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Disentangling the causal structure behind environmental regulation

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ABSTRACT

Determinants of environmental regulation have been identified in different studies. The present paper takes the analysis of environmental policy determinants one step further by also studying the interaction effects between the determinants. In this article we seek to disentangle the causal structure behind environmental regulations with the help of structural equation modelling for a data set of 47 countries. Green advocacy and governance capacity come out as the main structural determinants of environmental regulation quality. Internet access is found to have a positive influence on environmental regulation through green advocacy and governance capacity. The influence of green advocacy and governance capacity on international environmental governance is through national environmental policy and not the other way, while international environmental governance is influenced by factors outside the scope of this paper. We also find that green advocacy depends more on the presence of a competitive green industry than on environmental activism, with respect to the influence on environmental policy making. Statistically, 92% of the variance of environmental policy output could be explained by our structural model, which is very high for a model incorporating only structural factors.

1. Introduction

Compared to the literature of the effects of environmental policy, the literature on determinants of environmental policy is relatively small. The literature falls into two categories: qualitative studies and quantitative studies of political–institutional and structural economic determinants. Among the qualitative studies, the study of Vogel (1986) about environmental policy styles in the United States and Great Britain stands out as a land mark study. It uncovered a number of important differences in environmental policy styles. Whereas the United States opted for a (conflict-ridden) command-and-control approach, Great Britain established a system of negotiated individual standards. It was found that the stricter system in the United States did not lead to better environmental outcomes, because enforcement proved difficult. A second important contribution to the topic of environmental policy output is the study of Jaenicke (1997) based on the notion of the political system's capacity for environmental policy.

Most quantitative studies on national determinants of environmental policy have been undertaken as part of the lead-laggard debate of countries (Liefferink et al., 2009) or assessed the role of the green industry (Jacob and Volkery, 2006).

Avoiding adjustment cost of international regulation, strengthening economic advantages and competition of domestic industries, as well as gaining a stronger leadership role in future international environmental policy dialogue are considered as strategic motivations for environmental policy making. The interaction of those factors however awaits further analysis.

This paper is an attempt to disentangle the causal structure and structural, country-specific determinants of environmental policy, with the help of a rigorous analysis in the form of structural equation modelling. More specifically, the paper seeks to disentangle the influence of *proximate* factors such as governance capacity and demand for environmental regulations (from green business and green activists) from *background* factors such as democracy, environmental knowledge and social cohesion.[1] Because the causal structure is complex and various causal chains are conceivable, we will investigate different causal structures, based on the framework of Jaenicke (2005), which is considered a suited framework by incorporating political advocacy in the analysis, economic circumstances, structural political–institutional factors and structural cognitive-informational factors. Missing from the framework are situative factors and culture, which are difficult to include both technically (structural equation modelling does not allow for the inclusion of dummy variables such as protestant ethos) and analytically (both variables comprise many events and phenomena).

The determinants of environmental policy are investigated with the help of a structural equation model incorporating manifest and

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[1] The background factors are called "ultimate" variables in the socio-economic development literature (Rodrik, 2003, and Szirmai, 2015).

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latent variables. Special attention is given to the interaction effects of the causal variables. All variables are structural variables and are measured at a high level of aggregation. The analysis is restricted to an analysis of the systemic conditions for policy making action (Jaenicke, 1992). Our approach does not allow us to analyse the choice of policy instruments (policy) nor does it enable us to analyse the policy making process (the wheeling and dealing between politically active parties involved in environmental policy making). The analysis investigates the normative and particular organizational aspects of policy mechanisms (polity) as the basis for the choice of instruments and national decision making (Jaenicke, 1992).

Our analysis differs from other studies in incorporating more countries (47) and more environmental policy determinants in the analysis (including structural factors), by examining interaction effects of relevant factors in a structural equation model, by building latent variables, other than Jacob and Volkery (2006) who run regressions with no more than 30 observations (countries) and focus on the analysis of carbon emission and renewable energy policy. Liefferink et al. (2009) run multivariate regressions without forming groups of influencing factors. We study the influence of the determinants for the quality of environmental policy as an aggregate variable (across environmental issues) in a nation.

The structure of the paper is as follows: In the second part, the environmental policy making process and the concept of capacity for environmental policy making are explained. Also the data of the quantitative analysis is discussed. The third section describes the method we apply in our empirical analysis. The fourth section discusses the results about the factors that influence the stringency of environmental regulation (47 countries). The last chapter concludes.

2. Theory and data

There does not exist a fully-fledged theory of environmental policy making but useful approaches to build one have been made.

According to Jaenicke (1997) capacity for environmental policy depends on the administrative capacities but also on societal forces, working through the political process. He states that on the one hand the ability of the government to formulate and enforce environmental policy, and on the other hand knowledge creation, green enterprises, degree of corporatism, public awareness and well-functioning communication channels are important elements of the environmental policy making process.

In a later publication Jaenicke (Jaenicke, 2005) contends that the following country-specific factors are determinants of whether a country will be a pioneer country or laggard in environmental policy:

- strength of environmentally friendly advocacy groups,
- economic factors,
- structural political–institutional factors,
- structural cognitive-informational factors.

The political–institutional factors refer to the capacity of policy making and capability for dialogue. Cognitive-informational factors refer to the capability to generate and transfer environmental knowledge. Economic factors describe the degree of economic development and constitute general administrative as well as scientific capacities.

In much of the literature which has been undertaken in the footsteps of Vogel and Jaenicke, the focus of attention is on the structural determinants such as the openness of an economy, the presence of a protestant ethos, the political economy institutional structure (statist, liberal pluralist, neo-corporatist), EU membership (Liefferink et al., 2009), corruption, the degree of democracy (Pellegrini and Gerlagh, 2006) and political instability (Fredriksson and Svensson, 2003). The influence of situative factors and issue-specific factors has been ignored in those studies, as they are difficult to measure and operationalize in an objective way.

Liefferink et al., 2009 argue that countries with advanced environmental policies tend to exert pressure of competition on states lagging behind in their environmental policy implementation. They found that EU membership played the strongest role, as it facilitates the communication and technology transfer between countries. Other positive predictors for being an environmental leader are: a neo-corporatist institutional structure, environmental pressure (proxied by CO_2 intensity of the industry), as well as a high level of economic development. Culture (religion) and trade openness turned out to be not significant determinants of environmental policy leadership. The findings of this study are informative, yet they do not tell us how the factors potentially interact with each other. Missing from the analysis is the influence of a clean technology industry in the policy making process. Industry's role in environmental policy is captured by the dummy variable neo-corporatism as an institutional structure variable (next to liberal-pluralist and statist structures), but this variable captures many things.

The influence of green industry is examined in the study of Jacob and Volkery (2006) together with the influence of 26 other variables. Green industry is positively associated with environmental policy, together with neo-corporatism, governance effectiveness, and strength of environmental NGO activity. In this study, the role of religion and cultural factors is not being investigated. The results are not fully comparable, as the study of Liefferink et al. studies environmental policy gaps (as the dependent variable) whereas the dependent variable of Jacob and Volkery is based on climate and energy related policies in the form of CO_2 reduction targets, CO_2/energy taxes, quotas for renewable and energy feed-in tariffs.

Studies analysed corruption, democratization, trade openness or political instability as factors influencing environmental policy making (see for an overview Pellegrini and Gerlagh, 2006; Liefferink et al., 2009). Yet, scholars assess factors in an isolated manner or concentrate on the analysis of only few potential determinants, which leave their models underspecified and neglect the potential interdependencies between the influencing factors. One relevant scheme is the framework of environmental policy diffusion created by Tews and others (Tews, 2005). In this framework a distinction is made between horizontal diffusion of environmental policy and vertical policy diffusion. Horizontal policy diffusion occurs when environmental policy is transferred from lead countries to other countries. Vertical diffusion of environmental policy takes place when international organizations set policies which are being implemented by countries. The different factors in this approach are grouped into two categories (Tews, 2005): i) dynamics of the international system and ii) national factors.

Giving the sovereignty of nation states, national factors influence the various designs of environmental policies across countries (see further Kern et al., 2001). Whether governments want to adopt an environmental policy agenda depends on the institutional capacity, made up by the functioning of institutions of a government, and those national capacity set the limits to policy innovation. Distinct country characteristics as well as the structural framework of a country can influence national environmental policy (Tews, 2005). The size of a country, market volume, and contextual reputation of a country are relevant country characteristics (Tews, 2005) but they are not determinants of it.

