Lund University
Department of Political Science

STVK01
VT10
Tutor: Åsa Knaggård

Environmental sustainability and Institutional quality

An ambiguous relation

Helena Strand

Abstract

Sustainable development is a frequently used concept these days. It is often captured trough three dimensions of economic, social and ecological sustainability. As the importance of institutions has been accentuated within the first two dimensions, it has lately been the object of study within the dimension of environmental sustainability. As environment is often described as a collective good, the problem with maintaining a sustainable environment can be understood as problems of collective action due to the conflict between individual and collective rationality. High-quality institutions are assumed to generate trust, making people cooperate. They could therefore be the reason why societies manage to elude these collective action problems. The thesis analyzes if institutional quality affects states´ performance in environmental sustainability, trough a quantitative method. Due to the breadth of the concept environmental sustainability, the analysis is divided into two different sets using two different indexes as dependent variables, Environmental Performance Index and Ecological Footprint.

The result confirms that institutional quality affects environmental sustainability. The effect is contradictory however, depending on which variable is used as the dependent one. This ambiguous result makes it hard to come to a general conclusion regarding institutional quality and environmental sustainability but rather demonstrates the complexity with broad concepts and their vagueness.

Key words: Environmental sustainability, Institutional quality, Quantitative method, Collective action problem
Words: 9280

List of abbreviations

EF	Ecological Footprint
EKC	Environmental Kuznets Curve
EPI	Environmental Performance Index
ES	Environmental Sustainability
FAO	Food and Agriculture Organization
HDI	Human Development Index
SD	Sustainable Development
UN	United Nations
WEF	World Economic Forum
WGI	Worldwide Governance Index

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1 Introduction

1.1 Problem formulation and purpose

Since the days of the Brundtland report *Our common future* [1], the concept of Sustainable Development (SD) has been widely discussed: both its content and what actions need to be taken in order to reach the vision. One of the most common ways to understand the concept is through three interlinked dimensions reconciling economic activity, social progress and environmental and natural resource protection (Baker 2006:5; Steurer et al. 2007:148). Discussions about a fourth dimension have emerged lately, regarding the role of institutions (Spangenberg 2002:296). The importance of institutions in capacity building for SD strategies and programs has been acknowledged, for example concerning formulation, implementation and evaluation of the strategies. To tackle specific national problems, the institutions need to be formed and adapted to the national basic conditions and contexts. No institutional solution fits all societies but their structures are still significant (Göll et al. 2008:69,84). The role of institutions has been studied within economics, e.g. importance of stable and high-quality institutions for poverty-reduction and economic growth (North 1990; Kaufmann et al. 2002). Studies within social development highlight the correlation between institutional quality and democracy, civil liberties (Holmberg et al. 2009:138), as well as support for government (Anderson et al. 2003:91*f*).

Recently, the importance of institutions has been accentuated within the third dimension of SD, regarding environmental sustainability. An example of this is from the EPI report 2008, where the authors conclude ” …*in many cases good governance contributes to better environmental outcomes*” (EPI 2008:9). To further observe this relationship, the thesis will examine if institutional factors, more exactly their quality, affects states´ environmental performance in order to reach sustainability. My thesis will consist of a test of the hypothesis: *Institutional quality affects states performance in environmental sustainability*

The purpose of the thesis is to investigate and reflect over the importance of institutions in the field of environmental sustainability. New datasets will be used and two types of measurement of Environmental Sustainability (ES). The thesis is

[1] 1987 in World Commission on Environment and Development

a comparative analysis on a large number of countries and will complement the many case-studies or small-N studies carried out. The discrepancy in earlier studies and ambiguous relations between institutional factors and environmental outcomes makes the field and institutional indicators interesting to focus on. I will also pose a possible theoretical foundation to my quantitative analysis, something that often has been absent in other large-N quantifications.

1.2 Methodology and material

A quantitative method will be used to test the hypothesis, more specifically a regression analysis. One of the strengths with the quantitative method is that it includes many cases which make it possible to control for counterfactual variations. Using a regression analysis will also make it easier to isolate the effects of the independent variables (institutional quality) by controlling for other explanatory factors (Teorell et al 2007:183). Control variables are assumed to affect both institutional quality and environmental sustainability. They can also serve as alternative explanations. The empirical regression analysis will be executed in SPSS, a computer program for statistical analysis.

For the quantitative analysis, I will use data derived from several sources such as World Bank, World Economic Forum and the UN. Materials for the qualitative parts of the thesis (such as the theoretical framework), are derived from scientific journals and books. A lot has been written about sustainability and institutional quality. The gathered material is supposed to cover as broad a picture as possible, where some texts are reflecting and critical.

1.3 Theoretical account

There is a difference of opinions concerning institutional quality and environmental outcomes, both from empirical studies as well as the theoretical aspects. One explanation might be the broad concepts, like sustainability and institutional quality. The wideness enables several ways to interpret and translate the notions, clearly with differing results.

The effect and importance of institutional quality has been discussed in a wide variety of fields. Regarding the environmental aspect, I will argue that environmental degradation (contrary to environmental sustainability) is caused by the difficulties in maintaining collective action. It is caused by the conflict between individual and collective rationality. To maintain collective action and elude the so-called social traps, people need to cooperate (Gärling et. al. 2002:85*ff)*. Social trust has been accentuated as a factor that makes people more

prone to cooperate and some theories stresses that social trust is created by high-quality and reliable institutions. Institutional quality can therefore be presented as a solution for solving collective action problems and maintain a sustainable managing of the environment.

1.4 Delimitations

The state is the basic site for environmental management and politics, notwithstanding that many environmental problems stretch far beyond national borders, as well as the increasing number of international commitments and agreements (Duit 2005:1). States are also the site for evaluating and measuring both environmental performance and institutional quality, and will therefore be the main object in this thesis. The study considers several features of institutional quality such as political stability, absence of violence, rule of law and regulatory quality. Many of these factors are to a high extent interlinked with democracies and what is considered as liberal governing (Holmberg et al. 2009:137). This could be a problem concerning the validity of the thesis. In order to avoid that the results indicate democracies' effects on environmental sustainability rather than institutions, I will limit my units of analysis analyze units (countries) to only include democracies. The limitation will be done according to the widely known and used definition of Freedom House, where countries are classified as Free, Partly Free and Not Free (Freedom House). The analysis will only include Free and Partly Free countries. This will obviously imply limitations as to the extent to which my result may be applicable. However, I consider this limitation necessary and valid.

The analysis is based on cross-section data: I will analyze many countries but only at one occasion. It will therefore be somewhat critical to analyze the result in terms of 'change' (Teorell et al. 2007:170*f*), meaning that higher institutional quality *will lead* to better environmental sustainability. This is problematic since the regression analysis only looks at differences between countries at a given juncture. The theory however accentuates the assumption that higher institutional quality could lead to better environmental sustainability. To somehow support this hypothesis that cause (institutional quality) leads to effect (environmental sustainability), the dependent variables are the latest updates available and precede the independent variables in time.

