Analysis of Soil Conservation Policies
: A Case Study of Germany and Bangladesh

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Abstract

Based on case study through literature review, the paper was to focus mainly to analyze soil conservation policies using the Institutions of Sustainability (IoS) framework. Germany and Bangladesh were considered as study area of the paper. Although both countries are initiating conservation policies to mitigate the problems, the degree of sustainability varies from one country to the other. Among the policies, at least the incentive-based policy of agri-environmental schemes are successful and sustainable in Brandenburg even after the termination of the program. These schemes help raise farmers' awareness of soil degradation problems through information distribution and learning processes. Apparently, lack of awareness of the problem among farmers is the first barrier to policy implementation. Obligatory policies such as the Nitrate Directive of Germany and the Fertiliser Regulation Guide of Bangladesh seem promising in achieving greater impacts. However these impacts can be achieved only when the policies are backed with effective and efficient governance structures that can be able to implement, monitor and evaluate the progress as well as sanction defaulters. Combinations of voluntary and obligatory policies across different sectors are necessary for desire result.

Key words

Soil, Conservation, Policies, Germany and Bangladesh

Introduction

Institutions are "the rules of the game in a society, or, more formally, are the humanly devised constraints that shape human interaction" (North, 1990). In his definition, North includes both formal constraints (e.g., rules) and informal constraints (such as conventions, customs, traditions, and codes of behavior). Institutions are different from organizations, insofar as organizations are created by groups of people for specific purposes that can themselves be agents of institutional change. Institutions have both constraint and enable human behavior (Hodgson, 2006). The existence of rules implies constraints to human actions on the other hand it can also paved way for other possibilities that otherwise would not exist if that institution is not in place.

The Institutions of Sustainability (IoS) framework is a coherent framework that takes into accounts the interdependencies between ecological and social systems to analyse a given human-nature related interactions and/or transactions (Hagedorn, 2008 and Prager, 2010). Nature-related transactions are typical for agriculture, fishery, forestry and others which interact with natural systems frequently. The framework would help us to capture the complex interrelation of nature-related transactions: in our case soil conservation. The framework has four exogenous dynamics (see Fig 1) which includes properties of transactions, characteristics of actors, institutions and governance structures which determine the outcome of the analysis (ibid). Properties of the transactions are induced or prevented in the action situation (including the bio-geophysical conditions), the characteristics of the actors involved in the action situation. Institutions are the set of rules/property rights

that regularize actor's behavior, the governance structures are organizational solutions for making institutions effective these could include contracts, bureaucracy, cooperation or markets. The properties of transactions and characteristics of the actors determine what kind of institutions and governance structures emerge (Prager, 2010).

These four exogenous factors interconnected and influences to each other (See Fig 1). According to Hagdorn (2008): institutional arrangements arise depends on the features and implications of the transactions related to nature and the ecosystem. This is mainly influenced by the physical properties and material transformations with which environmental goods and bads, benefits and damages are associated. At the same time, institutional change depends on the characteristics and objectives of the actors involved in those transactions. This not true for individual actors but it also holds true for communities who use organizations and networks to shape institutions according to their interest and to solve conflicts. The change in institutions due to the properties of transaction and characteristics of the actors affect the design and allocation of rules at different level and in particular property rights on ecosystem functions. Then such changes in institutions/rules are accompanied by changes in governance structure.

For the purpose of this paper we make 'soil conservation policies and practices' as the action arena which comprises all policies and practices that apply to our cases (German and Bangladesh) directly or indirectly. The related action situations in this arena are the farming practice of the farmers and policy implementation at the farm level.