The exposure to regulatory competition of a country has been discussed as another potential determinant of environmental regulation (Holzinger et al., 2008; Jaenicke, 2005; Vogel, 1997). It has been hypothesised that global economic competitiveness, expressed by trade openness, leads to a mutually adjustment and convergence of regulations, also with regard to environmental regulation. Yet exposure to regulatory competition has only been studied for a small sample size (EU countries) and quantitative results have not necessarily been satisfying (Liefferink et al., 2009).

Structural determinants of environmental policy are: environmental policy capacity, green advocacy coalitions, knowledge about environmental problems, active or passive support for regulations by the wider public, and acceptance of regulations by business which is directly affected by it (Jaenicke, 2005). Put differently, environmental policy capacity refers to "a society's ability to identify and solve environmental problems" (OECD, 1994, p. 8).

Environmental policy theory has been based on interest groups and constitutional structures (summarized in Oates et al., 2003) but it

offered a rather crude description of interactions and failed to consider wider structural conditions such as the role of environmental knowledge creation within a country. We opt for a different approach, building on the work of Martin Jaenicke and other scholars, which is based on political–institutional framework conditions and cognitive-informational framework conditions (Jaenicke, 1997, p. 11; Mason, 1999).

The political–institutional framework conditions describe more structural conditions as requirements in the policy cycle, ranging from sensing a problem, agenda setting, target formulation, to decision and implementation (Jaenicke et al., 1999). An important element of political–institutional structural conditions is "green" advocacy coalitions of private and public actors (Sabatier, 1999).

The cognitive-informational framework conditions are systemic preconditions that relate to individuals' values and knowledge and the communication channels through which they learn and express themselves.

In the following we discuss each of the types of conditions, starting with the political–institutional framework conditions, which directly influence the environmental policy making process (as proximate factors).

It shall be highlighted that due to the requirement of using homogenous data across countries, it was necessary to use data from one source for each variable. The Environmental Sustainability Index (ESI) provides a compilation of variables to represent the conditions described in this section. The set of variables has been used in the discussion about environmental regulatory stringency in a set of simple regression analyses, without building on a construct of latent variables and its dependencies (Esty & Porter, 2005). The ESI data appear suitable for the purpose of comparing a large set of country level variables due to the fact, that they are relatively homogenous, even though many of them are dating back to the year 2005.

2.1. Political–institutional framework conditions

How the policy process is structured regarding openness of input structure has influence on the opportunity to include citizens' environmental interests in the policy making process (Jaenicke, 1997, p. 12). This participative capacity shows to be decisive for the influence of environmental movements on policy making. Also the capacity for cooperation between environmental policy institutions and non-state actors describes environmental capacity (Jaenicke, 1997, p. 13). The interaction of interest groups in society and business with the government influences the policy making (Vogel, 1986, p. 273–275).

If interest groups and sub-societies participate in policy consultation, then these interest groups can heavily influence the policy making while governments still can choose whom they grant consultative status and access to policy consultations.

In our analysis, the variable "green advocacy" is used to account for the actions and support for environmental policy of civil society actors and private industry. Such actions and support are conceptualized as civil society and private sector political–institutional framework conditions for (more) environmental policy. We chose environmental activism of civil society on local, community level and private sector, green industry activity as green advocacy drivers in the political–institutional framework. Our variables of green advocacy are:

Civil society and private sector political–institutional framework conditions: Green advocacy	
Environmental activism	Degree to which civil society on local level cooperates with the local governments to create a sustainable future.
Competitiveness of green industry	Environmental competitiveness and innovative strength of environmental technology sector contributes to solutions to environmental problems and increases the power of these sectors in the policy making process.

Note: see appendix for further description.

On the other hand, the effectiveness of government actors and strength of government administration has a direct influence on environmental policy making as well. The governance capacity, the ability of government bodies to formulate environmental regulation can be understood as the public sector political–institutional framework conditions[2]:

Public sector political–institutional framework conditions: Governance Capacity	
Government effectiveness	The government effectiveness describes the competence of civil servants and quality of bureaucracy which enhances the ability of society to effectively translate environmental concerns into regulation.

Note: see appendix for further description.

The hypothesis is that environmental activism of civil society as well as the strength of the green industry has a positive influence on the quality of environmental regulation. Further, the effectiveness of the government and competence of civil servants is believed to be indispensable for effective formulation of regulation, which also applies towards high quality environmental regulation.

2.2. Cognitive-informational framework conditions

Environmental knowledge and environmental awareness of citizens are associated with cognitive-information framework conditions which are being hypothesised to be positively linked to environmental policy (Jaenicke, 1997, p. 11–12; OECD, 1994). They can be considered a necessary element and positive predictor for environmental policy. Awareness is influenced by culture while knowledge gets influenced by information generation and distribution. Thus, the knowledge base has to be produced, transferred and adopted by the public sphere (Jaenicke, 2005). All those factors are equally important in the policy innovation process and grouped under the term cognitive-informational framework conditions.

In this category we not only group awareness infrastructure and awareness institutions, but also include environmental knowledge, the access to this knowledge and sharing and distribution of knowledge.

Also, societal cultural values and the attitude towards the environment are seen to be the key factors in determining capacity in environment (OECD, 1994, p. 12). Cultural heritage determines how problems are solved, whereas the willingness and ability to change is also embedded in culture. Social awareness, creation of effective linkages among organizations and a strengthened role for the private sector and non-governmental organizations does contribute positively to the abilities of a society to identify environmental problems and solve them. The influence of social cohesion and trust has been discussed in the literature in the context of economic performance (Knack and Keefer, 1997) and environmental performance (Bouma et al., 2008). They are based on informal societal attributes that influence human interaction, by lowering transaction costs in the interaction among citizens, which comprise norms, values and attitudes (Foa, 2008).

Cognitive-informational framework conditions (which we cluster as the latent variable awareness) are pre-conditions for green advocacy and governmental institutions to act towards formulation of environmental interests and design of environmental regulation. They are the basis for the flow of information, which is necessary for political–institutional framework conditions to unfold. Awareness enables the advocacy for a specific cause. In this context, awareness is not to be understood as popular awareness raising campaigning but the infrastructure of creating and raising awareness.

[2] Other variables like Regulatory Quality are dropped from the analysis as they are highly correlated with Government Effectiveness.

Cognitive-informational framework conditions: Awareness	
Democratization	In democracies citizens are better informed and can express their concerns about environmental problems more transparently. Thus, democratic structures support the flow of information.
Internet access	Access to internet enables the quick and inexpensive access to information on environmental issues. It is crucial for efficient knowledge sharing.
Environmental knowledge	Creation and publication of knowledge especially in the field of environmental processes promotes decision-making based on sound information and data. It is an indicator for the sophistication of environmental knowledge in a country.
Interpersonal safety and trust	Trust between individuals which influences social cohesion and safety. This increases the creation of effective linkages among individuals and lowers transaction cost of information sharing and trust in information and reliability.

Note: see appendix for further description.

Environmental policy output: Environmental regulation, international environmental governance	
Environmental governance	Environmental governance is a policy output indicator which comprises 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.
Participation in international environmental agreements	Participation in international environmental efforts is a result of the work of national environmental government institutions to contribute to solving environmental problems. Further it also gives an indication of the degree of exchange on the international policy arena and communication of policy issues across countries.

Note: see appendix for further description.

We hypothesise that on the one hand environmental knowledge creation by scientists is important for the sensing of environmental problems by the wider public and on the other hand democratization, use of internet, and trust between individuals facilitates the sharing, distribution and application of such knowledge towards environmental awareness raising and policy making.

It is important to note that also economic factors can influence the policy output. The level of national income and individual disposable income increases the availability of financial and technical resources and can improve the capabilities of a system to solve environmental problems (Jaenicke, 2005). The influence of this has been tested for post hoc (in the structural equation model analysis and in a separate linear regression analysis). GDP was found not to have a significant influence which is why we haven't brought it into the structural model.[3]

2.3. Dependent variables: national environmental policy output and international environmental governance

The environmental policy capacity, reflected in political–institutional and cognitive-informational framework conditions, is assumed to influence the policy making process and finally the policy output. We use Environmental Governance as a measure for the quality of national environmental policy output. An indicator on stringency of environmental regulation, which has also been constructed by the World Economic Forum (WEF, 2014) in a survey among CEOs, is highly correlated with the Environmental Governance measure (WEFGOV) which we use (R^2 0.93). The stringency indicator asks how CEOs perceive the stringency of environmental regulation. In our research we opt for the broader Environmental Governance measure. All WEF indicators are subjective in nature, yet there are no other indicators available on the subject matter with that large sample size (see also Haščič et al., 2009). Further, the participation of countries´ administrations in international environmental agreements is a policy output which we call International Environmental Governance. International Environmental Governance influences national environmental policy as well, according to the environmental policy diffusion theory, which acknowledges the influence of international policy institutions influencing national government's administrations (Tews, 2005). Also vice versa, we hypothesise that participation in international environmental agreements is an output of national Environmental Governance capacity, while International Environmental Governance also influences national environmental policy.

