Inclusive Green Growth and Sustainable Development through Productive Consumption

Soumyananda Dinda

Sidho- Kanho- Birsha University, Purulia, West Bengal, India.

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Abstract

This paper analyses development mechanism through which natural resource capital regenerates and contributes to economic growth. Climate change challenges economic development in the 21st century but it also provides opportunity to grow with developing green. New development strategy is the inclusive green growth that leads towards sustainable development. Regeneration of natural resource is a crucial productive capital in the economy. This paper suggests a theoretical model and explains sustainable development mechanism through productive consumption. Empirical observations also support this model. This paper suggests policy inputs regarding regeneration of natural resource capital and its preservation in term of water shed development, flood control or development of ecosystem services through creation of jobs in the channel of productive consumption. Policy makers should focus on employability, regeneration and preservation of natural resource capital for sustaining livelihoods in the economy.

JEL *Classifications*: Z_{130}, J_{240}, O_{150}.

Key Words: Green Growth, Climate Change, Social Capital, Productive Consumption, Reciprocity, Flood Control, Watershed Development, Natural Resource Capital, Human Capital, Inclusive Growth, Sustainable Development.

Address for Correspondence: Department of Economics, Sidho Kanho Birsha University, Purulia 723101, India. E-mail: sdinda2000@yahoo.co.in, and sdinda@gmail.com

1. Introduction

Climate change challenges to the developing world which follows unsustainable development strategy[1]. What is the development strategy of developing countries for their economic growth and sustainable development to mitigate climate change? Does climate change reduce economic activities? Answering such questions is essential for searching sustainable development strategy which mitigates climate change issues. Sustainable development is a lifestyle of human society that continues for long time without major adverse consequences (Heal 2011). Climate change provides certain space and opportunity to grow with efficient products such as clean, green and climate friendly product or climate smart goods (Dinda 2011). Resource-efficient growth process has less impact on environment and highly desirable in long run.

Recently, the global climate change associated with economic crisis forces policy makers to rethink about traditional growth strategy. Urgent need is to reduce GHG emissions and prevent further damage to environment/nature and human society. Climate change threats human life with a negative effect on human health and also threats to social security. Urgent requirement of the world is to adopt *green growth* development strategy. *Green growth* decouples economic growth from adverse environmental impacts.

[1]It is facing problem of energy security, and resource constraint to achieve desirable economic growth and development. Development strategy of the twentieth century is the rapid industrialization. Worldwide rapid economic development starts in the process of industrialization that leads to mass production system. This mass production is based on fossil fuel oriented industry, which released huge green house gases (GHG) emissions. These accumulated GHG emissions and other wastes gradually deplete the existing environment and ecological system of the Earth. Carbon dioxide (CO_2) emission is one major component of GHG. CO_2 emission is the main culprit of recent global warming and climate change (Coondoo and Dinda (2002)). Desirable growth is not achievable due to depletion of resource, climate change and other growth constraints (Arrow et al (2004), Dasgupta et al (2000)). Agricultural production also leads to loss of soil and water pollution due to over use of fertilizers; depleting ground water, deforestation - all leads to change the climate and threats to human civilization.

This paper focuses on green growth and development that is achievable through productive consumption[2], and emphasises on regeneration of natural resource[3]. The government expenditure on flood control and water shed development etc are considered here productive consumption rather than simple investment on natural capital. Productive consumption has wider impact on the economy in terms of development of natural resource and, human and social capital[4]. This paper incorporates regeneration and/or preservation of natural resource capital, which is generated in the channel through improvement of ecological services, flood control mechanism; water shed development, raising soil moisture, improvement of soil fertility, and expansion of green area etc. Natural resource capital is endogenous variable in our model that emphasises on the contribution of man-made natural resource capital in the economy.

Green growth is a development strategy to achieve *sustainable development*[5] with relatively more focus on economic growth and environmental quality improvement

[2]Productive consumption is a part of expenditure that creates employment opportunity at local level and creates base for interaction among them (Dinda 2008).

[3]Natural resource is a crucial productive capital in the economy and makes sense to invest in it. So, spending on regeneration or preservation of natural resource should be considered as investment in productive natural resource capital.