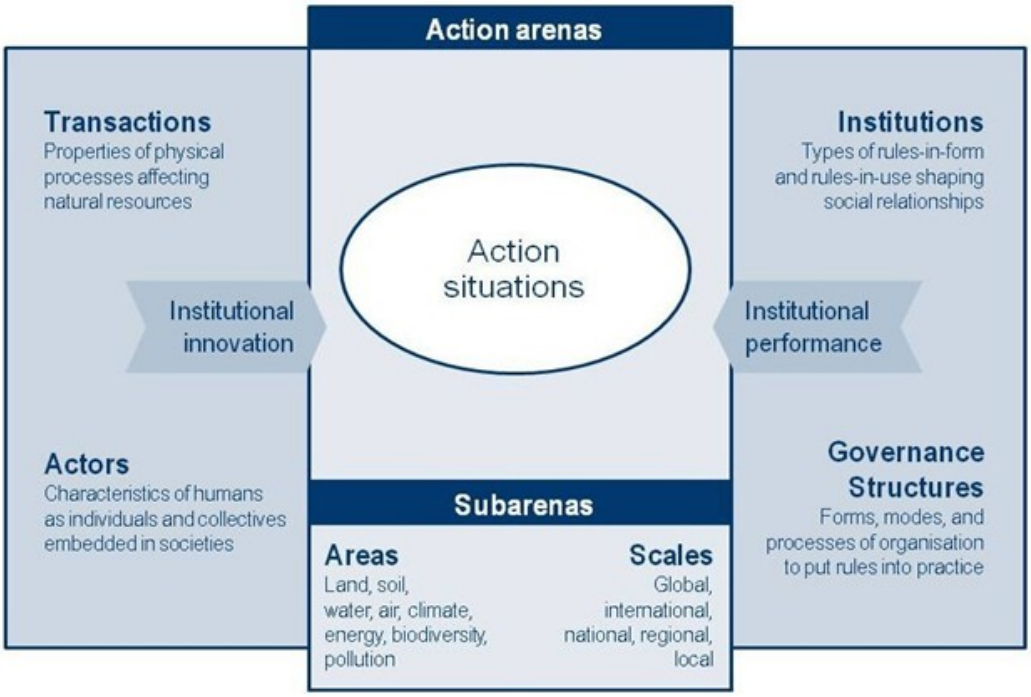

Fig 1: The IoS framework (Hagedorn, 2008)

Objectives of the Study

1. Analyze soil conservation policies using the IoS framework
2. Compare the sustainability of soil conservation in the case studies

Methodology

Different literatures especially reputed scientific documentations, books; journals etc. were studied for developing theoretical concepts of the topic and conduction of the paper as well.

Theoretical Concept of Soil Conservation

Soil degradation could happen due to many reasons mainly wind and water erosion. In addition to these facts, soil erosion also could happen and exacerbated when farming practices are not compatible with the fact that soil can be washed away. Thus soil erosion enhances by natural and anthropogenic causes. The later increase the magnitude and frequency of the process (European commission, 2004). Further the report pointed out that agriculture is one of the man drivers of unnatural soil erosion because many farming practices are soil-unfriendly. These farming practices include: overstocking and overgrazing, inappropriate farming techniques, lack of crop rotation, planting crops down the contour instead of along it. Thus, agricultural activities are one of the main factors which contribute to soil degradation (Boardman et al., 2003). The problems had been neglected for long time because of an emphasis on increases in productivity and the fact that many of the costs were hidden or were external to the farm and were borne by society (ibid). In addition to these facts, land use policies are one of the most direct socio-economic factors which influences land management.

Land degradation has been identified as a serious problem and poverty traps in the developing countries (Dasgupta and Maler, 1991; Barbier and Lo´pez, 1999 cited on Shively, 2010). But the problem of soil erosion is not only confined to developing countries rather it is global problem which affects both developing and developed countries. For instance despite the introduction of several soil conservation policies, degradation of agricultural land remains one of the major environmental problems in German agriculture (Prager et al., 2011). Despite increased awareness and years of effort and investment made for prevention or mitigation, the problem of soil degradation exists (Prager, 2010). In addition, it is also predicted that the Europe's soil resource will continue to deteriorate, probably as a result of changes in climate, land use and other human activities (Gobin et al., 2003).

Thus, it is apparent that practices of farmers and other land users affect the practice of soil conservation. The activities of these actors are influenced by interrelated institutions and policies and the governance structure in which they are working on. It is also increasingly recognized that achieving sustainability as an issue of institutional change and institutional innovation. For instance Imperial (1999) concluded that institutional analysis can be used to better understand the institutional arrangement used to implement eco-system based management programs.

Soil conservation is an issue that requires a consistent approach that encompasses social systems as well as natural systems, because both may substantially affect institutional change and institutional performance. Thus, it is important to have an analytical framework which comprehends all the relevant systems in its analysis. Historically, soil conservation issues and related agri-environmental policies has been addressed separately from different disciplinary perspectives this often led to inadequate results because approaches were not sufficiently integrated and gaps are merged (Prager, 2010). The IoS framework which is introduced by (Hagedorn, 2008) is a useful tool for our analysis to capture the complexity of factors and its relationship which affects soil conservation practices. The framework integrates four exogenous factors which includes the properties of transactions, characteristics of actors, institutions and governance structures and displays their relevance in action arenas and action situations.