[3] We discuss the model findings with GDP as an explanatory variable.

3. Method and model

Our quantitative analysis is based on theory, in the form of a conceptual model consisting of three types of conditions for environmental policy: green advocacy, governance capacity and awareness). The precise interplay between the conditions is something which we do not want to specify beforehand but investigate empirically. Specifically, we are interested if the influence of green advocacy on environmental policy is partially through governance capacity and whether awareness works directly on governance capacity or works also via advocacy. Ordinary Least Squares is not well suited for studying such complex causal relations between explanatory variables (*A* having an influence on *D* directly and via *B*, in combination with variable *C* which has an influence on *A* and *B*), which is why we opted for the use of Structural Equation Modelling. Structural Equation Modeling (SEM) is a multivariate data analysis, which is based on a theoretical model involving unobservable latent variables and a measurement model (Haenlein and Kaplan, 2004). SEM allows the researcher to investigate different model structures. SEM include usually two types of sub-models: the inner and the outer model (Wong, 2013). SEM allow researchers to include unobservable variables, which are measured indirectly by indicator variables (Hair et al., 2014). The inner model describes the relationship between independent and dependent latent variables (Fig. 1, left and right hand side of inner model). Latent variables cannot be observed directly.[4] The outer model, also known as measurement model, specifies the relationship between observed indicators[5] and latent variables.

SEM analysis entails two models. The measurement model specifies how latent variables are measured in the measurement model (Hair et al., 2014). The measurement model consists of a formative measurement part which describes assumed causal, predictive, relationship of the indicator variables with the explanatory construct (left hand side measurement model in Fig. 1) and a reflective part which is about the measurement of the dependent latent variable (right hand side measurement model in Fig. 1).[6]

The structural model consists of the relations of the theoretical variables with each other (inner model in Fig. 1). The theoretical variables consist of exogenous (explanatory) variables and endogenous (dependent) variables. The theoretical model is thus the model of the latent (non-observable) exogenous and endogenous variables. It consists of the constructs and path relationships between them. It is about how the exogenous constructs, or independent latent variables, influence

[4] They are also known as constructs or factors.

[5] Indicators are also called items or manifest variables.

[6] Reflective indicators are different way of measuring the latent variable; formative indicators are not measurements of a latent variable but variables which affect it (either positively or negatively) (for an insightful discussion and empirical examples, see Haenlein and Kaplan, 2004).

the endogenous constructs, or dependent latent variables (sequence from left to right in the structural model, Fig. 1). Together, the structural model and measurement model form the structural equation model.

There are two approaches to estimate the parameters of a SEM, the variance-based approach and the covariance-based approach.

Partial Least Square (PLS), as a variance-based approach, uses the available data to estimate the path relationships, or coefficients, that maximize the R^2 values of the (target) constructs by reproducing the measurement values as linear combination (Hair et al., 2014). Compared to that is the co-variance (CB) based approach (Weiber and Mühlhaus, 2010). The CB approach, similar as in factor analysis, tries to "explain" the measurement variables through the latent variable and attempts to minimize the difference between the sample covariance and those predicted by the theoretical model. In the structural model the CB method focuses on the factor variance while the error variance is excluded. Thus, this approach is similar to factor analysis.

SEM, based on PLS analysis, can be useful when the following situation is encountered (Wong, 2013): i) sample size is small, ii) little available theory on application, iii) predictive accuracy is important, iv) model specification cannot be ensured.

The PLS approach estimates in the first step the values of constructs for each latent variable. PLS estimates coefficients that maximize the R^2 of the constructs. In the second step those values of constructs are used to estimate the structural model, the relationships between latent variables, in a subsequent regression approach. PLS is the preferred method when the theory, which is underlying to the structural model, is not well established (Hair et al., 2014). The CB based approach aims at testing the overall validity of variable interactions by optimizing the overall interaction of all variables (Weiber and Mühlhaus, 2010). It is to be applied when the goal is theory testing or validation and when a global goodness-of-fit criterion is critical (Hair et al., 2014). Additional advantages of PLS over CB based modelling are that small sample sizes can be used and that no special assumptions are needed concerning the data distribution (Hair et al., 2014). Different from normal multivariate regression, its use is not restricted by the following limitations: a) the postulation of a simple model structure, b) the assumption that all variables can be considered as observable, and c) the conjecture that all variables are measured without error (Haenlein and Kaplan, 2004 p. 284). SEM-PLS helps to study causal structures in the form of path relations, something OLS-based multivariate regression is not capable of doing as it is based on a linear model. PLS should be used when key "drivers" shall be predicted within a structural model and when the theory shall be explored rather than be confirmed (Hair et al., 2014).

In this paper, we occupy a middle ground between theory testing and theory exploring. Relevant variables for use are identified (on the basis of proto-theory and the empirical literature) but the exact relations between various items and its power in the overall construct is to be identified. Thus, PLS is a suitable theoretical modelling approach.

The structural model consists of the constructs Green Advocacy, Awareness and Governance Capacity as independent latent variables, constituting "environmental policy capacity" which influence the dependent latent variable Environmental Policy (Fig. 2). All manifest variables, directly or indirectly constitute the national drivers (stimuli) for Environmental Policy. We hypothesise that Green Advocacy, and Governance Capacity, represent the political–institutional conditions of the polity. Awareness represents the construct for cognitive-informational conditions. The construct International Environmental Governance interacts with national Environmental Policy. Which way of causality this link has (see Fig. 2, option 1 or 2) is discussed below.

We postulate that cognitive-informational framework conditions, the capacity to generate knowledge, and effectively distribute knowledge influence the political–institutional framework conditions. However, we hypothesise that Awareness does not directly influence the policy output. Policy output is believed to stem from the interactions of green advocacy actors with the administration and political actors. The influence of Awareness is hypothesised to occur via Green Advocacy, while in our path analysis we will also consider its influence via the direct route to Environmental Policy.

The influence of institutional structure of a country (neo-corporatism, liberal-pluralism) and culture (dominant religion) is not being examined as done by Liefferink et al. (2009) because structural equation modelling is not suitable for the inclusion of binary dummy variables.

We adjusted the data set by carrying out a missing value analysis to ensure validity of our analysis. Since e.g. for the variable Knowledge more than 5% of the data cases are missing (Hair et al., 2014, p. 51) we chose not to revert to mean replacement algorithms but apply case-wise replacement of missing values, which means that cases with missing variables are dropped (Ringle et al., 2010). This reduces our set of observations from 71 countries to 47 country data sets (see appendix Table A 9).

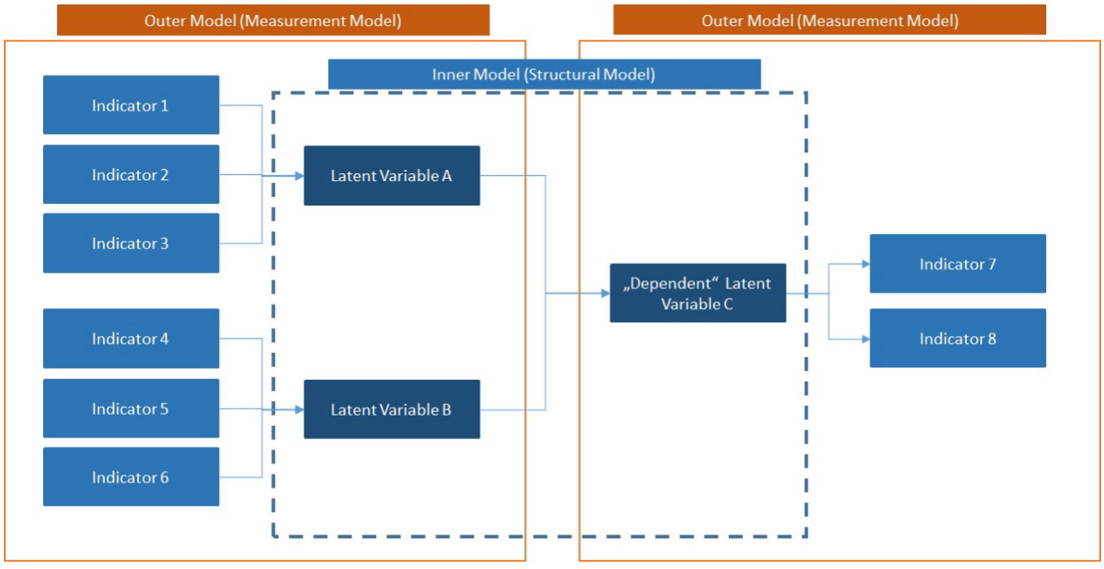

Fig. 1. Measurement model and structural model.
Source: based on Wong, 2013.