To somewhat narrow the notion of sustainability, the analysis will only consider environmental sustainability. The institutional factors included in the analysis will only be those related to institutional quality. The role of institutions

will be considered regardless of reigning politics. It is obvious that environmental politics will affect environmental conditions but I will try to look beyond this fact.

1.5 Outline

The next chapter will be a short resume of some literature and earlier studies carried out. The main focus is on institutions and the environment, but I will also give a short summary of these two in connection to other aspects such as economy and democracy. This chapter could be seen as a background to give the reader a better comprehension to the subject.

The following chapter will outline a theoretical foundation as to why we can assume a correlation between institutional quality and environmental sustainability.

The chapter after that offers a short description of the methodology and the regression analysis. Following this, the remaining part is devoted to the concepts *institutional quality* and *environmental sustainability*. The earlier rather vague descriptions of the concepts will at this juncture be defined and operationalized. Thereafter follows the empirical analysis. It is carried out in SPSS but will be reproduced and presented in two tables. The next chapter is a discussion about the results.

The thesis is summarized in the last chapter and is followed by an appendix that includes a more detailed description of the used variables.

2 Literature Review

In this section, I will offer a short presentation of some research and literature about environment and institutions: the relation between the two, as well as aspects of the economy and democracy.

The role of institutions has been acknowledged in economics and especially the importance of well-functioning institutions for economic growth. For example, Kaufmann and Kraay note a positive correlation between institutional quality and per capita income (Kaufmann et al. 2002:2), and North writes about institutions as the underlying determinant for economic performance (North 1990:107). There is some ambiguity about the causal link, concerning the order in time (what comes first?) and the benefits of the poor (Holmberg et al. 2009:141).

The importance of economic growth for environmental outcomes is amongst others accentuated by the Environmental Kuznets Curve (EKC). This empirical model demonstrates how pollution starts out low at low level incomes, but increases at early stages of development (i.e. as income rises). Levels of pollution will later diminish as the economy shifts to being less-resource intensive and with better technology at a post-industrial stage. Pollution is no longer regarded as an acceptable side-effect of economic growth (Duit 2010:4*f;* Baker 2006:29*ff*). EKC has been widely criticized, e.g. for measuring development as level of income, and for seeing it as linear. Furthermore it does not consider the fact that high-polluting industries could be relocated and displaced from the industrialized to the developing parts of the world (Baker 2006:32). Though related to pollution, the same development cannot be assumed for other relevant areas such as water pollution. Also the increase of some emissions (e.g. CO2) is highly correlated to a higher economic level (Weidner et al. 2002:410*f*)

It has also been argued that economical and financial reforms are necessary to strengthen institutional structures, which will provide incentives for better environmental regulation (Tamazian et al. 2010:138).

The significance of well-functioning institutions in democracies has been studied and scrutinized. Since citizens are granted more power in a democracy, some argues that this would lead to more efficient institutions, even though there is no clear link between democracy and better institutions. Others argue that the two are different things, and highlights several empirical examples where democracies have ill-functioning institutions, and non-democracies have well-functioning ones (e.g. Hong Kong and Singapore) (Holmberg et al. 2009:138*f*). It is often assumed that democracies should have a positive impact on the

environment, e.g. because there is a lesser probability for war as well as higher level of equality in society (Midlarsky 1998:341*f*). Results in an empirical study by Midlarsky however indicated a negative relationship between democracies and some indicators of environmental preservation (CO2 emissions, soil erosion and deforestation). Non-democracies could possible suffer from difficulties in maintaining environmental protection (due to a higher potential for political violence and inequality in society). But even democracies are fighting some obstacles, for example concerning the associated free-market behavior of individuals that could be inimical to environmental protection. Also the protection of property rights could have a negative impact, preventing government of interfering on the reckless behavior of individuals and corporations (Midlarsky 1998:342*f*).

2.1 Institutions and the environment

Institutional quality and its relation to environmental sustainability are reflected in several research studies, but with differing results. A reason for this could be variations in definitions and operationalizations of the concepts (Holmberg et al. 2009:17).

Many studies often seek to elude the wideness of the concept of environmental sustainability or performance, by focusing their research into particular environmental fields. A study by Bahttarai and Hammig showed that institutional quality (here as rule of law, non-corruption and bureaucratic quality) had a positive and significant impact of forest resource preservation (Bahttarai et al. 2004:375). Welsch finds that corruption increases pollution, using different indicators of air and water pollution (Welsch 2004:665). In another study by Barrett and Graddy, the authors observed that civil and political freedom significantly improved environmental quality (measured as a number of pollution variables) and they concluded that promotion of freedom could improve environmental conditions (Barrett et al. 2000:434,455). Duit and Hall look at institutional effects on biodiversity by using data for woodpeckers. The limited regression analysis only contains 20 European countries and doesn't show any particular impact of institutional quality (Duit et al. 2009:57). Another, somehow contradicting result is presented in a more comprehensive study by Esty and Porter. It is suggested that a country's environmental performance requires improvements in its broader institutions. They also state that competitiveness has a positive impact on environmental performance. The authors argue that countries that are more integrated in the world market will be stimulated to a better and more efficient resource usage. This could mean that economic competitiveness and environmental goals doesn't have to indicate conflicts (Esty et al. 2005:393,424).

Institutional quality also seems to affect politics. There are results indicating that environmental policy stringency is lower in states with corruption and a lower degree of rule of law (Fredriksson et al. 2004:383). Pellegrini and Gerlagh found that institutional quality, here defined as corruption, had a strong negative effect on environmental policy stringency and furthermore found support to the idea that institutional settings affect the way that policymakers respond to environmental concerns (Pellegrini et al. 2006:337,348).

Another factor discussed to have impact on environmental sustainability is decentralization. The underlying assumption is that a decentralized way of governing is often more beneficial for environmental management. Even though the assumption seems adequate, a number of empirical analyses have not been able to find any connection. Decentralization may facilitate a more sustainable management of resources but contextual factors such as involvement, project design and use of patterns of resources may therefore offer a better explanation for success (Brooks et al. 2006:1535). Therefore, decentralization cannot be seen as a sufficient arrangement for environmental management, leaving the notion that the overall institutional quality is more important (Weidner et al. 2002:420*f*).

3 Theoretical Framework

I will here present a theoretical framework explaining why states effort for environmental sustainability could be affected by their institutional quality. It is a possible explanation why we can assume to find a correlation between these two variables.