Most studies on soil conservation have failed to identify properties of transaction and characteristics of actors as the main drivers of institutional innovation/change (Hagerdon, 2008). Through these drivers, degradation

processes, farming practices and institutional design which constitute the different dimensions of soil conservation are interrelated. Many authors such as Sommer and Zach (1992); Lahmar (2010); Liu et al. (2011) and Emadodin et al. (2011) have treated these aspects separately. The emergence of the IoS framework which captivates this interrelationship calls for new research on institutional analysis of soil conservation (Prager et al. 2011). For analysis we took Germany (Brandenburg providence) and Bangladesh as the comparison analysis on soil conservation policies and their practices.

Discussion of the Paper

Case Study 1: Brandenburg- Germany

Soil Degradation Processes

Soil erosion and soil compaction are the major soil degradation processes in Brandenburg (Prager et al., 2011, Emadodin et al. 2011; Hüttl and Frielinghaus, 1994). Apart from climatic changes, these degradation processes are also caused by human activities in relation to changes in land use pattern such as agriculture (Hüttl and Frielinghaus, 1994; Emadodin et al. 2011). Brandenburg is characterized by intensive agriculture on large fields with steep slopes. The soil type is predominantly glacial (Hüttl and Frielinghaus, 1994; Emadodin et al. 2011). As the authors explained these soils are prone to aggregate slaking and surface sealing which makes the surface impermeable and consequently runoff during heavy rainfall. The fields converging fields with long and steep slopes facilitate the runoff flow which develops rills and gullies with enhanced sediment transport and deposits (Liu et al. 2011).

Soil compaction on the other hand is a typical man made process caused by repeated use of large and heavy machinery on the soil (Sommer and Zach, 1992; Hüttl and Frielinghaus, 1994; Matthias et al., 2007; Emadodin et al. 2011). This reduces soil conditions like aeration and water infiltration; conditions which become severe on soils with low humus content like the morainic (Hüttl and Frielinghaus, 1994). As Sommer and Zach (1992) explain, reduce tillage improves the macro and not the micro structure of the soil. The authors further explain that high tillage intensity which depends on the crop type further increases soil compaction.

Farming Systems and Practices

Arable land in the region is used for the cultivation of winter wheat, winter rapeseed, winter barley, maize, sugar beets and potatoes. Conventional farming is the prevailing farming system although organic farming has been increasing in the last 10 years (Prague et al., 2011). Farmers use conventional mouldboard ploughing to remove leftovers of previously cultivated crop, manage weeds and break up large clods for seedbed preparation. During this period, the soil is left uncover until late into the planting period making it prone to compaction and runoff during rainstorms (Sommer and Zach, 1992; Prague et al., 2011). Short crop rotations between cereals and root crops are common but these crops require intensive tillage (Sommer and Zach, 1992). There is also the production of row crops like maize, sugar beets and potatoes which enhance water erosion (Prager, 2011).

Soil Conservation Policies

Soil conservation policies in the Brandenburg as identified by Prager et al. (2011) are the Federal Soil Protection Act and EU agricultural policies which include Agri-environmental Schemes (AES), Nitrate Directives and Direct Payment Act. The German Federal Soil Protection Act obliges farmers to take precautionary measures that will preserve soil fertility and its natural resource base capacity (Lebert et al., 2007). With its lay down principles directly targeting soil degradation, the policy looks promising except for its lack of organizational structure and implementation measures (Gunreben, 2005; Lebert et al., 2007; Pager et al., 2011).

AES, Nitrate Directives and Direct Payment Act are all EU agricultural policies mandatory to member states

that help to mitigate soil degradation. For a federal state like Germany, their designs are at the level of the regions. While AES is designed as an incentive based and voluntary participation by farmers (Uthes et al., 2010; Prager et al., 2011), Fertilization Ordinance (translation of the Nitrate Directive to German national policy) and Direct Payment Act remain compulsory to all farmers (Prager et al., 2011). These policies have clearly defined principles and measures of enforcement in mitigating soil degradation. AES through measures of intercropping and under sowing as described by Uthes et al., (2010) and Prager et al., (2011), help reduce water erosion in targeted vulnerable zones. The Fertilization Ordinance (a translation of the Nitrate Directive at the national legislation) regulates the use of fertilizers, soil auxiliary materials, culture substrates and plant aids in accordance with principles of good agricultural practices. The ordinance clearly outlines enforcement measures such as quantity of fertilizer farmers are allowed to apply, time of application and none application of liquid manure in the months of winter when the soil is wet. Direct Payment Obligations Act on the other hand prescribes measures of Good Agricultural and Environmental Conditions (GAEC) such as no ploughing on 40% of arable land after harvest until 15 February unless a new crop is sown before December 1st to reduce soil erosion and intercropping with a minimum of three crops each covering atleast 15% of the farm land. An alternative for the farmer is the conduction of yearly soil tests all to conserve soil organic matter (Prager et al. 2011).