[4] It develops certain social norms and networks that generate shared understandings, which underpin co-operation and collective action for mutual benefits like developing flood control system, and water shed management that creates the base for economic prosperity. This productive consumption has duel impact on the economy in terms of creation of social (networks) capital and regeneration of natural resource capital. Here, social capital refers to the norms and networks that enable collective action. It represents an interaction between individual and society (Alesina and Ferrara 2002), since social capital allows individual to act in certain ways, but only within a collectively defined and supported area of freedom (Berggren and Jordahl 2006). Interaction enables people to commit themselves to each other and repeated interactions with each other in their daily business reduce social transactions cost (Putnam 1993). Social capital allows individuals to resolve collective problems more easily. Individuals often might be better off if they cooperate, with everybody doing her/his own work (Coleman 1988, 1990). In this context, social norms and networks provide an institutional mechanism with the power to ensure compliance with the collectively desirable behaviour (Bourdieu 1980, 1986). Social capital greases the wheels that allow communities or nations to advance smoothly.

[5]Sustainable development is the development that meets the needs of the present generation without compromising the ability of the future generation to meet their needs (*Our Common Future (1987)).* The concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given. It leads to a secured growth engine through research and development of clean energy and green technology and creating new jobs.

activities. *Green growth* balances harmony between economy and environment by preventing climate change and reducing environmental damage with conservation of resources and energy, and efficient use of them. Sustainable development is not followed automatically by green growth which consists of economic growth, ecological-efficiency and social development. Policy makers should consider more social development including all.

Inclusive growth approach emphasizes on the broad-based policies that remove constraints to develop and create a level playing field for investment such that it can allow people to *contribute to* and *benefit from* economic growth. *Inclusive growth approach* is different from earlier *pro-poor growth* approach[6], which is interested only in welfare of poor people. Pro-poor growth approach focuses on one deprive section of the society and ignores others, whereas inclusive growth approach includes all. *Inclusive growth* approach[7] is a long run perspective emphasising on increasing productive employment opportunities. This paper argues for inclusive growth focusing on (i) productive consumption (Steger 2002) which creates opportunities for the majority of the labour forces, poor and middle-class alike etc and (ii) regeneration of life support system (Cleveland (2003)) in the economy[8].

[6] In the relative definition, growth is *pro-poor* if and only if the incomes of poor people grow faster than the rest of the population, ie., inequality declines.

[7] The analysis focuses on ways to raise the pace of growth by utilizing more fully parts of the labour force trapped in low-productivity activities or completely excluded from the growth process. Recently the World Bank (2012) suggests adopting inclusive growth model for sustainable development.

[8]The life support system includes all biotic & non-biotic systems which provide ecological and environmental services to all living flora and fauna in this planet. The world wide environmental degradation (World Bank 1992) makes people worried about life support system or declining the quality of environment (Dasgupta et al 2000). Natural resources and environmental services decline both in terms of quality and quantity. A considerable literature (World Bank (1992), Boyce (1994), Agras and Chapman (1999), Beckerman (1992), Dinda (2004, 2005), Bimonte (2002), Cole et al. (1997), Cole (2004), de Bruyn (1997), Dinda et al. (2000), Gawande et al. (2000), Grossman and Krueger (1995), Munasinghe (1999), Pasche (2002), Rothman (1998), Selden and Song (1994), Shafik (1994), Suri and Chapman (1998), Tisdell (2001)) provide evidences on the link between economic growth and environmental degradation.

Green growth approach[9] is a newly development strategy which requires proper balancing across environmental resources and socio-economic activities that certainly drives toward sustainable development. Links between environment, economic and social factors are complex and nonlinear. Green growth is based on natural resource and its regeneration and/or protection through productive consumption which has potentiality to include all for desired social development. Inclusive green growth is a pathway to sustainable development. Recently, the World Bank (2012) emphasizes on inclusive green growth which argues that sustained growth is necessary to achieve the urgent development needs of the poor. The green Solow model of Brock and Taylor (2010) explains the relationship between environmental degradation and economic growth using Solow model (1956). Dasguta and Heal (1974), Nordhaus (1974) and Solow (1974) consider exhaustible (non-renewable) natural resource as a factor of production but reproducible natural resource is used in our model. Smulders (1994), Bovenberger and Smulders (1996) also differ from our model in terms of regeneration mechanism through production consumption.