3.1 Environment and Collective action problems

Environment and natural resources is often described as collective goods or 'commons', such as forests, fishing, clean air and water. One special feature about the commons are that these resources are non-excluded, meaning that everyone can use them freely. There are at the same time an individual interest in not having these resources depleted (Rothstein 2005:48). These collective goods give often rise to social traps or collective action problems. It is situations where individuals will act of self-interest (defection) and not cooperate since it gives better individual trade-offs than acting in the interest of the group (cooperation) (Gärling et al. 2002:87). Explaining the logic, the situation implies that everyone wins if everyone chooses to cooperate. But if I cannot trust that others will cooperate, it will be meaningless for me to do so since the end-outcome is dependent on cooperation by almost everyone else. It will therefore be rational with non-cooperation behavior (defection) if people do not trust that most other will choose to cooperate. To conclude, efficient cooperation for common purpose comes about if I trust that a great number of others also will choose to cooperate. Prisoner's dilemma demonstrates a game between two interdependent individuals that independently select between cooperation and defection. Also captured in game theory, rational action for individuals would be to free-ride on the cooperation of others (Rothstein 2005:12-15). This is illustrated by the upper part of Figure 1 where the payoff for an individual increase with the number of cooperators.

Environmental degradation and unsustainable use of resources are in fact captured as collective action problems where *"…environmental damaging behavior is essentially the negative outcomes at an aggregate level of choices that individuals and groups make in self-interest*" (Gärling et. al. 2002:85). This was also depicted in Garrett Hardin's famous essay *The tragedy of the commons*

(1968). It describes how a common used limited resource will be depleted if everyone acts of self-interest, illustrated by herds sharing a common pasture for their cattle. Psychological experiments in the subject also indicates that individuals tends to overestimate the size of a common resources and consequently request too much, regardless of individual acting or in a social context (Gärling et al. 2002:88). It leads to environmental stresses, overexploited and unsustainable use of natural resources, illustrated by e.g. over-fishing, global warming and degradation of ecosystems caused by expanding recreation and tourism. These environmental problems show that individuals acting in their own interest instead of cooperate, will make everyone worse off in the long run with undesirable consequences for the collective (Vlek et al. 2007:9; Gärling et al. 2002:87). In trust games, the payoffs are worse for non-cooperators when the number of cooperator increases. In general, the lower part in Figure 1 can describe the payoffs of environmental problems more adequate.

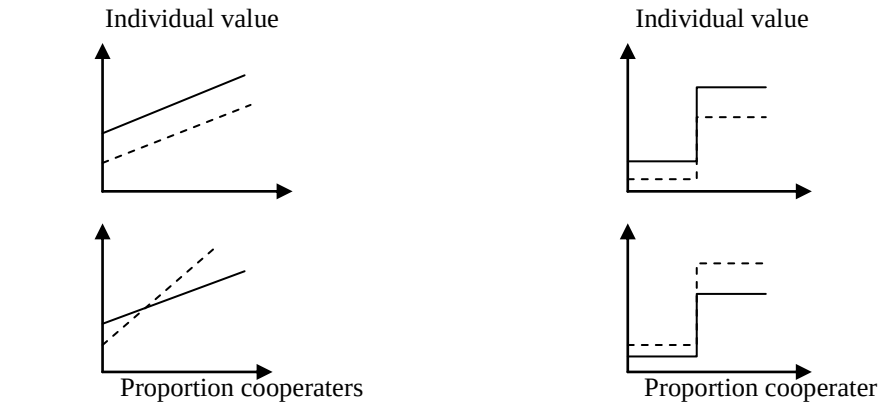

Figure 1

(Gärling et al. 2002:87)

Since many environmental problems (global warming, loss of ozone layer, acid rain, toxic pollution) reveal that they basically stem from social behavior they can all be reversed by human behavior, and e.g. not just by technical solutions. Environmental sustainability therefore requires several changes in old-patterns of individual behavior and thinking about unlimited natural resources (Vlek et al. 2007:3,8; Oskamp 2000:375), "*...to create a sustainable world, we need everybody's participation*" (Oskamp 2000:388). Obvious is that cooperate will make everyone better off and lead to a more sustainable environmental condition. The difficulties are how to solve these social traps or how to maintain collective action, and a very essential question to pose is what makes people cooperate?

3.2 The idea of trust and institutions

As noted, one of the biggest challenges in order to achieve sustainability is to understand the fundaments for cooperation, which is central in addressing collective action problems (Levin 2010:13). This is not only referring to decisions between citizens with conflicts between individual and societal interests, but also when it comes to decision making on organizational level (Gärling et al. 2002:86*f*). Social traps are therefore valid on all levels of society both on micro level in interaction between individuals (e.g. recycling) as well as macro level (e.g. international relations between countries, support and implement international environmental treaties).

Trust is a widely accepted explanatory factor of how to sidestep the social traps, meaning that actors will choose to cooperate if they trust that other actors also will do so (Sønderskov 2009:145). As e.g. Sønderskov argues, this implies that people in general are conditional cooperators. This premise is up-backed by experimental empirical evidence (e.g. in evolutionary psychology and economics). Experiments has shown that human mind is adapted to follow principles of conditional cooperation, and that people are more prone to contribute in public good-like games, when they expecting other to do so (Sønderskov 2009:147).

But there are different ideas of how the trust is created. In Putnam's work *Making Democracy Work* it is claimed that trust and social capital is created 'from below', through social networks and voluntary associations (Putnam et al. 1992:167). Other stresses that trust and social capital instead is posed 'from above' where political institutions are important in creating social capital and trust (Rothstein 2005:26).

The concept has been divided into several groups where one distinguishes different kinds of trust. *Generalized trust* is constituted by believes that people in general are trustworthy and fair. This differs from the *particularized trust* that addresses towards friends, relatives and particular groups (Rothstein 2003:11; Sønderskov 2009:146). Another kind is also the *institutional trust* which contains of both generalized trust and trust in political institutions (Duit 2010:5).

3.2.1 Institutional trust

The notion of *institutional trust* is important since it interlinks high quality institutions (e.g. reliable, uncorrupted, and impartial) to the creation of trust, but also to the performance of institutions. This theory implicates that if political institutions and public officials can be trusted, actors will assume that people generally can be trusted; it generates generalized trust (Rothstein 2003:11*f*). It will also have impacts on how the institutional work is carried out. If citizens trust the

core institutions they will let themselves be governed by these to a higher extent. Governments will not need to invest as much to enforce, sanction and monitor policies that require large-scale collective action. The *institutional trust* (trust in others and to institutions) will therefore facilitate provision of public goods and in the extent cause better institutional performance (Duit, 2010:4*f*, 24*f*). Institutional trust is then especially important for those policies, programs and interventions that call for a large number of citizens to cooperate, since it will give better outcomes.