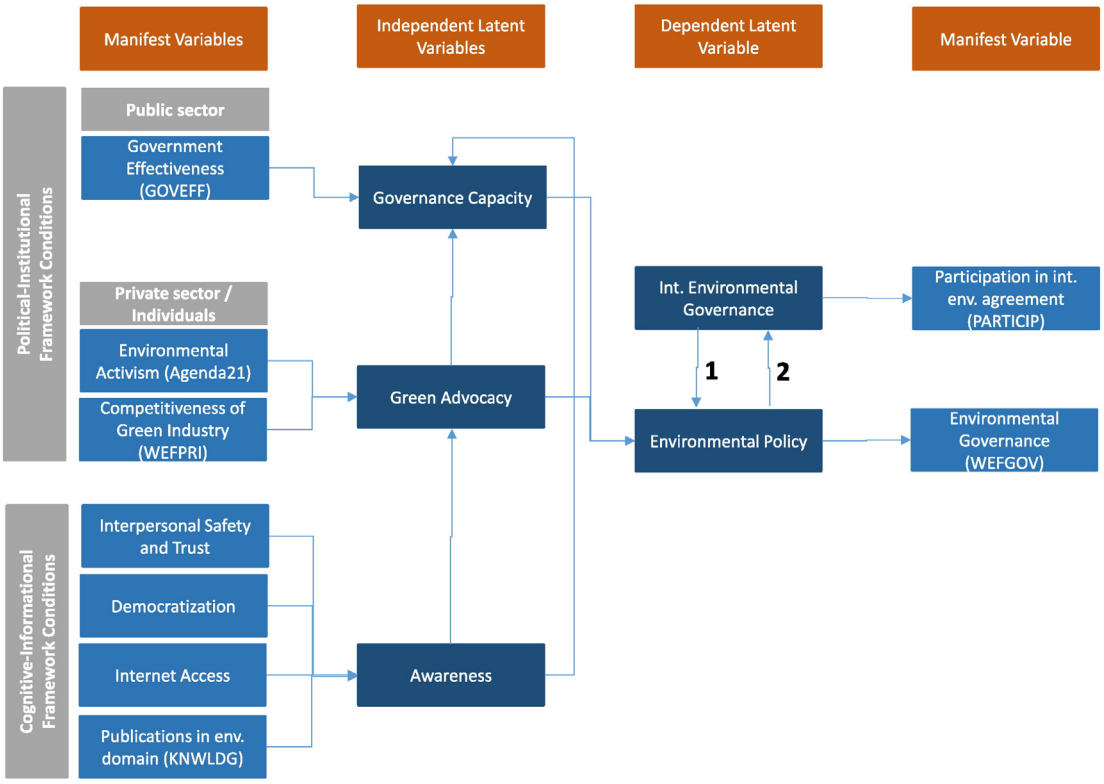

Fig. 2. Determinants of environmental policy conditions and environmental governance.
Source: own illustration, related to Jaenicke (2005).

4. Results and discussion

We calculated the basic structural model in order to detect the influential power of the different constructs towards Environmental Policy by using the software SmartPLS (Ringle et al., 2005). Alternative specifications of the structural model are investigated too, and results of those will be given too, but we start with the results for the model described in Fig. 2.

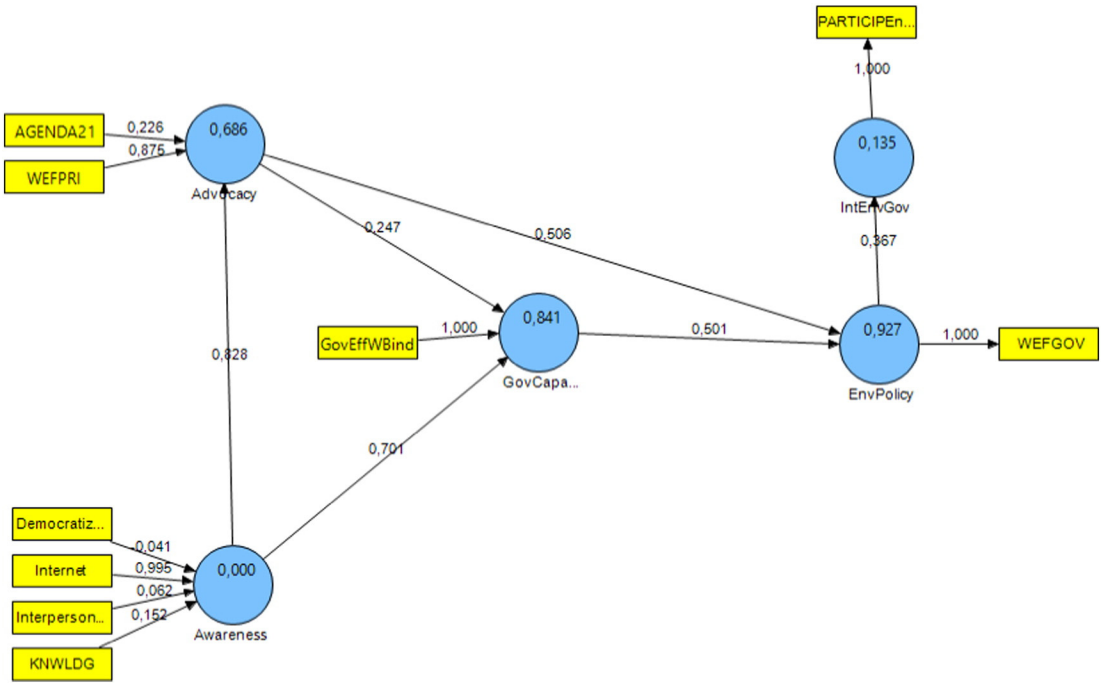

Fig. 3. Path coefficient of the main model.
Source: based on own calculation using SmartPLS. Threshold values for coefficients is 0.2. The outer loading is always 1.0 in single item constructs. Coefficients in measurement models are always between −1.0 and 1.0. The closer the number is to −1.0 or 1.0 the larger is the effect of the item. Value in circle shows R^2.

Table 1
Formative measurement model results.

Formative constructs	Formative indicators	Weight	T-statistics (significance levels)	VIF
Awareness	Democratization	−0.044	0.686	1.18
	Internet	0.993***	9.423	1.87
	Interpersonal Trust	0.067	0.499	1.70
	Knowledge	0.146*	1.672	1.21
Advocacy	Agenda21	0.243***	2.897	1.18
	WEFPRI	0.864***	17.145	1.18
Governance capacity	GovEff	1.000***	0.000	/

Source: own calculation using SmartPLS. VIF is calculated in SPSS. Note: the critical values for significance levels of 1% (***), 5% (**) and 10% (*) probability of error are 2.57, 1.96, and 1.65 respectively. Bootstrapping calculation uses 47 cases (since we have 47 countries in the dataset) and 5000 samples.

The assessment of the PLS model results is conducted in two steps (see Weiber and Mühlhaus, 2010). First the outer models (measurement models) are being assessed. In the next step the inner model (structural model) is examined.

4.1. Reflective measurement model

First, we discuss the reflective models with regard to the latent variable 'Environmental Policy' and 'International Environmental Governance'. We need to examine the estimates for the relationships between the latent variables and the indicators (the outer loadings), which is WEFGOV and PARICIP respectively. The outer loadings of the latent variables on WEFGOV of 1.0 and PARTICIP of 1.0 are above the threshold value of 0.7,[7] because they are single item constructs (Fig. 3).[8] Thus, the reflective constructs (Environmental Policy, International Environmental Governance) are acceptable for the analysis.

4.2. Formative measurement models

The validity of formative constructs is examined by assessing the size of weights. If weights are close to 1 or −1 the dependency between manifest variable and latent variable is high. If weights are closer to 0, the dependency between manifest variable and latent variable is weak (see results in Fig. 3).

The constructs Advocacy, Awareness and Governance Capacity all include some indicators with high weights (Table 1). Internet Access, and Strength of Green Industry (WEFPRI) have the strongest influences on the composite constructs Fig. 3).[9] The indicator AGENDA21 has low weights. Strength of Green Industry (WEFPRI) is weakly correlated with the world trade share of potential environmental goods of OECD countries (R^2 at 0.13) (Legler et al., 2007, export share in total world export for 24 countries only) with the United States, Germany and Japan being outliers in relative export strength. Thus, WEFPRI, which is available for a larger sample size, is operationalized to capture strength of green industry.