Governance Structures

The Regional Administration of Brandenburg is the only governance structure in the area responsible for the effective implementation and monitoring of the soil conservation policies. They are however responsible for the GAEC and Fertilization ordinance. Along with other auxiliary governance structures such as the INVEKOS data base, the administration effectively monitors the implementation of the fertilization ordinance in accordance with its clearly stated measures (Prager, 2011). Assessing the effectiveness of regional administration in the case of the Direct Payment Obligation Act is less difficult as the policy leaves the farmer with an alternative regular soil tests. The presence of higher governance structure at the level of the European Commission that monitors structures at the national level highly affects the efficiency of the regional administration as a strong communication network has been established across the different levels for update on regulatory measures and monitoring.

The Soil Protection Act remains the only policy that is not represented at the level of governance structure. The ordinance assigns to agricultural extension services the responsibility of implementing the principles of Good Agricultural Practice prescribed in the legislation. Base on the findings of Prager et al. (2011), state extension services are absent in the region. The lack of precise measures also makes it difficult for implementation by regional administrators.

Brief Explanation

The main actors in the transaction of soil degradation in Brandenburg are the agricultural farmers with the sole objective of increasing production. In pursuing their profit maximization objective, they employ farming practices that reduce on-farm cost and increase productivity. However, their practices impact on the level of soil degradation with environmental consequences and negative effect on their production in the long-run. The sustainability of soil degradation policies lies in its ability to guarantee the economic objective of the farmer while protecting and maintain soil quality (Hagedorn, 2008). This can be achieved by incorporating the properties of the transaction (ibid).

Some of the soil conservation policy measures in Brandenburg exhibit the dynamics of institutional change as captured by the IoS framework. The Fertilization Ordinance for example exhibits properties of transaction in its measures such as; variability and separability – time of manure application non-application of liquid

manure during winter, measurability – quantity of manure application per hectare of land. Sanctioning defaulters by means of effective implementation and monitoring of these measures, the policy affects farmers' decision on increasing productivity. The AES was also designed in a similar way except for the conditions of compliance which were voluntary and incentive based. The AES however remains sustainable as farmers still apply the measures despite the termination of the program. This is due to increase awareness and its contribution to reduce on farm cost. GAEC exhibits properties of transaction like the Fertilization Ordinance, however its degree of impact on farmers' productivity objective is lesser as the farmer is exposed to alternatives.

The Soil Protection Act does not reflect the dynamics of institutional innovation and change as depicted by the IoS framework. Lack specific policy measures and the absence of the required governance structure makes implementation difficult. Considering that it is the only policy in the area that is designed specifically for soil conservation, transforming the principles into "rules in use" will contribute highly to the mitigation of soil degradation in Brandenburg.

Case Study 2: Bangladesh

Soil degradation Processes

Like Germany soil degradation is also a problem in Bangladesh. Some of the main processes that have been identified include erosion, contamination, and compaction, loss of organic matter by the use of improper farming practices, salanisation, water logging and compaction. Changes in land use pattern and deforestation mainly due to population pressure, poverty and other natural processes such as drought also cause soil degradation in Bangladesh (Hassan and Alam, 2006; Jahiruddiin and Satter, 2010). These degradation processes vary with different landscapes. The landscape structure is characterized by flood plains, terrace and hills which constitute 80%, 8% and 12% respectively of total arable land. Jahiruddin and Satter (2010) revealed that floodplains are the most degraded because they are over exploited and intensively used for agricultural production; a situation that is getting worse with the increasing population.

Farming System and Practices

Farming system of Bangladesh is basically characterized by crop, livestock and fisheries sectors. Traditional farming practices have been very common as mechanization of the farming yet not been adopted. Most farmers are using wooden made plough for tillage operation. Zero tillage which helps soil conservation is also very rare. To conserve soil moisture farmers adopt mulching techniques. Farmers do not practice suitable cropping patterns or crop rotation. Farmers in the hilly area commonly practices faulty "Jhum" cultivation which causes gully erosion and losses of soil (Farid *et al.*, 1992) where "Jhum" is the popular local term which is following slash and burn traditional shifting cultivation practices in the hilly area of Bangladesh (Gafur, *et al.* 2002). Residual of the crops are used as fuel for cooking rather than incorporated into the soil for improving soil quality. Cow dung is also used as fuel rather than applying as organic manure. Residual of the poultry, dairy and cattle are being used as feed for fish farming and in the soil as manure.