In collective action problems, actors' behaviors are determined by their beliefs of the future action of others; people will cooperate if they think that other will. The decisions (cooperate or not) are based on answers of two questions, namely *who* are the others, and what is to *expect* from them (Rothstien 2005:15)? Information about the other actors is therefore essential but often lacking. The choice will be made under uncertainty since it is difficult to have full and personal information about all other individuals and their behavior. The dilemmas will be more tractable the greater the number of individuals there are, since this increases the level of uncertainty (Vlek et al. 2007:9). People become anonymous and their responsibilities are diluted because they feel that their action makes a little difference (Gärling et al. 2002:87*f*). Most environmental problems are captured of this feature, namely large scaled and includes a large group of anonymous actors. It makes the problems very hard to overcome since there is no way of have full knowledge about the other actors and their behavior (here: cooperate or not). But the *institutional trust* (especially in the generalized form), could work as general information about other actors and their trustworthiness and determine the outcome of collective action problems (Sønderskov 2009:147).

To sum up: Well-functioning, high quality institutions create institutional trust, and people will consequently be more prone to cooperate since they think that other will do so. It will also lead to better outcomes since people will let themselves be governed by the institutions. This could therefore be the solution to maintain collective action and solve environmental problems and unsustainable use of natural resources (Sønderskov 2009:147). One can assume that there will be a positive relation between institutional quality and environmental sustainability.

The theoretical linkages between institutional quality, trust and behavior in collective action problems are quite clear and straightforward. Empirical studies have however shown slightly more ambiguous results. In a recent work, Duit´s (2010) result indicates that institutional quality influences levels of generalized and institutional trust, but that only the institutional trust restricts free-riding norms. However, the result in a study of Sønderskov (2009) tells us that generalized trust affects individuals' behavior in collective action problems (here recycling). A tentative conclusion could be that institutions affect the trust of

individuals (general or institutional) and that this has repercussion for both norms and behavior.

3.3 Another approach

In economics, the logic regarding reliable institutions (e.g. non-corrupted, ruled by law, ensure property rights) is that they create safety. Institutions reduce the insecurity that occurs with interaction among actors, and will therefore reduce transaction costs because actors can make cheaper and faster decisions (Spangenberg et al. 2002:69). This encourages economical activities such as investments and entrepreneurship which leads to economic growth (Gamber et al. 2007:257).

When it comes to institutions and environment, this consecution could imply some concerns. As the state is a main actor in providing and restricting access to collective resources (Rothstein 2005:48), a similar function of institutions could be expected when it comes to managing environmental resources. If well-functioning institutions facilitate interaction among a large amount of actors, high-quality institutions could consequently generate a more 'effective' degradation of natural resources. Effective is here referring to a more easy access and use of natural resources and could by that contribute to lower performance of environmental sustainability (Duit, 2005:13). A negative correlation between institutional quality and environmental sustainability could then be assumed.

4 Methodology

4.1 About the analysis

The hypothesis *Institutional quality affects states performance in environmental sustainability* is tested with a quantitative method, a multiple regression analysis. The analysis is based on comparative cross-section data and the cases will consist of states. One advantage with using quantitative method is the prospects of finding a correlation between the dependent and independent variables and therefore be able to support absence of counterfactual variation (Teorell et al. 2007:64,166). Another benefit of the method is that it enables control for the effects of other explanatory variables, meaning that one can 'isolate' the effect of the independent variable (i.e. ceteris paribus) (Teorell et al. 2007:64,183). The analysis aims to investigate whether there a correlation can be found or not; *if* institutional factors affect states performance in environmental sustainability. Answering the question of *how* will not be approached in the regression analysis and the variables will not try to cover for intermediate factors. The theories outlined in previous chapter are a way to fill the temporal gap and explain *how* institutional quality affects environmental sustainability. Results from the analysis could also be a start point for closer studies to scrutinize the assumed relationship.

Since the method includes a large number of cases, the data is quite standardized and generalized. It implies a conflict between the two aims of validity and reliability (Teorell et al. 2007:267*f*), where quantitative studies sometimes have to compromise, often on behalf of reliability. This could to some extent be compensated by using indexes as data. Many variables are gathered into indexes. As many of the concepts are quite wide and hard to define, an index could be a more reliable operationalization of the theoretical concept than using the empirical indicators separately (Esaiasson et al. 2007:435*f*). Aggregation of data also implies advantages for analyzing the results, since it will be more lucid to use an aggregated variable than using all of its separate components. On the other hand, it could also be a disadvantage since the concepts become quite wide and fail to cover for its essences.

4.2 Concepts and operationalizations

4.2.1 Environmental sustainability

As aforementioned, the concept of sustainability is often captured and described trough three dimensions of economic, social and ecological development (Baker 2006:19). Even though sustainable development denotes different set-ups in different contexts there is a common global 'base-line' condition which includes a healthy eco- and biosphere (Baker 2006:8). It could be of interest to distinguish the environmental part from the other interlinking dimensions since human economy, life and welfare are dependent upon the "natural capital", i.e. natural resources (Wackernagel et al. 2002:9266). A steadily growing population of the planet and an economic growth, to a large extent based on natural capital, has lead to great pressure in the environment (therefore causing loss of biodiversity and disruption of ecosystems) (Ewers et al. 2007:1). Environmental Sustainability is a wide concept that somehow tries to define how human life affects the supporting system of natural resources (both renewable and exhaustible), according to its limitations and the maintenance of environmental service capacity (Goodland 1995:2). As Ewers and Smith put it: *"…how current living standards and human population pressure affects the long-term quality and availability of biodiversity, ecological processes, and other natural resources*" (Ewers et al. 2007:1).

4.2.2 Operationalization

The concept ES will be operationalized in two ways. The first empirical dataset that will be used is *Environmental Performance Index* (EPI). This index is compiled by Yale and Columbia University, for the purpose of identifying how states perform compared to environmental targets. It is based on 25 indicators, considered to give a representative and comprehensive impression of the existing environmental challenges, with focus on sustainability and current policy performance by single nations (EPI 2008:12). For each indicator, a specific long-term target is identified. These targets are developed from: international treaties, international standards, leading national regulatory requirements or prevailing scientific consensus. The distance between the target and the current national performance is measured, so called proximity-to-target value (EPI 2008:8,16).

Variables in EPI based on data relevant to two main purposes:
1. Reducing environmental stresses to human health (Environmental Health objective)
2. Protecting ecosystems and natural resources (Ecosystem Vitality objective)[2]
The EPI ranking has been criticized for not measuring the whole concept of sustainability and only within national borders, doesn't take account to outsourcing of polluting industries for example (Ewers et al. 2007:2). Also, it does not include consumption, resulting in many industrialized countries scoring high while many developing countries do not.

Due to the critiques and limitations of EPI, my analysis will be expanded with another way of estimating current environmental performance and sustainability of states. This index is *Ecological Footprint (EF),* which aims to measure the effect on the environment caused by human activity. It is calculated by Global Footprint Network (WWF 2008:42) and translates human demand into the area required for production of food and goods, together with the absorption of waste (Weckernagel 2002:9266). A country's ecological footprint consists of: *"…the sum of all the cropland, grazing land, forest and fishing grounds required to produce the food, fiber and timber it consumes, to absorb the wastes emitted when it uses energy, and to provide space for its infrastructure"* (WWF 2008:14). The EF doesn't have the same country constraints as EPI since a country's footprint contains consumed areas, regardless of where on the planet it is located. EF is also a good complement to EPI, which has been criticized for not taking consumption into account to consumption to the same extent.