Following Steger (2002) this study incorporates productive consumption in the growth model and adds value in literature focusing on a specific development mechanism through which natural resource capital regenerates and contributes to economic development. Earlier economic analysis has given less emphasis on regeneration of stock of natural resources for promoting economic growth and recently, economists become more and more interested on green growth for sustainable development. This paper identifies and prioritizes inclusion of natural resource constraints in economic growth

[9]There is sufficient scope to develop without slow growth. Green growth is necessary, efficient and affordable (World Bank 2012).

process, which creates opportunities for all through productive consumption (Steger 2002) that promotes economic growth and social development[10]. This paper mainly concentrates on formation of natural resource and its preservation in the channel of productive consumption[11]. Environment is a common natural resource, i.e., public goods. Everybody access it for survival. So, one part of expenditure should be utilized to develop and protect the environment. We analyze formation of resource capital and its impact on sustainable economic development in the framework of endogenous growth model. Paper will help policy makers for designing and implementing climate change related policies.

This paper is organized as follows: Section 2 builds up a model, and sub-section 2.3 discusses how productive consumption develops natural resource capital; Sub-section 2.6 analyses the results derived from the model. Section 3 provides empirical observations tangentially. Section 4 suggests policy, and lastly Section 5 concludes.

2. Model

[10]Social capital contributes to economic growth by focusing the importance of cooperation and trust within firm, market and the state. Heller (1996), Ostrom (2000) and Rose (2000) point out that social capital contributes to economic growth by facilitating collaboration between individual interests and the achievement of increased output. Countries/regions with relatively higher stocks of social capital, in terms of generalized trust and widespread civic engagement seem to achieve higher levels of growth, compared to societies with low trust and low civicness. Several studies (Bertrand and Mullainathan (2000), Beugelsdijk and Smulders (2004), Bjornskov (2006), Glaeser et al. (2000), Alesina and Ferrara (2002), Dinda (2008), Knack et al. (1997), Sobel (2002), Temple and Johson (1998)) have discussed about the features of social capital and its contribution to economic growth.

[11]The productive consumption (Steger 2002) stimulates to accumulate human capital through which a base is created for cooperation, norms and regulations, and institutional formations, and thus, it helps to develop and strengthen social networks and thereby form social capital that may help to create public goods and protect it. The expenditure on health and education has positive contribution to the output growth, which is revealed, on macroeconomic level. This consumption expenditure related activities is classified as productive consumption. Development economists (Steger (2002), Dasgupta and Marjit (2002)) recognize the possibility of productive consumption that enables the satisfaction of current needs and also increases productivity of labour.

This section develops a model that analyses how productive consumption leads natural resource capital formation and/or prevents the loss of productive inputs, and improve efficiency and thereby economic growth and development. Steger (2002) defines capital as the composition of physical and human capital; here we add productive resource capital to it for wider sense of capital that is discussed later. Consider a close economy with given fixed population (i.e., growth rate of population is zero).

2.1 Welfare function

The representative household maximizes her (his) instantaneous utility (or welfare) through consumption at each moment. Using traditional utility function *U(c),* objective of the household is

$$\underset{c}{Max} \int_0^{\infty} U(c)e^{-\rho t}dt \qquad U_c>0\ ,U_{cc}<0 \qquad (2.1)$$

Where ρ (>0) is the discount rate.

2.2 Production function

The representative economic agent (household or planner) produces output, *y*, using composite capital, *k*. Under constant AK- type production technology, the intensive production[12] functional form is

$$y = f(k),\ f' = constant > 0,\ f'' = 0 \text{ and } f(0)=0. \qquad (2.2)$$

The assumption of diminishing returns is replaced by constant returns, which is crucial for sustainable growth in long run and also a broader interpretation of capital. Steger (2002) defines capital as the composition of physical and human capital, here; natural resource capital is added to it for wider sense of capital that is discussed later.

[12] All variables are measured in terms of per capita. Here, we assume that population growth rate is zero.

One part of produced output is used for consumption and other part for investment. The equation of motion of the physical capital, k_p, is

$$\dot{k}_p = f(k) - c - \delta_p k_p \qquad (2.3)$$

Where δ_p is the depreciation rate of physical capital, and *c* is consumption. Suffix *t* is absent in stock dynamics, for simplicity we drop suffix *t* from all equations in this paper.