Soil Conservation Policies

Now-a-days, protection of the soil from degradation is the major challenges in Bangladesh. Application of all necessary measures for proper use of land and soil conservation so that there should not be loss of fertility, stability, and productivity (Barakat, *et. al* 2007). The 1994 forestry policy of Bangladesh encourages tree planting by communities, local groups or individual families and other public and private and through NGOs and relevant state agencies (Mustafa, 2002). Plantation of the trees improves the soil and protect from erosion (Singh and Hazra, 1995). Reforestation through Acacia (fast growing tree) improves soil quality and regenerates the degraded land (Islam and Weil, 1998). This is an incentive system for successful management

of forestry that strengthens agriculture and soil conservation. Another environmental friendly policy is the Fertiliser Recommendation Guide (FRG) of the Ministry of Agriculture (Ministry of Agriculture, 2005). This policy covers a broad spectrum of soil conservation policies. Base on agri-ecological zones, it specifies and recommends different nutrient status of crops and different cropping patterns, fertilizer management in multiple cropping systems, soil organic matter management, minimum tillage and hill farming all related to soil improvement and quality production. Farmers are encouraged to use crop residues, Farm Yard Manure (FYM), compost, bio-slurry, green manure in combination with chemical fertilizers.

Governance structures

The Administration of the Department of Agricultural Extension (DAE) at different levels (national, regional, district, sub-district and block levels) is the main governance structure in Bangladesh for implementing, monitoring, evaluating and reconsidering the policies related to soil conservation. They work in collaboration with other units of the Ministry of the Agriculture such as the Agricultural Research Council. Department of Forestry (DoF) and local government units are responsible for the tree planting exercise. The department provides fiscal incentives, technical guidance and material support to selected beneficiaries to plant particular species of trees. They also design programs to generate massive awareness through local institutions, clubs, schools and colleges (Ministry of Agriculture, 2006).

Basically most of the activities related to soil conservation have been done at block level where farming practices are frequently exercised. For instance for implementing the FRG policy, information transfer and demonstrations are conducted at the local level by the extension agents to teach farmers on crop rotation, cropping patterns and how to combine fertilizers with manures, (Rahman et al., 2007).

Brief Explanation

Although soil degradation in Bangladesh has been related to other natural processes such as landslides, high temperature and drought (Hassan and Alam, 2006; Jahiruddiin and Satter, 2010), human activities especially through farming practices remains a priority for mitigation (Hassan and Alam, 2006; Jahiruddiin and Satter, 2010). The adoption of the FRG in principle contributes greatly to this mitigation process. However the rate of implementation is affected by a number of factors. In their study Rahman et al. (2007) reveal that farmers lack awareness on soil conservation, they have low education that hinders them from adopting the policy. Their findings also reveal that the proportion of extension agents to the number of farmers is very small and demonstration models are not enough. Shortage in supply of recommended fertilizers and constant price fluctuation affects the efficiency of the policy.

In general there is a problem of governance structure in Bangladesh. This is mainly because there is no systematic monitoring and evaluation of governance structures in Bangladesh. The multitude of decisions that trigger implementation process and the capacity of the entire administrative chain are inappropriate to absorb the feedback of the policies for further processing (ibid).

Conclusion

In both countries soil degradation is an important issue with some similarities in their processes. Although both countries are initiating conservation policies to mitigate this problem, the degree of sustainability varies from one country to the other. The IoS framework is an appropriate way to provide a common framework for the case studies mainly because it can include all the relevant elements and make a comparison analysis in our soil-conservation research questions. Among the policies at least the incentive-based policy of agri-environmental schemes are successful and sustainable in Brandenburg even after the termination of the program. These schemes help raise farmers' awareness of soil degradation problems through information

distribution and learning processes. Apparently, lack of awareness of the problem among farmers is the first barrier to policy implementation.

Obligatory policies such as the Nitrate Directive of Germany and the Fertiliser Regulation Guide of Bangladesh seem promising in achieving greater impacts. However these impacts can be achieved only when the policies are backed with effective and efficient governance structures that can be able to implement, monitor and evaluate the progress as well as sanction defaulters. Combinations of voluntary and obligatory policies across different sectors are necessary for better results.

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