To conclude, EPI measures states´ performance compared to compiled goals, while EF directly quantifies the area required to support consumption and welfare. They are first and foremost measuring environmental performance, though this will be interpreted as performance in sustainability. A lesser performance indicates environmental degradation and over-use of resources leading to unsustainable conditions. As discussed, none of the rankings give an all-inclusive picture of ES. One has to keep in mind that the indexes are based on which components are included and how they are weighted. The ranking of nations then depends on how and by whom the indexes are defined and aggregated (Morse et al. 2005:626).

[2] A more detailed description about the indicators can be found in appendix 1.

4.2.3 Institutional quality

Institutional quality is, as earlier described concepts, quite vague and could refer to various conditions and attributions of institutions. Also the term *institution* carries several implications and refers to a lot. Institutional theory describes institutions as organizations or social structures which contain a collection of embedded rules and practices which control and maintain human behavior (March et al. 2006:3*f*). They could be studied by many disciplines, e.g. trough their affects on social relations and how they restrict human behavior or if they contain rational actors or social structures (Spangberg et al. 2002:68*ff*). The Political Science approach focuses on those factors of political relevance. Political institutions could capture this, since they *"…are both social entities, appearing as actors in political processes, as well as systems of rules, structuring political behavior*" (Spangberg et al. 2002:70). The institutions that are going to be studied are therefore formal political institutions.

The way in which institutional quality should be studied has been contested. The concept has also close links to quality of government, in the way that both concepts are defined: as political institutions. Critics contend that institutional quality either is defined too broad and therefore miss in functionality, or to narrow and therefore not cover the whole interpretation (Rothstein et al 2008:167*f*). Quality has therefore come to constitute various conditions in different studies, such as impartiality of institutions or just as absence of corruption (Rothstein et al. 2008:169*f*). Measuring quality means that one has to put up structural indicators to measure governments and outcomes. The method has been criticized for making the concept too equable since good government could mean different things in different countries and contexts (Andrews 2010:28).

A commonly used definition is the one formulated by the World Bank. They define government as "*the traditions and institutions by which authority in a country is exercised*"[3]. This definition will be used in the study. The World Bank states that the quality derives from:

> … process by which governments are selected, monitored and replaced; the capacity of the government to effectively formulate and implement sound policies; and the respect of citizens and the state for the institutions that govern economic and social interactions among them (Kaufmann et al. 2008:10).

This definition has been criticized for not taking fully into account the distinction between access and exercise of power. The definition of government and institutions is claimed to be too broad (Rothstein et al. 2008:168), and therefore makes no clear distinction between the definition and liberal democracies. It could

[3] Though the term here is government and not institutions, one could assume this to be more of a difference in used concepts since its definition foremost refers to political institution.

imply implications in validity and the analysis will therefore only include Free or Partly Free countries. Using this definition is both a cumulative choice since it is widely used and recognized, and also conscious choice due to the possibility of operationalization.

4.2.4 Operationalization

Given this definition, institutional quality will be operationalized through the latest update of the *Worldwide Governance Indicators* (WGI). This research program is a compilation from the World Bank measuring six dimensions of governance, namely; Control of Corruption, Rule of Law, Regulatory Quality, Government Effectiveness, Political Stability and Absence of Violence, and Voice and Accountability[4]. Indicators are aggregated and organized to summarize the large amount of information in all underlying data sources. The WGI constitutes of subjective and perceptions-based data of governance. This is to reflect the diverse views from different stakeholders, including survey respondents from households as well as firms, together with experts working for the private sector, NGOs, and public sector agencies (Kaufmann et al. 2008:6*ff*). There are several reasons for the use of this method for collection data: perceptions matters because individuals and agents base their actions on subjective impressions, in many areas there are few other alternatives to gain information for example corruption and also the fact that many fact-based data do not capture the conditions in reality (Kaufmann et al. 2008:6). Though this method has been criticized for lacking objectivity and the fact that countries are rated according to prejudices of how a country should perform (Holmberg et al. 2009:137). The WGI has been blamed for not releasing all available data that the results are based on and the indicators are therefore criticized for lacking validity (Thomas 2010:31). Taking this into account, it is still one of the most comprehensive datasets available, covering 212 countries and territories (Kaufmann et al. 2008:1).

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[4] A more detailed description of the indicators is available in appendix 1.

5 Empirical Analysis

5.1 Dependent and independent variables

The analysis is constituted of two separate sets, one with *Environmental Performance Index* (EPI) as dependent variable and one with *Ecological Footprint* (EF). Other variables (independent and controls) are the same in both models. EPI has a range between 0-100 where a high value indicates a good performance. EF has a range between 0-10 where a high value indicates a 'big' ecological footprint.

The independent variables consist of the *Worldwide Governance Indicators* (WGI). One risk with using indexes as the WGI is that the concepts are too wide and consequently measures the same phenomenon. This could also cause multicollinearity in the regression analysis. It occurs when two or more variables are highly correlated in the analysis, leading to underestimation of the significance of some variables (Djurfeldt et al. 2010:364*ff*). This could be controlled in SPSS by executing a tolerance- or vif-test.

To avoid multicollinearity, I will summarize the WGI-factors in compliance with the theoretical definition.

- Quality 1: *Process by which governments are selected, monitored and replaced:*

Political Stability and Absence of Violence (PV) and
Voice and Accountability (VA)

- Quality 2: *The capacity of the government to effectively formulate and implement sound policies*:

Government Effectiveness (GE) and
Regulatory Quality (RQ)

- Quality 3*: The respect of citizens and the state for the institutions that govern economic and social interactions among them*:

Control of Corruption (CC) and
Rule of Law (RL)

While executing the regression analysis, a tolerance- and vif-test indicated a high correlation between Quality 2 and 3. Since the link between these two variables was significant, they were added to a single variable named Quality 2 and 3.

5.2 Control variables

One crucial issue with the regression analysis is the control variables. Since the aim of the thesis is to investigate the effect of institutional quality on environmental sustainability, it will be of great importance what variables that are controlled for, both to avoid spuriousness and to strength my explanatory variables (Teorell et al. 2007:204-208).