2.3 Productive Consumption creates natural resource capital

One portion of national consumption expenditure is used for regeneration and restoration of natural resource capital in terms of water shed development, reforestation, regeneration of ecological services, controlling flood and preserving soil fertility etc that definitely increases life support system in the economy and improves quality of life and productivity. This type of consumption is considered as productive consumption that helps to develop natural resource capital as well as improve productivity. Productive consumption improves natural resource capital of a country/region and thereby economic development. In this context, natural resource regenerating function depends on available stock of natural resource capital (k_R) and productive consumption (c) spending for its development and preservations. Natural resource generating function is:

$$R = l(k_R, c) \qquad (2.4)$$

$l_c > 0$, $l_{cc} \leq 0$, $l_{k_R} > 0$, $l_{k_R k_R} < 0$, $l_{ck_R} > 0$; $\lim_{c\to\infty} l_c = \bar{l}$ & $\lim_{c\to\infty} l_{cc} = 0$.

$l(k_R, 0) = \bar{R}$ but $l(0, c) = 0$

In the production process, each production generates certain pollution as a bye product. Pollution degrades environment and natural resources deplete. Let pollution is generated

as a proportion of output and damages natural resource capital at the rate of ϕ $(0 \le \phi < 1)$ for each unit of output. Due to pollution, natural resource damage function is $D = \phi f(k)$.

The equation of motion of natural resource capital, k_R, is

$$\dot{k}_R = l(k_R, c) - \phi f(k) - \delta_R k_R \qquad (2.5)$$

Where, $l(k_R, c)$ is regeneration function of natural resource, $\phi f(k)$ is the damage function due to (output) production that extracts resources, and also generates pollution and waste in the production process, and δ_R (>0) is the natural depreciation rate.

Physical capital[13], k_p, is used to produce consumption goods and its accumulation requires, at least one part, the renunciation of consumption, while natural resource capital, k_R, results from productive consumption (similar to human capital enhancement function of Steger (2002)).

2.4 Composite capital

The whole stock of composite capital is defined as $k = k_p^{\alpha} k_R^{1-\alpha}$, 0<α<1. The equation of the motion of stock of composite capital, *k*, can be written as:

$$\dot{k} = \eta_1 \dot{k}_p + \eta_2 \dot{k}_R \qquad (2.6)$$

Where $\eta_1 = \frac{\alpha k}{k_p}$, and $\eta_2 = \frac{(1-\alpha)k}{k_R}$.

Substituting eq.(2.3) and (2.5) in eq(2.6), it can be written as

$$\dot{k} = (\eta_1 - \eta_2 \phi) f(k) - \psi(c, k_R) - \delta k \qquad (2.7)$$

Here $\psi(c, k_R) = \eta_1 c - \eta_2 l(k_R, c)$ is the Net Consumption, and $\delta = \alpha \delta_p + (1-\alpha)\delta_R$.

[13] In this context, k_p could be equally interpreted as physical and human capital that requires the renunciation of consumption for its accumulation (Steger 2002).

The coefficient of production function in equation (2.7) is different from standard dynamic equation of stock of capital and it is net share of output contributing capital formation. Eq (2.7) contains one additional term viz., net consumption $\psi(c, k_R)$, which includes productive consumption through renewable resource function $l(k_R, c)$. So, productive consumption creates and preserves natural resource capital, which has two fold impacts on the economy – directly develops natural resource capital and indirectly creates social capital that helps to reduce conflicts and creates the pace for sustainable development.

2.5 Optimization

The traditional objective of the household (eq. (2.1)) is

$$Max \quad \underset{c}{W} = \int_0^{\infty} U(c) e^{-\rho t} dt$$

Subject to the constraint (eq. (2.7))

$$\dot{k} = (\eta_1 - \eta_2 \phi) f(k) - \psi(c, k_R) - \delta k$$

The Hamiltonian function is

$$H = U(c) + \lambda\{(\eta_1 - \eta_2 \phi) f(k) - \psi(c, k_R) - \delta k\} \tag{2.8}$$

Where $\delta = (\alpha \delta_p + (1-\alpha)\delta_R) > 0$, $(\eta_1 - \eta_2 \phi) \neq 0$, $\lambda > 0$, $k_p(0) > 1$, and $k_R(0) > 1$.

