs of environmental damage as well as the benefits that would be able to create a positive action.

In the second stage, parameters like corporate government collaboration, GHG reduction, enhancing education skills and sustainable economic growth are being highlighted. Industry, services and agricultural contributes around 26, 48 and 25.6 percent to the GDP of India, which is approximately US$390 billion. Though it occupies only 2 percent of the land's area, it supports over 16 percent of the world's population. Although industrial growth plays a major role from an economic point of view, India has to pay a heavy price for it and the burden is on the environment.

Corporates, whether they are low or highly technical, manufacturing or agricultural, all produce wastes that are capable of polluting. Not many enterprises have a cleaner production strategy in countries like India, where a very high population has a high demand and creates wastes in form of pollutants, burdening the environment. A balance between the industrialization and environment can achieve SD. As a matter of fact, appropriate rules regarding the conservation and protection of natural resources would create an impact on corporations, which would in turn create an impact on economic system and organization structure in an environment friendly manner. An inclusive growth would be led by this step.

Employment creation which is at third level is led by enhancing education skill and sustainable economic growth. These two parameters fully would lead to improved health care and effective corporate governance. A major concern of increased risk to health and safety has led to a significant interest in environmental management.

Conclusion

The present scenario suggests that a lot of focus is required by the GOI to attain SD. India with its 1.1 billion plus population is the youngest country in the world, with a higher percentage of the population below the age of 25 than any other big nation. Out of one billion plus population, 43.6 percent belongs to the labor force and 41.6 percent are employed. For more than 50 percent unemployed population, poverty plays a significant role in the economy. Poverty and a degraded environment are closely inter-related, especially where people depend for their livelihoods primarily on the natural resource base of their immediate environment. Restoring natural systems and improving natural resource management practices at the grassroots level are central to a strategy to eliminate poverty. As not many poverty alleviation programs have been inducted in the official policies and strategies, the result would give an important insight to the policy makers. A positive development is the gradual slowing down of the population growth and the labor force. With higher education achievement, the labor force is expected to go down further.

Health in India is directly linked to the issue of poverty plaguing a huge population especially those in rural areas and urban slums such that it affects the accessibility and quality health care services to people. The annual expenditure on health by the GOI has experienced an increase of 1-2 percent of the GDP in Eleventh Five-Year Plan. Corporations are the power houses that generate employment, provide education and health care and give sustenance to the society. Good governance needs to ensure that the corporations take in to account the interests of all constituencies in which they operate. A business enterprise's corporate actions must be compatible with long-term societal needs such as the quality of environment and welfare of local community. Therefore, an emphasis on corporate governance would lead to SD in India. Adequate resources and support for education for SD are essential. An understanding must be promoted among key decision makers of the potential of education to promote sustainability, reduce poverty, train people for sustainable livelihoods and catalyze necessary public support for SD initiatives.

In recent years, development planning in India has increasingly incorporated measurable goals for enhancement of human well-being, beyond mere expansion of production of goods and services and the consequent growth of per capita income. With the increasing pressures on land due to urbanization, rapid economic development, increasing infrastructure requirements, etc. especially in a fast growing economy like India, the acquisition of land by the government has increased.

Limitations of the model

To decide the relationship through ISM, only two expert's opinion have been considered in local Indian scenario. Hence, the study may be limited by their level of knowledge and experience. Also the ISM model developed is not statistically validated. Since, the ISM model developed has not been statistically validated, SEM also commonly known as the linear structural relationship approach, may be used to test the validity of such a hypothetical model.

Scope for future research

Since the study does not consider all the stakeholders of CDM, it may be considered in the future study. Across the society, the data can be gathered, namely, from industries, NGO's, government, academia, etc. and can be analyzed to get a more enhanced view on CDM and SD.

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Further reading

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