In compliance with earlier review (see chapter 2), economic factors are relevant to control for and will be included in the analysis. "Willingness to pay" and public demand for better environment often increase with better economic conditions, concurrent as higher economic development could worsen environmental conditions like emissions and water quality (Widner et al 2002:410). According to the theory of EKC, a higher level of development will eventually lead to lower levels of pollution, though it is not certain that this holds for all polluting activities. Economic level and development could therefore be either negative or positive correlated with environmental sustainability. As estimation of development I will use both GDP/capita in purchasing power parity rates (PPP) and Human Development Index (HDI). GDP is common used as an approximate for development. Likewise is HDI, often considered as a broader way to measure human development. Since HDI also includes GDP/capita (along with life expectancy and literacy) (UN), the two variables will not be included in the same models.

Population pressure is another factor assumed to have an impact on environmental sustainability. The factor has been used in earlier studies e.g. by Bahttarai and Hammig (2004). It is also noted in the definition of ES. A greater population pressure implies a greater demand and stress on environment and natural resources and will therefore affect ES negatively. This factor is derived from Food and Agriculture Organization (FAO) and measures population density.

To be able to analyze the effects of institutions without taking account to the affects of the broader environmental politics, I will use an index reflecting environmental governance. This index is derived from World Economic Forum (WEF) and includes principal components and several aspects of environmental governance such as regulations, regulatory stringency and leadership.

Technology is often accentuated as a solution for environmental problems, for example when it comes to efficiency and cleaner technology that can reduce emissions and pollution. It is also a variable in the basic formula of environmental impact derived from Ehrlich that considers I (impact) = P (population)*A (affluence)*T (technology) (re-produced in Oskamp 2000:381; Vlek et al. 2007:6). There is no general way to measure the level of a country's technical and scientific capacity. To put it in words of Esty and Porter "*It is […] hard to measure scientific sophistication and analytic rigor directly*" (Esty et al. 2005:409). Align with their study, I will use a number of proxies to somehow estimate a country's technological level. The used factors are: spendings on

research and development (R&D), willingness to absorb new technologies, availability of technology and licensing of foreign technology. The three latter will be used as an index due to high correlation between the variables. None of these variables are adequate or sufficient measurements but could help to give a broader picture. They are assumed to have a positive impact on ES.

The last variable that will be controlled for is competiveness. This is done in accordance to the study by Esty and Porter (2005) whom finds that competiveness has a positive impact on environmental performance. The Global Competitiveness Index (GCI) measures the set of institutions, policies, and factors that determine the level of productivity of a country and how it uses available resources.

The empirical model is

$$ES = \alpha + \beta_1 IQ + \beta_2 EG + \beta_3 P + \beta_4 T + \beta_5 D + \beta_6 C + e$$

Where:
ES = Environmental Sustainability, dependent variable
α = Intercept
IQ = Institutional Quality
EG = Environmental Governance
P = Population pressure
T = Technology
D = Development: GDP/HDI
C = Competitiveness
e = Residual

A more detailed description of the control variables is available in appendix 1.

5.3 Regression Analysis

5.3.1 Environmental Performance Index (EPI) as dependent variable

Table 1

	Model 1	**Model 2**	**Model 3**	**Model 4**
Quality 1	,663	,895	-,180	-,527
Quality 2 and 3	,737	-1,951*	-,743	-,609
HDI	-	-	53,229***	57,906***
GDP/capita PPP	-	,001***	-	-
Population pressure	-	-,030**	-,033***	-,032***
Environmental Governance	,503**	,528*	,489*	,572**
R&D spending	-	1,323	1,085	1,308
Technology	-	-,437	,669	2,114
Competiveness	-	-	-	-4,677
df	103	56	57	57
Adjusted R^2	,430	,583	,667	,666

***= significant at 1% (<0.01), **significant at 5% (<0.05), *significant at 10% (<0.1). Two tailed test.

The numbers in the tables show b-coefficient of the regression analysis. The rows consist of the independent and control variables, number of cases and adjusted R^2. The columns are divided into several models. The first model tests the hypothesis: institutional quality affects environmental sustainability. The only control variable included environmental governance that will make it possible to analyze the effects of institutional quality, regardless of environmental politics.

Model 2 includes the notion of environmental impact depending upon = P (population)*A (affluence)*T (technology). Affluence is not fully correct interpreted but constitutes of GDP per capita and HDI in Model 3. Model 4 includes the last control variable of competiveness.

5.3.2 Ecological Footprint (EF) as dependent variable

Table 2

	Model 1	**Model 2**	**Model 3**	**Model 4**
Quality 1	-,104	,035	-,442*	-,340
Quality 2 and 3	,532***	,207	,585***	,545***
HDI	-	-	6,453***	4,974***
GDP/capita PPP	-	9,124E-5***	-	-
Population pressure	-	-,004***	-,004***	-,004***
Environmental Governance	-,024	-,038	-,047	-,071
R&D spending	-	,248	-,087	-,182
Technology	-	-,238	-,120	-,672
Competiveness	-	-	-	1,536
df	101	56	57	57
Adjusted R^2	,649	,746	,687	,698

***= significant at 1% (<0.01), **= significant at 5% (<0.05), *= significant at 10% (<0.1). Two tailed test.

6 Result and Discussion

In the first model with EPI as independent variable, a tolerance- and vif-test indicates that the significance of Quality 2 and 3 might be a bit underestimated. The adjusted R^2 tells us that about 43% of the variance in the dependent variables could be explained by the independent variables (Teorell et al. 2007:175). With EF as dependent variable, Model 1 shows a differing result. Worth to note is that the institutional quality here is positive correlated with EF.

Model 2 includes some additional variables. The explained variance has increased in both sets. In the model with EPI as dependent variable, the vif-test continues to be quite high for Quality 2 and 3. It indicates that the significance of this variable still might be underestimated. Number of cases has declined in both sets.

The third model includes HDI. The variable is significant and positively correlated with both EPI and EF. It is also highly significant and with a bigger effect on the dependent variable then GDP. In the EF analysis, adjusted R^2 has decreased. It could be an effect of HDI, that is a broader measure then GDP. The variables of institutional quality are now significant in the EF set, but with different impacts; Quality 1 is negative correlated and Quality 2 and 3 is positive correlated with EF.

The last model also controls for the variable of competitiveness which has no significant effect on both of the dependent variables.

After exercised the two analyses one can establish that they reflect quite differing result. All models in both sets of the analysis are significant on a 1% significance level.

In the analysis with Environmental Performance Index as dependent variable, the factors of institutional quality were only significant in the second model. Quality 2 and 3 (included effectiveness, regulatory quality, corruption and rule of law) was negative correlated with EPI. The interpretation is that lower institutional quality is connected to a lower score of EPI, a lower performance of environmental sustainability. This result backs up the hypothesis and the theory where institutional quality is assumed to affect people's behavior to manage environmental collective action problems. However, the relationship disappears when HDI is included in the model. It indicates that the correlation is either spurious or that institutional quality has an indirect effect on EPI, via HDI. The right interpretation could not be read in the table. Since both institutional quality and level of development are factors that are quite stable over time, the result calls for a closer scrutiny. Quality 1 (e.g. political stability and absence of violence) is

not significant in any model with EPI as dependent variable. The reason might be that the analysis only includes countries considered as free or partly free, and could be assumed to be quite stable.