Democratization, Knowledge and Interpersonal Safety and Trust have no meaningful influence within the construct Awareness. Internet Access has the highest loading on Awareness.

Technically, the correlation (i.e. multicollinearity) between manifest variables of a construct should be low. If manifest variables correlate, the construct is over-specified (Weiber and Mühlhaus, 2010, p. 207). For all formative models the variance inflation factor (VIF), indicating multicollinearity, is below the threshold level of 5, except within the construct Governance Capacity. Governance Effectiveness and Regulatory Quality are correlated at an R^2 of 0.88 (VIF 8.33). Thus, we drop Regulatory Quality from the construct Governance Capacity and use Governance Effectiveness as single-item construct.[10] All other variables are used in the measurement models.

The quality of formative measurement models can also be investigated by testing for the significance of the outer weights. The bootstrapping methodology can be used to calculate t-values which indicate whether a weight is significant (Nitzl, 2010 p 29; Hair et al., 2014, p 157). In three cases (Democracy, Interpersonal Trust, and Knowledge) the value is below 1.9, indicating that significance of the weight is not meeting the 5% significance level, while Knowledge meets the 10% level (see Fig. 4, Hair et al., 2014, p. 171).

Knowledge (KNWLDG) as an indicator for richness of knowledge in the domain of environmental issues within a society, does not contribute to the construct of Awareness in a significant way and it is understood as a cognitive-institutional framework condition. Shifting the indicator Knowledge into the construct of Advocacy does not yield any better results.

4.3. Structural model

Several aspects are important for the assessment of the structural model (relations between latent variables). If path coefficients are above 0.2 the relation between latent variables is meaningful (Weiber and Mühlhaus, 2010, p. 255). Further, the bootstrapping methodology can be used to determine the significance level of path coefficients. If the t-value is above 1.96 the path coefficient is significant at a 5% level.

There is no meaningful direct impact of the construct Awareness on Environmental Policy.[11] As discussed above, Awareness works through Advocacy and Governance Capacity (Fig. 3, see an overview of values also in Table 2).

If the construct Awareness is dropped from the overall structural model, the effect of Governance Capacity as well as Advocacy towards Environmental Policy does not change much. Yet the path coefficient from Awareness towards Advocacy is 0.83 (Fig. 3) which is a rather strong effect which is also significant (Fig. 4).

The effect of Advocacy on Environmental Policy is as similarly as strong as the effect of Governance Capacity on Environmental Policy. With a coefficient of 0.70, the impact of Awareness on Governance Capacity is slightly weaker than the impact of Awareness on Advocacy, with a coefficient of 0.83.

Government Effectiveness, the manifest variable in the construct Governance Capacity, is positively correlated with the policy output manifest variable WEFGOV.[12] This is as expected, as general Governance Capacity does obviously influence the quality of policy output, also in specific policy areas like Environmental Policy.

Private sector advocacy does influence the general Governance Capacity slightly.[13] Further, private sector green advocacy has a direct influence on Environmental Policy. A limitation of our model and dataset is that there are no numbers on “environmental” or “green” aspects of Governance Capacity available for our sample size (since we use data for 47 countries). Yet, it cannot be ruled out, and empirically it shows to be

[7] Weiber and Mühlhaus (2010, p. 262). Hair et al. (2014, p. 109) suggest a threshold value of 0.7.

[8] In the single-item constructs “Environmental Policy” and “International Environmental Governance” factors are not represented by a multi-item measurement model. Thus, the criteria for reflexive measurement model analysis do not apply and it is left to the structural model examination whether the factors are representative (Hair et al., 2014, p. 99).

[9] If we add the CO_2 intensity per GDP to the construct Advocacy as an instrument for the strength of polluting industry, the sign is negative (negative influence of high CO_2 intensity per GDP on Advocacy, as expected). Yet the influence is insignificant in our model (coefficient − 0.16, significance level at 1.94). We use the average value between 1998 and 2003 of the CO_2 emission per GDP (2005 USD) from the World Bank World Development Indicators.

[10] Adding a corruption index into the construct Governance Capacity is not sensible, since corruption (measured by the variable GRAFT, see appendix) is highly correlated with Governance Effectiveness (R^2 at 0.95).

[11] Calculating the path between Awareness and Environmental Policy would yield a coefficient of 0.13 and a significance value of 1.05, thus this path is not significant.

[12] The R^2 of WEFGOV and GOVEFF is 0.88.

[13] There is some influence of Advocacy on Governance Capacity. If a path between both constructs is added in the structural model, it yields a coefficient of 0.25 and a significance value of 2.53. All other paths do not change if this influence is dropped.

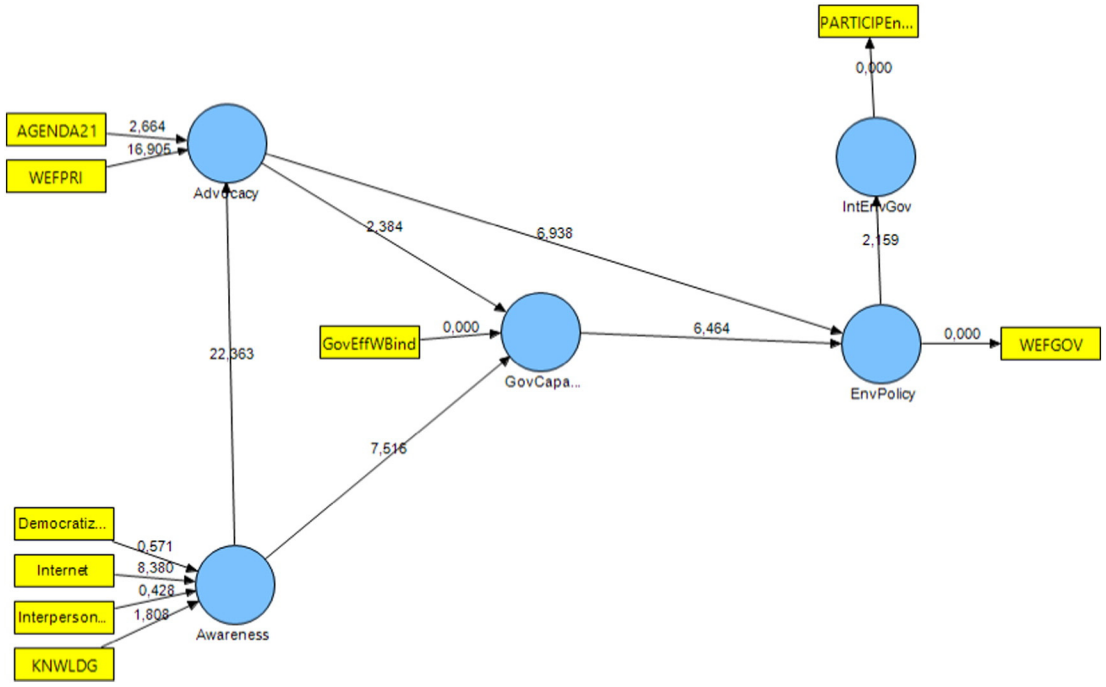

Fig. 4. T-values of the main model.
Source: based on own calculation using SmartPLS. Threshold values for significance of 1%, 5% and 10% probability of error are 2.57, 1.96, and 1.65 respectively. Singe item constructs do not have a significance level.

reasonable according to our model results, that green Advocacy of the private sector has an influence on the Governance Capacity.

If Democratization and Interpersonal Safety and Trust are put in a separate construct, apart from Awareness, their direct influence on Environmental Policy is not meaningful. This indicates that those variables are well placed in the construct Awareness (see appendix, Figs. B 5–B 6).

When we add an economic factor (GDP per capita) as another independent latent variable to influence Environmental Policy (Jaenicke, 2005), the results are not significantly changing.[14] GDP per capita correlates positively with WEFGOV with an R^2 of 0.72. This shows that rising GDP per capita may have a positive influence on the stringency of environmental regulation, yet in the structural model this influence is not systematically captured. The fact that an economic factor as another construct does not change the significance of the other variables reaffirms our structural model and lends credibility to the causal structure of polity drivers.

Adding Economic Conditions as a separate construct does not change the overall results. The path relationship between the latent variable Economic Conditions, measured by Foreign Direct Investment (FDI) and Trade Openness (trade as a share of GDP), and Environmental Policy is insignificant (Figs. B 11, B 12).[15] This shows that the theory of regulatory competitiveness or pressure between countries and the pollution haven hypothesis (Kalamova and Johnstone, 2011) is not captured or confirmed in our model (similar finding as in Liefferink et al., 2009 and Jacob and Volkery, 2006; Kalamova and Johnstone, 2011 show a positive effect of environmental regulation on FDI). Liefferink et al. (2009) conclude in their analysis that a positive relationship between economic wealth and environmental policy exists. Countries with weaker environmental regulation do not per se receive higher amounts of FDI as postulated by the pollution haven hypothesis.

