

# Beyond Strong Sustainability

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## Summary of Article

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- Sustainable has become part of decision making language but many issues still unresolved.
- How does one sector of economy contribute to economy as a whole?
- What is the role of ecological resources in a sustainable economy?
- Paper provides an examination of concepts towards answering these questions.
- Application of a sustainable development model to Mining in Brazilian Amazon.



## Introduction

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- Definition of sustainability
- Debate over to what degree can sustainability be implemented.
- Literature on weak sustainability (Gutes 1990, Hediger 1999), strong sustainability (Stern, 1997) and potential for sustainability (Solow, 1974, Stglitz, 1974, Dasgupta and Heal, 1974)



## Substitutability

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- Interchange between natural and man made capital in concepts of sustainability.
- Aggregation of natural capital
- Natural capital treated as a homogenous capital.
- Critical vs non critical natural capital



## Traditional Approaches

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- Tend to focus on human made capital accumulation.
- Harrod-Domar model
- Solow factor substitution model
- Kaldor saving rate adjustment model



## Policy Implications of Traditional Approaches


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- Development viewed as a process of artificial capital accumulation and removal of obstacles to the artificial capital accumulation process.
- Development policy may have focused too much on accumulation of human made capital to the exclusion of consideration of natural capital (and other types).



Accumulation of Human made Capital and the vicious cycle of poverty / Environmental deregulation and the vicious cycle of poverty

- Injection of capital has not worked in many international development programs.
- Environmental degradation affects and is affected by poverty.
- Hence environmental resource capital is essential to sustainability.



## Sustainability and Exhaustible Resources

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- Early work by Malthus and Ricardo
- Built on by Barnett and Morse, 1968
- More exploration by Hartwick 1977, 1993; Mikesell 1997; Pezzey 1989; Pezzey and Withagen 1998; Tilton 1996 and Vincent et al 1997.



## Barnett and Morse

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- Technological innovation in discovery, extraction and production techniques lowered the cost of extractable resources, greatly outweighing the cost increasing effects of depletion.
- Interchangeability or perfect substitution between labour (HC), man made capital and extractable natural resources as inputs to the production process.
- Models do not incorporate environmental resources as production process inputs.



## Other Arguments (Kahn & O'Neill 1999)

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- At the large scales defined by the current level of economic activity, artificial capital cannot provide an adequate substitute for environmental resources as it is completely infeasible for human activity to provide the ecological services at the level of natural activity.
- Ecological complexity argues against complete substitutability between environmental and other types of capital.
- Inadequate pricing system. Ecological systems do not have prices associated with their services because they are external to markets.



## A Revised treatment of Sustainability

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- Hartwick Model – focuses on the generation of sustainability through a replacement mechanism. Defines the level of investment and savings which must be generated by the current generation to replace the natural capital they have consumed in order to maintain a constant level of consumption for future generations.
- Environmental resources omitted for Hartwick model.
- Paper adds ER to Hartwick model.



## Revised Treatment (slide I)

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- $*C = (1-x) FrR$  if  $x=1$ , then  $*C = 0$
- $x$  = chosen proportion of rents associated with production of exhaustible resources.
- $Fr$  = MP of resource flows
- $R$  = resource extraction
- Does not consider Enviro. resources



## Revised Treatment (slide II)

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- Assume ERS (E) proportional to ExRS
- Assume S get smaller E gets smaller.
- $EcoS = F(E)$
- $C = Q + pE - *K$



## Revised Treatment (slide III)

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- $*C = (1 - x) Fr * R + p * E$
- $*C$  must be -ve when  $0 \leq x < 1$
- Therefore non sustaining
- We want +ve  $*C$
- Can be enhanced by growth in E or diminished by enviro. Negligence.



## Revised Treatment (slide IV)

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- Tech. Opts  $*R$  is +ve,  $*R$  and  $*Fr$  are large therefore more +ve  $*C$ .
- Enviro. Pess.  $*E$  is -ve,  $*R$  proceeding to -ve therefore  $*C$  is -ve.
- $*C$  is a policy choice
- Invest in artificial capital (R&D) or invest in protection of ecoservices.



## Production Function

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- Sustainability cannot be left to market forces as these can alleviate scarcity of mineral resources but are not applicable to environmental resources in this scenario.
- Critical point at E2. E1 enhanced ecoservices and increasing TP.



## Implications for Brazilian Amazon

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- Tension between domestic benefit and global costs of development
- There is Low artificial capital, low levels of human capital, high levels of extractive resources and high levels of environmental capital.
- How can the necessary surplus to increase artificial and human capital be created?
- (Note: surplus for capital investment need not come from the region itself.)



## Implications for Brazilian Amazon (slide II)

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- Expansion of Mining.
- Can lead to sustainable development if...
- (i) Rents are reinvested in natural and man made capital
- (ii) Activity must result in no significant damage to rainforest or riverine systems.
- Subsistence level – Investment in human capital – sustainable farming techniques.



## Conclusions

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- The central focus of sustainable development should be the accumulation of human capital, artificial capital and natural capital while protecting the stock of environmental capital.
- Environmental capital over time is crucial to development
- In long term, reinvestment from productive activities into artificial capital is not enough to support development unless preserved environmental capital stock is also included.