The effect of population pressure stays in contrast to earlier assumption that greater population density leads to greater stress on the environment. HDI correlates with the dependent variable and is significant on a level of 1%. Development (as HDI) has a big positive impact on EPI where the b-coefficient indicates that when HDI changes one unit, the dependent variable changes 53 units (which is much for an index with a range from 0 to 100). Environmental governance is significant in all four EPI models. This result is not very surprising since EPI rankings are based on performance relative a stated environmental target. Governance such as regulations and policies are of great importance to reach this goal.

In the second analysis is Ecological Footprint used as dependent variable. This analysis shows significance for Quality 2 and 3 in most models. The link is however positive, indicating that a bigger ecological footprint is correlated with better institutional quality. The result confirms the hypothesis but stands in contrast to theoretical idea where high-quality institutions are assumed to have a positive impact on environmental sustainability. This relation was however outlined by another contrasting theory which stated that effective institutions could lead to a more easy access and use of natural resources. Institutional quality would therefore have a negative impact on ES. The latter theory seems to better explain the result of the analysis with EF as dependent variable. The relation disappears when controlling for GDP. An interpretation is that the relation is indirect, e.g. since the factors of institutional quality are assumed to have greater fixity than the economic variable. It means that better institutional quality leads to economic growth and a higher economic level, which will have a negative effect on ES. Model 3 shows that a lower degree of e.g. political stability, absence of violence and voice and accountability (Quality 1) are linked to a smaller ecological footprint. It confirms that political stability but also other forms of freedom have a positive impact on environment.

The factor of environmental governance is not statistical significant in any of the models with EF as dependent variable. It implies that a state's environmental regulations and policy stringency does not affect environmental sustainability, when measured in quantitative terms as area required for production of food and goods for human demand.

Both HDI and population pressure are statistical significant variables. The b-coefficient of HDI indicates that it has a big impact on EF meaning that countries with higher level of development have bigger ecological footprint. Relation between population pressure and EF confirms earlier assumed connection where less population density leads to a less stress on the environment and a smaller ecological footprint.

In contrast to the result of Esty and Porter (2005), none of the last models showed any significant correlation between competitiveness and a state's environmental condition. The analysis therefore fails to support the idea that a more competitive economy could lead to better environmental performance.

The factors of technical development weren't significant in none of the models. One conclusion would therefore be that the technological level in a state doesn't have any statistical significant effect on its performance in environmental sustainability. However, as earlier mentioned, these variables are not sufficient to cover the whole technical capacity of a state. Another more careful conclusion would be that technology is important but available data and the included factors not are adequate to show a statistical significant correlation to ES.

To somehow summarize the analysis, one can conclude that institutional quality has different impact depending on how environmental sustainability is operationalized. In models with Environmental Performance Index, the institutional quality doesn't seem to have a great effect (or a potential positive indirect effect). It implies that the quality doesn't have any impact on how environmental collective action problems are solved. As mentioned earlier, EPI has some restrictions and does not take account to outsourcing of polluting industries and consumption for example. If one defines ES as performance compared to compiled goals, a country's performance is more dependent on the structure of environmental governance. Moreover, the level of development has a positive impact on environmental sustainability.

In the second part of the analysis where ES constitutes of Ecological Footprint, institutional quality is more important. The quality though seems to have a negative impact on ES. It confirms the idea that institutional quality makes use of resources more 'effectively'. But the result stays in contrast to the outlined theory where qualitative institutions could be helpful in creating institutional trust, an important factor when it comes to elude environmental collective action problems. When ES is defined as a direct quantification of the area required supporting consumption and welfare, well-functioning institutions seems to facilitate access. The quality of institutions will then have a negative impact on ES. Level of development and population pressure has (in contrast to the earlier set of the analysis) a negative impact on environmental sustainability. It supports the idea that these factors increases consumption and stresses on the environment, which with given definition of ES has a negative impact on states´ performance.

The analyses demonstrate differing result of development and its effects on ES. The EPI variable seems to capture the 'input-side' of ES, since level of development (and environmental governance) is highly important. It confirms the theory that better economic conditions and higher level of development increases "willingness to pay" for the environment, by e.g. higher political priority and stronger regulations (Weidner et al. 2002:410*f*). On the other hand, a higher level of development is often correlated with a better welfare and living standards

which implies more consumption and use of resources. It has negative effects on environmental sustainability since it increases the amount of waste and resources needed to maintain a certain lifestyle. This 'output-side' is captured by EF, which is negatively correlated with level of development. .

As we can see, the notion of environmental sustainability is not easy to capture leading to divergence in results and conclusions. Concurrent as ES could be captured in various ways, so can the notion of institutional quality. My analysis only includes the WIG measures and it is not unlikely that another operationalization of institutional quality also would have generated a different result. Another critical issue with large-N analysis is the generalized cross-section data, losing the importance of contexts. For example, what is considered as corruption here might not have the same appellation or referring to the same phenomenon in other context. What is considered as good environmental governance in one country might be useless in another. The analyses are in that sense limited, depending on available data and what factors that are feasible to control for. It could lead to under- or overestimating of some phenomenon as well as other important factors are not captured at all. One could for example question the usefulness of EPI and EF, since both variables are very strong correlated and dependent of HDI. One would therefore be careful when it comes to generalization of the result, also since the analysis only includes states classified as Free and Partly Free by Freedom House. Another limitation with the regression analysis is that it only depicts linear correlations and one will not find significance for variables having a nonlinear relation with the dependent variables.

The result showed a weak support for the theory of institutional quality, institutional trust and better environmental sustainability, due to eluding collective action problems. One reason could be that many environmental problems in fact are not captured by the notion of common action but rather depending on other conditions. Another reason could also be the operationalizations of environmental sustainability might not cover this idea, and the measures are constituted by other settings.

It is hard to say if institutional quality leads to better ES since no clear pattern is showing. A consistently feature is that quality in terms of effectiveness, regulatory quality, rule of law and control of corruption seems to be more important than stability, absence of violence and voice and accountability. However, this result can be a consequence of the included countries; Free or Partly Free. If the analysis had included all types of countries the result might have been different, showing a greater importance of the latter variables (i.e. Quality 1) for environmental sustainability. The result, assumed only to be applicable on Free and Partly Free countries, indicates that e.g. regulatory quality, rule of law and control of corruption is of greater importance. However, it is not clear if it affects states performance in a positive or negative way. The result

indicates that institutional quality might have a positive indirect linkage to environmental sustainability when it comes to performance compared to compiled goals, but negatively linked to environmental sustainability when it comes to usage of resources. The broad concept of ES could lead to confusion and fuzziness if one is not clear with what interpretation the concept is given. The complexity of sustainability is also highlighted, implying that no easy solution can be given of how a more sustainable environmental condition can be reached. The result could though serve as a basis for further studies to closer scrutinize the role of institutions and how they affect environmental sustainability, since the result in this thesis only showed a weak support for the outlined theory.