We use strength of environmental industry (Competitiveness of Green Industry, WEFPRI) as a proxy for strong advocacy of the industry, which is in favour of environmental regulatory stringency, while also the other direction of causality could be prevalent. Reverse causality cannot be tested in structural equation modelling based on partial least squares (Henseler and Fassott, 2010). Though, there could be potentially reverse causality between strong environmental industry (WEFPRI) and environmental policy (WEFGOV). In fact, Environmental Policy (WEFGOV) and Competitiveness of Green Industry (WEFPRI) are significantly and positively correlated[16]. The inability of reverse causality testing in partial least square analysis is a limitation in our methodological approach. If we change the structural model in the way that Environmental Policy influences the strength of environmental industry (WEFPRI) and environmental activism (AGENDA21) the R^2 of Environmental Policy decreases to 0.84 (Figs. B 7, B 8). We thus conclude that Advocacy at least has the potential to influence Environmental Policy.

As for the relationship between International Environmental Governance and Environmental Policy, the path analysis indicates that the causality runs from Environmental Policy to International Environmental Governance much more than in the other way. The coefficient for the influence of national Environmental Policy towards International Environmental Policy is larger than the coefficient for the reverse influence.[17] A deeper (case-based) analysis is needed to investigate the question of causality, for example the identification of critical conditions for a policy to become adopted (which may have to do with individuals and/or changes in government.[18] Also, the R^2 of the construct International Environmental Governance is very low at 0.13. This

[14] The path coefficient of GDP per capita as a single item construct (independent latent variable) on Environmental Policy is at −0.036.

[15] If we include a latent variable construct with only FDI as a reflexive instrument, which is influenced by Environmental Policy, the small positive relationship between quality of environmental regulation and FDI is insignificant. It could have been expected that stronger environmental regulation leads to fewer FDI inflows, according to the pollution haven hypothesis.

[16] R^2 of 0.82.

[17] Path coefficient from national Environmental Policy to International Environmental Policy is 0.36, whereas the coefficient in the other direction is −0.013. The R^2 of the construct Environmental Policy does not change.

[18] Case studies are an important source of information for theory building but less suited for testing theories.

Table 2
Path coefficients and significance.

Path	Path coefficient	Standard deviation	T statistics
Advocacy -> EnvPolicy	0.5021***	0.0462	10.8711
Avcocacy -> GovCapacity	0.2593**	0.1039	2.4956
Awareness -> Advocacy	0.8296***	0.0236	35.0885
Awareness -> GovCapacity	0.9061***	0.0144	63.0199
EnvPolicy -> IntEnvGov	0.3669***	0.1109	3.3088
GovCapacity -> EnvPolicy	0.5038***	0.0492	10.2378

Source: own calculation using SmartPLS. Note: the critical values for significance levels of 1% (***), 5% (**) and 10% (*) probability of error are 2.57, 1.96, and 1.65 respectively. Bootstrapping calculation uses 47 cases and 5000 samples.

indicates that other factors do influence International Environmental Governance beyond national Environmental Policy making capacity.

Advocacy and Governance Capacity have no direct, meaningful effect on International Environmental Governance, but via national Environmental Policy.[19] This does not necessarily mean that e.g. Governance Capacity does not have a positive influence on International Environmental Governance, but that in this structural model it does not yield meaningful results. This could be an indication that international environmental policy making follows very different dynamics than national environmental policy making.[20]

Of the directly measured variables, Jacob and Volkery (2006) detected a strong and positive influence of governance effectiveness, green industry strength as well as green NGO activity on environmental policy, which we can also confirm according to our results. Internet Access is positively associated with environmental policy, which has not been treated in other quantitative studies. It is found, that the influence of Internet Access (as a cognitive-informational framework condition) is through Advocacy and Governance Capacity. Different from Pellegrini and Gerlagh (2006), the influence of the degree of democratization does not turn out to be significant. Democratization might influence environmental regulation, yet its direct influence cannot be measured in our model. In line with our results, Jacob and Volkery (2006) find no significant dependency between environmental knowledge creation and environmental policy pioneer behaviour.

The analysis is subject to some further limitations. First, the effect of international environmental governance on countries is not appropriately measurable with the proxy participation in environmental agreements (PATICIP). For this construct further indicators or time series are required, which we do not have, to explore the international environmental policy making dynamics as well as situative factors like economic growth cycles, or electoral turnout in greater detail. This would allow to better understanding the interaction between national and international environmental governance and to investigate the influence of international policy pressures. Jacob and Volkery (2006) find a significant positive relationship between participation in international policy making and national environmental policy making. Second, only the influence of structural determinants is being analysed. In doing so, we do not want to deny the influence of strategic action in the form of wheeling and dealing and the role of media. Our approach does not allow us to analyse such factors. Third, the influence of resistance from polluters as a negative factor could not be analysed, because there are no statistics or any good proxies for countervailing advocacy forces. Fourth, reverse causality could not be tested simultaneously in our structural equation model. This is a clear limitation of the analysis. Fifth, we use an aggregate measure for policy output, which is not differentiating between emission policies and waste policies for example. It also would be interesting to do the analysis for different domains of environmental policy: climate policy, waste policy and clean air policy. Unfortunately information at lower levels of aggregation is not available for our country sample. A last limitation, holding true for all quantitative analysis, is that all variables are subject to measurement problems. The use of different manifest variables helps to go around this problem somewhat. Of the various measures we consider the construct for Governance Capacity as the weakest measured variable. This is caused by the absence of information on the size and quality of environmental protection agencies or representation of green interest in parliament in the countries of investigation. For GOVEFF and WEFPRI, subjective measures are used from the World Economic Forum. We would have liked to have used objective measures, if only to compare the robustness of the findings against more objective measures, but such measures are not available for the sample of investigation.

Despite several limitations, the results appear rather plausible. They fit quite well with the empirical grounded propositions from Jaenicke (2005) and Jacob and Volkery (2006), in particular that national green industry competitiveness and cooperation with the government has a strong, positive link with environmental policy output. But also access to internet and information distribution, via the political–institutional framework, positively contributes to environmental policy making.

The R^2 of the dependent latent variable (Environmental Policy) is an important measure for the quality of the overall structural model. An R^2 above 0.5 can already indicate a good fit of the inner, structural model. The R^2 is at 0.92 for the construct Environmental Policy. This shows that the four constructs explain 92% of the variance of the endogenous latent construct Environmental Policy.

Statistically, 92% of the variance of environmental policy output could be explained, which is very high for a model incorporating only structural factors.

If the construct International Environmental Policy is dropped, the R^2 and coefficient values of the Environmental Policy model do not change. The construct International Environmental Governance is underrepresented, which is indicated by R^2 of 0.13. Thus, as said above already, International Environmental Governance follows a more complex structure beyond the scope and capability of our model to be captured.

We check the structural model (Table 3) for collinearity issues by extracting the latent variable scores from each predictor construct (Hair et al., 2014, p. 188). For two sets of predictors on dependent variables the bilateral possibility of collinearity is tested: Awareness and Advocacy on Governance Capacity, and Advocacy and Governance Capacity on Environmental Policy. Results show, that the tolerance VIF for the latent variable values is slightly above the threshold value of 5 in three cases, which indicates that we encounter small collinearity among the predictor constructs and respective dependent latent variables (Table 3).

In addition to the evaluation of the R^2 of the endogenous construct Environmental Policy, it can be insightful to assess whether omitting a

Table 3
Collinearity assessment of constructs.

Set 1 (dependent latent variable Governance Capacity)		Set 2 (dependent latent variable Environmental Policy)	
Construct	VIF	Construct	VIF
Awareness	5.61	Advocacy	6.57
Advocacy	3.18	Governance Capacity	6.53

Source: own calculation using SPSS.

[19] If paths between Advocacy and International Environmental Agreements as well as Governance Capacity and International Environmental Agreements are tested, it yields the following results: coefficient values are at 0.006 and 0.680, significance values are at 0.014 and 2.311.

[20] Correlation between WEFGOV and PARTICIP is very low, with an R^2 at 0.17.

construct can have a substantive impact on the endogenous construct. This can be measured for each construct with the f^2 effect size (Hair et al., 2014, p 177). The f^2 effect size measures the change in the R^2 value when a specified exogenous construct is omitted from the overall structural model. It is used to evaluate whether the omitted predictor construct has a substantive impact on the R^2 values of the endogenous construct (Governance Capacity and Environmental Policy). It represents the contribution to dependent construct R^2 of an exogenous construct. Threshold values are 0.02, 0.15 and 0.35, representing small, medium, and large effects of the exogenous latent variable to the endogenous latent variable's R^2 value.