2.6 Interpretations

F.O.C of this solution is

$$u_c = \lambda \psi_c \tag{2.9}$$

Where λ is the shadow price of composite capital, *k*, and $\psi_c(c, k_R) = \eta_1 - \eta_2 l_c(c, k_R)$. The eq. (2.9) implies that along the optimal trajectory the marginal utility of consumption equals to marginal net cost of consumption in utility measured units.

The optimal economic growth rate is

$$\frac{\dot{c}}{c} = (\sigma + \theta)^{-1}\left\{(\eta_1 - \eta_2\phi) f_k(k) - \psi_{k_R} - \frac{\psi_{ck_R}}{\psi_c}\dot{k}_R - (\rho + \delta)\right\} \tag{2.10}$$

Where $\sigma = \dfrac{-cu_{cc}}{u_c} > 0$,

$\theta = \dfrac{c\psi_{cc}}{\psi_c} = \dfrac{-\eta_2 l_{cc} c}{\eta_1 - \eta_2 l_c}$, provided $\eta_1 \neq \eta_2 l_c$,

i.e., θ is undefined at $l_c = \dfrac{\eta_1}{\eta_2} = \dfrac{\alpha}{(1-\alpha)}\dfrac{k_R}{k_p}$,

$\theta < 0$ if $l_c > \dfrac{\alpha}{(1-\alpha)}\dfrac{k_R}{k_p}$ and $\theta > 0$ if $l_c < \dfrac{\alpha}{(1-\alpha)}\dfrac{k_R}{k_p}$

The term σ is inter-temporal elasticity of consumption. The second term, θ is the elasticity of net consumption, in the first bracketed term. It is only extra term added to traditional optimal consumption growth rate due to productive consumption. That means consumption or expenditure on development of flood control system, reforestation, watershed development, conservation of soil, and protection of biodiversity and local ecosystem that regenerate natural resource capital, which stimulates and creates base for sustaining economic growth. In other words, productive consumption has significant impact on economic growth through elasticity of net consumption (θ).

We observe that natural resource capital is an important factor that explains economic growth. Since $-\psi_{k_R} > 0$, in eq.(2.10), economic growth rate is more than productive

consumption growth model developed by Steger (2002). This difference is created due to incorporation of regeneration of natural resource capital. It is also reflected in third term, $\frac{\psi_{ck_R}}{\psi_c}\dot{k}_R$, in the second bracket in eq. (2.10). The stock dynamics of natural resource capital ($\dot{k}_R$) has strong and direct association with economic growth. Cross marginal net consumption increases with natural resource capital i.e., $-\psi_{ck_R} > 0$. Productivity of natural resource capital improves due to productive consumption, and thereby it has definite returns or/and incentives to grow natural resource capital through widening productive consumption and it also generates social capital through social awareness and social network.

4. Policy

Productive consumption is effective and essential in LDC to overcome the bottlenecks and stimulate for accelerating economic growth. For incremental productive consumption (c) the natural resource capital $l(c, k_R)$ rises and it influences economic growth rate through formation of natural resource stocks and elasticity of productive consumption (θ). Thus, productive consumption should be a prime policy for development of underdeveloped countries if it truly enhances human capital of that country and develops institutions to regulate and control activities for social benefits.

In less developed economies, productive consumption should be a crucial policy for development of human (health and knowledge) capital that generates social norms, regulations and cooperation, and builds up social networks that helps to create and concretize social capital. Formation of social capital is a necessary precondition to

develop and build up infrastructure and other public goods. Cooperative social networks can protect natural resources and environmental quality.

5. Conclusion

This paper suggests a green growth model and provides evidence of development mechanism drives to green growth in India. Development mechanism, in the channel of productive consumption, generates natural resource capital and stimulates economic growth in consequent years. Directly and indirectly, productive consumption contributes to economic growth in endogenous growth framework. The economic growth rate is more compared to classical growth rate. .

This paper suggests few policies for green growth and sustainable development. Policy makers might focus on the building of social capital through natural resource capital formation through productive consumption that improves economic prosperity of distressed communities, and economic inclusion of deprived, disadvantaged and marginalised individuals. Productive consumption might build a new level of social trust that acts as collateral and solve collectively the problems of poor people (Dowla 2006). This study has several limitations that indicate future research direction - social capital formation and its role in natural resource protection are not discussed in this model; better prediction of the model needs more data and application of innovative research methodology. Our next research agenda is in this direction.

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