7 Conclusion

The objective of this thesis was to investigate for the relation between institutional quality and environmental performance by testing the hypothesis:
Institutional quality affects states performance in environmental sustainability

Institutional quality was operationalized with the Worldwide Governance Indicators (WGI) concerning dimensions like corruption, absence of political violence, rule of law and effectiveness. Environmental Performance Index (EPI) and Ecological Footprint (EF) were used as operationalizations of the concept Environmental Sustainability. The hypothesis was tested with quantitative method, a regression analysis. Since two different measures of the dependent variable were included, the analysis was constituted by two different sets but with same independent and control variables.

The concept of environmental sustainability is wide and hard to define as it could be constituted of various interpretations and conditions. This fact was visible in the result. It showed different correlation depending on which variable that was used as dependent.

The thesis does partly succeed to verify the posed hypothesis. Institutional quality doesn't have a significant effect (or a potential positive indirect effect) on environmental sustainability, when defined as performance relative a stated goal (using EPI). The quality of institutions has however a significant negative impact on environmental sustainability when it is defined in terms of area required to support human consumption and welfare (using EF). The latter result stays in contrast to the assumed relation between high-quality institutions and better environmental sustainability, outlined in the theoretical part. Since the purpose was to further reflect over the importance of institutions in the field of environmental sustainability, the thesis in a sense fails to give a broader theoretical foundation to the result. It does however not imply that the theory is overthrown or incorrect. One will have to keep in mind that the result depends on the used variables and their definitions, and the theory failed to predict the outcome of the analysis using these variables.

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Appendix 1

Dependent Variables

Environmental Performance Index (EPI)

Description:

Ecosystem vitality (50%) which includes:

- Climate change (25%): Greenhouse Gas Emissions 12,5%, CO2 Emissions 6,25%, Industrial Greenhouse Gas 6,25%,
- Agriculture (4,167%): Agriculture water intensity 0,8333%, Agriculture subsides 1,25%, Pesticide Regulation 2,083%
- Fisheries (4,167%): Marine Tropic Index 2,083%, Trawling intensity 2,083%
- Forestry (4,167%): Growing stock 2,083%, Forest cover 2,083%
- Biodiversity & Habitat (4,167%): Biome protection 2,083%, Marine protection 1,042%, Critical habitat 1,042%
- Water, effects on ecosystem (4,167%): Water quality index 2,083 %, Water stress index 1,042%, Water scarcity index 1,042%
- Air pollution, effects on ecosystem (4,167%): Sulfur dioxide 2,083%, Nitrogen oxides 0,694%, NMVOCs 0,694%, Ecosystem ozone 0,694%

Environmental health (50%) which includes:

- Environmental burden of diseases (25%)
- Air pollution, effects on humans (12,5%): Outdoor pollution 6,25%, Indoor pollution 6,25 %,
- Water, effects on humans (12,5%): Access to water 6,25%, Sanitation 6,25%

Units: Index, 0-100

Source: EPI

Ecological Footprint

Description: The Ecological Footprint measures the amount of biologically productive land and water area required to produce the resources an individual, population or activity consumes and to absorb the waste they generate, given prevailing technology and resource management. This area is expressed in global hectares, hectares with world-average biological productivity. Footprint calculations use yield factors to take into account national differences in biological productivity (e.g., tones of wheat per UK hectare versus per Argentina hectare) and equivalence factors to take into account differences in world average productivity among land types (e.g., world average forest versus world average cropland).

Units: 0-10

Source: Ecological Footprint Network

Independent variables

Worldwide Government Indicators (WGI)

Description:

1. *Voice and Accountability (VA)* – measuring perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.

2. *Political Stability and Absence of Violence (PV)* – measuring perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism.

3. *Government Effectiveness (GE)* – measuring perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

4. *Regulatory Quality (RQ)* – measuring perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.

5. *Rule of Law (RL)* – measuring perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.

6. *Control of Corruption (CC)* – measuring perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.
(Kaufmann et al. 2008:7*f*)

Units: Range between -3 to 3
Source: World Bank

Control Variables

Environmental Governance

World Economic Forum Survey on environmental governance

Description: This represents principal components of survey questions addressing several aspects of environmental governance: air pollution regulations, chemical waste regulations, clarity and stability of regulations, flexibility of regulations, environmental regulatory innovation, leadership in environmental policy, consistency of regulation enforcement, environmental regulatory stringency, toxic waste disposal regulations, and water pollution regulations.

Units: Principal components of several survey questions; index 0-60

Source: World Economic Forum.

Population pressure

Description: Population density is midyear population divided by land area in square kilometers. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, which are generally considered part of the population of their country of origin. Land area is a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones. In most cases the definition of inland water bodies includes major rivers and lakes.

Units: People per sq. km

Source: World Bank Statistics, derived from FAO

HDI

Description: The Human Development Index (HDI) is a composite index that measures the average achievements in a country in three basic dimensions of human development: a long and healthy life, as measured by life expectancy at birth; knowledge, as measured by the adult literacy rate and the combined gross enrolment ratio for primary, secondary and tertiary schools; and a decent standard of living, as measured by GDP per capita in purchasing power parity (PPP) US dollars.

Units: Index, 0-1

Source: UN

GDP

Description: GDP per capita based on purchasing power parity (PPP). PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any

product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.
Units: Data are in current international dollars.
Source: World Bank, International Comparison Program database.

Research and Development Expenditure (% of GDP)

Description: Expenditures for research and development are current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications. R&D covers basic research, applied research, and experimental development.
Units: % of GDP
Source: World Bank Statistics, derived from United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics.

Firm-level technology absorption

Description*:* To what extent do businesses in your country absorb new technology?
Units: 1 = not at all; 7 = aggressively absorb
Source: World Economic Forum

Availability of latest technologies

Description*:* To what extent are the latest technologies available in your country?
Units: 1 = not available; 7 = widely available
Source*:* World Economic Forum

Prevalence of foreign technology licensing

Description: How common is licensing of foreign technology in your country
Units: 1 = extremely uncommon; 7 = extremely common
Source: World Economic Forum

Global Competiveness Index (GCI)

Description: The index captures the microeconomic and macroeconomic foundations of national competitiveness. *Competitiveness* is defined as: *the set of institutions, policies, and factors that determine the level of productivity of a country.* It is based upon 113 variables, organized into twelve pillars; Institutions Infrastructure Macroeconomic stability, Health and primary education, Higher education and training, Goods market efficiency, Labor market efficiency, Financial market sophistication, Technological readiness, Market size, Business sophistication and Innovation.
Units: Index, 0-6
Source: World Economic Forum