Predictive relevance postulates, besides the evaluation of the magnitude of the R^2 independent construct accuracy, that the model must be able to provide a prediction of the endogenous latent variable's indicators (Henseler et al., 2009). If the Stone–Geisser's Q^2-values are above zero, they give evidence that the observed values are well reconstructed and that the model has predictive relevance. Cross-validated redundancy measures (Q^2) are all well above 0 in our model (see further Hair et al., 2014, p. 186).

Also, similar to R^2 and the respective effect size f^2, the relative impact of predictive relevance can be compared by means of the q^2 effect size. As a relative measure of predictive relevance q^2, values of 0.02, 0.15 and 0.35 respectively indicate that an exogenous construct has a small, medium, or large predictive relevance for a certain endogenous construct. Both, Advocacy and Governance Capacity have strong predictive relevance with regard to the endogenous construct Environmental Policy (Table 4). Similarly, the dependent construct Governance Capacity, is predicted by Awareness and Advocacy in a relevant way.

The structural model is valid and the constructs have predictive relevance for the endogenous latent variable Environmental Policy and Governance Capacity.

5. Conclusion

In environmental policy making many actors are involved in a direct and/or indirect way: citizens and citizen organizations, business organizations, politicians and policy officials. Business is known as to exercise an important influence on environmental policy through lobbying activities. Business however is not a single actor. Those companies who will gain from new or stricter regulation (the suppliers of environmental technologies) can be expected to actively support such measures, whereas those that are affected negatively (the polluters) will lobby against new regulations. The success of business attempts at influencing policy will depend on the quality of environmental knowledge (whether or not this can be contested) and values in society. An important actor for the creation of environmental policy is the environmental protection administration, the cabinet-level agency responsible for protecting and conserving the natural environment. According to Jaenicke (2005), a high domestic capacity for environmental policy-making is a necessary condition for becoming a pioneer country in environmental policy.

Table 4
Effect size, and predictive relevance of constructs.

	Environmental policy			Governance capacity		
Construct	Q^2	q^2	f^2	Q^2	q^2	f^2
	0.89					
Advocacy		0.40	0.93			
Governance Capacity		0.50	1.08			
				0.83		
Awareness					0.95	1.04
Advocacy					0.65	0.04

Note: calculations based on SmartPLS and own calculations. We use an omission distance in the blindfolding procedure of 7 (it should be between 5 and 10 according to Hair et al., 2014). Only direct links in the structural model between exogenous and endogenous latent variables have been assessed.

Environmental policy making is also known to be affected by international environmental policy agenda setting and is interlinked with policy making of other countries (Tews, 2005). Macroeconomic factors are also hypothesised to play a role. Kalamova and Johnstone (2011) have found that environmental policy stringency is positively associated with foreign direct investment inflow. Trade openness is seen by Holzinger et al. (2008) as a driver for environmental policy competition which leads to environmental policy convergence.

In this paper, the influence of the above variables is investigated through structural equation modelling which is based on three non-observable constructs (Environmental Awareness, Green Advocacy and Governance Capacity) on the basis of formative indicators for which measures exist. This is an innovative methodological approach as other studies (especially Liefferink et al., 2009; Jacob and Volkery, 2006) have only used multivariate analyses so far without analysing the interaction among the influencing factors itself. Of the three constructs representing the independent latent variables, Green Advocacy and Governance Capacity are most strongly associated with Environmental Policy. The most important factor behind Green Advocacy is Competitiveness of Green Industry (WEFPRI), which suggest that demand from green business for Environmental Policy is more important than environmental activism (AGENDA21). This is an important conclusion, which fits with what Jaenicke (2005) has written and Jacob and Volkery (2006) showed empirically. Overall, Green Advocacy has a similarly strong effect on Environmental Policy as Governance Capacity, according to the path coefficients. This is an interesting finding since Advocacy incorporates environmental specific aspects while Governance Capacity does not constitute explicit administrative capacity in the environmental area.

Areas for further investigation are especially the direction of causality between national environmental policy and international environmental policy making. Our methodology has also not captured the influence of lobbying work of the industry per se and the role of media. Here case analysis is particularly useful as it allows many variables to be integrated into the analysis, including the role of key individuals acting as policy entrepreneurs and the influence of empirically identified circumstances.[21] There are also no coherent data available on the strength of environmental administration (which would be part of Governance Capacity) beyond the European Union countries. It would be a good deal of work to set standards for the measurement of environmental administration quality across countries.

The high positive and direct influence of the proximate variables Advocacy and Governance Effectiveness is a robust finding across different causal structures, which makes us confident about the pathway through which they exercise their influence. Different causal structures were investigated for different sets of data. We haven't exhausted all possible causal possibilities and the analysis is limited to variables that could be measured. We do not claim to have found the exact causal structure and true causal values. We do feel that we got quite deep into the analysis of causality, far deeper than what is possible with multivariate linear regression based on a simple model structure that does not permit the researcher to determine causal pathways of influence variables and build a theory. Structural equation modelling constitutes an important avenue for building a theory of environmental policy making and testing hypotheses. We propose that it is used more in political science and political economy analysis.

[21] An example of this is Lois Gibbs who, in the Love Canal case, was instrumental in bringing about change in U.S. environmental policy (Layzer, 2002) quoted in Crow (2010) who offers more examples of policy entrepreneurs and a discussion of the ways in which they were able to exercise influence.

Appendix A. Detailed data explanation

Table A 5
Political–institutional framework conditions.

Environmental activism	Abbreviation: AGENDA21	Unit: number of local agenda 21 initiatives per million people	Source: ESI (2005)	Year: 2001	
Logic	Local Agenda 21 (LA21) is an international sustainability planning process that provides an opportunity for local governments to work with their communities to create a sustainable future. The number of Local Agenda 21 initiatives in a country measures the degree to which civil society is engaged in environmental governance.				
Methodology	For each country, the number of existing Local Agenda 21 initiatives was counted and divided by the total country population.				
Competitiveness of green industry	Abbreviation: WEFPRI	Unit: Min.: 7.2 Max.: 15.09 = high World Economic Forum Survey on private sector environmental innovation	Source: ESI (2005)	Year: 2003/4	
Logic	Private sector innovation contributes to solutions to environmental problems.				
Methodology	This represents principal components of survey questions addressing several aspects of private sector environmental innovation: environmental competitiveness, prevalence of environmental management systems, and private sector cooperation with government				
Government effectiveness	Abbreviation: GOVEFF	Unit: Indexed between 0 and 1 = high levels of effectiveness	Source: World Bank, Worldwide Governance Indicators	Year: Average 2000–2002	
Logic	Governmental effectiveness is defined in this data set as "quality of public service provision, the quality of the bureaucracy, the competence of civil servants, the independence of the civil service from political pressures, and the credibility of the government's commitment to policies." It is relevant for environmental sustainability because basic governmental competence enhances a society's ability to monitor and respond to environmental issues.				
Methodology	Government effectiveness captures 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.				
Regulatory Quality	Abbreviation: REGQUAL	Unit: Indexed between 0 and 1 = high levels of quality	Source: World Bank, Worldwide Governance Indicators	Year: Average 2000–2002	
Logic	Regulatory quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.				
Methodology					

Note: this variable is not being used in the final structural model.

Table A 6
Cognitive-informational framework conditions.

Democratization	Abbreviation: democratization	Unit: Trend-adjusted 10-year average score with high values corresponding to high levels of democratic institutions	Source: Polity IV (ESI (2005))	Year: Average 1993–2002	
Logic	The presence of democratic institutions increases the likelihood that important environmental issues will be debated, that alternative views will be aired, and that decision-making and implementation will be carried out in an open manner. These factors improve the quality of environmental governance.				
Methodology	Average of the Polity IV scores for 10 years 1993–2002 adjusted for trend: if the trend was positive, the average was increased by 1, if the trend was negative, the average was reduced by 1. The purpose of the adjustment was to reward improvement.				
Internet access	Abbreviation: internet access	Unit: Internet users (with internet access) per 100 people	Source: World Bank, World Development Indicators	Year: Average 2000–2002	
Logic					
Methodology	Internet access, internet users (with internet access) per 100 people				
Publications	Abbreviation: KNWLDG	Unit: Min.: 1.67 Max.: 74.67 Average rank with low values corresponding to above average performance	Source: ESI (2005)	Year: 1993, 1998, 2003	
Logic	Creation and dissemination of knowledge about, inter alia, environmental, ecological, and socio-economic processes is important for achieving environmental sustainability for several reasons: i) it promotes decision-making on the basis of sound information and data, ii) it facilitates knowledge exchange and propagation between producers and users, iii) it allows adoption of new knowledge and technologies in other regions and sectors ("leapfrogging").				
Methodology	Publication of scientific knowledge in the top-rated peer-reviewed journals in the fields of environmental science, technology, and policy. We collected data on the primary author's institutional affiliation and the location where the research was carried out for 9 highly ranked peer-reviewed journals for each paper published during 1993, 1998, and 2003. The 9 journals are: Ecology, Conservation Biology, Environmental Science and Technology, Biological Conservation, Global Change Biology (founded in 1995), Environmental Health Perspectives, Water Resources Research, Environmental Toxicology and Chemistry, and Global Biogeochemical Cycles. Three regressions were carried out: Publications per author per million population ~ Researchers per million population + R&D spending as % of GDP + Publications per area and population; Publications about foreign countries ~ log(GDP) + Publications per area; Publications per area ~ Publications per author + Population. The residuals of each regression were ranked and aggregated to form an average rank score.				
Interpersonal safety and trust	Abbreviation: Interpersonal	Unit: Between 0 and 1	Source: ISS (2011)	Year: 2000	
Logic					
Methodology	Focusing on perceptions and incidences of crime and personal transgressions (scale, 1 = low degree of crime)				

Table A 7
Economic conditions.

Foreign direct investment		Abbreviaton: FDI	Unit: 0 = low, 1 = high	Source: World Bank, World Development Indicators	Year: Average 1998–2003
	Logic	The dependency on FDI could be an indicator how strongly a country is exposed to manipulation concerning global policy diffusion.			
	Methodology	Foreign direct investment, net inflows (% of GDP).			
Trade openness		Abbreviation: TRADEOPEN	Unit: Min.: 0.92 Max.: 364	Source: World Bank, World Development Indicators	Year: Average 1998–2003
	Logic	The trade openness could be an indicator whether a country is prone to regulatory competition due to its trade (economic) interconnectedness.			
	Methodology	Trade (% of GDP).			
Corruption		Abbreviation: GRAFT	Unit: Standardized scale (z-score); with high scores corresponding to effective control of corruption. Max.: 2.39 Min.: −1.89	Source: ESI (2005)	Year: 2002
	Logic	Corruption contributes to lax enforcement of environmental regulations and an ability on the part of producers and consumers to evade responsibility for the environmental harms they cause.			
	Methodology	Multi-pronged, experiential surveys of households, firms and public officials were used to measure social and economic costs of corruption. The quality of public service delivery, business, environmental, and public sector vulnerability were also examined, and the indicators on institutions, expenditure flows, and procurement were then added to yield the standardized score.			

Table A 8
Policy output.

World Economic Forum Survey on Environmental Governance		Abbreviation: WEFGOV	Unit: Min.: 15.3 Max.: 59.74	Source: ESI (2005)	Year: 2003/2004
	Logic	World Economic Forum Survey on Environmental Governance			
	Methodology	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			
Participation in international environmental agreements		Abbreviation: PARTICIP	Unit: Min.: 0 Max.: 1 = full participation (score)	Source: ESI (2005)	Year: 2004
	Logic	Participation in international environmental efforts should be measured beyond signatures to treaties. For this reason, this variable combines ratifications of treaties and conventions with the level of active participation in, contribution to, and compliance with the treaties' obligations.			
	Methodology	For each convention, protocol, and amendment points were allocated as follows: 1 point for signature, accession, and ratification without signature. An additional point for ratification with signature, acceptance, approval, or succession. The maximum number of points achievable is: 2 points for UNCCD, 12 points for Vienna Convention, Montreal Protocol, and its Amendments, 2 points for CITES, 4 points for UNFCCC and the Kyoto Protocol, 2 points for the Basel convention, 4 points for UNCBD, and 4 points for the Ramsar convention and the Cartagena Protocol. Due to the varying allocation of points, the observed value for each convention/protocol was re-scaled from 0 to 1 by dividing the observed points by the maximum number of points achievable. The re-scaled values were then aggregated using equal weights of 1/7 each. Countries or territories not listed under the list of parties to a convention/protocol/amendment were assigned 0 points for the respective convention/protocol/amendment.			

Table A 9
Table of countries used in main model.

Argentina	Ecuador	Jordan	Romania
Australia	Estonia	Latvia	Singapore
Austria	Finland	Lithuania	Slovenia
Belgium	France	Malaysia	Spain
Bolivia	Germany	Mexico	Sri Lanka
Brazil	Greece	Netherlands	Sweden
Bulgaria	Hungary	New Zealand	Switzerland
Canada	India	Nicaragua	Thailand
Chile	Ireland	Norway	Ukraine
China	Israel	Peru	United Kingdom
Colombia	Italy	Poland	United States
Denmark	Japan	Portugal	

Appendix B. Different model structure

Here we offer the results of alternative model structures. The influence of a separate construct consisting of Democratization and Interpersonal Safety and Trust on Environmental Policy is shown to have no causal influence (Figs. B 5, B 6). The influence of Democracy and Interpersonal Safety and Trust (shown in Figs. B 7 and B 8) cannot be viewed as separable from Knowledge and Internet (see Figs. 3 and 4).

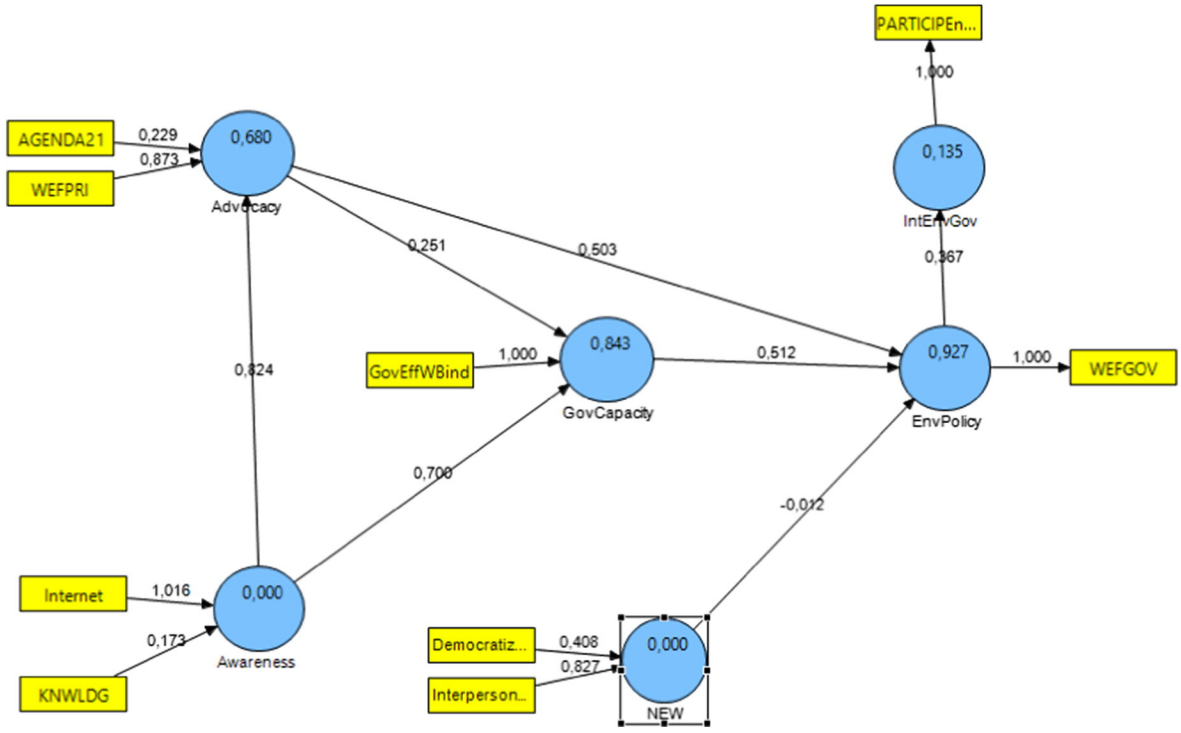

Fig. B 5. Path coefficients of model variant A. Source: based on own calculation using SmartPLS. Threshold values for coefficients are 0.2. The outer loading is always 1.0 in single item constructs. Coefficients in measurement models are always between −1.0 and 1.0. The closer the number is to −1.0 or 1.0 the larger is the effect of the item. Value in circle shows R^2.

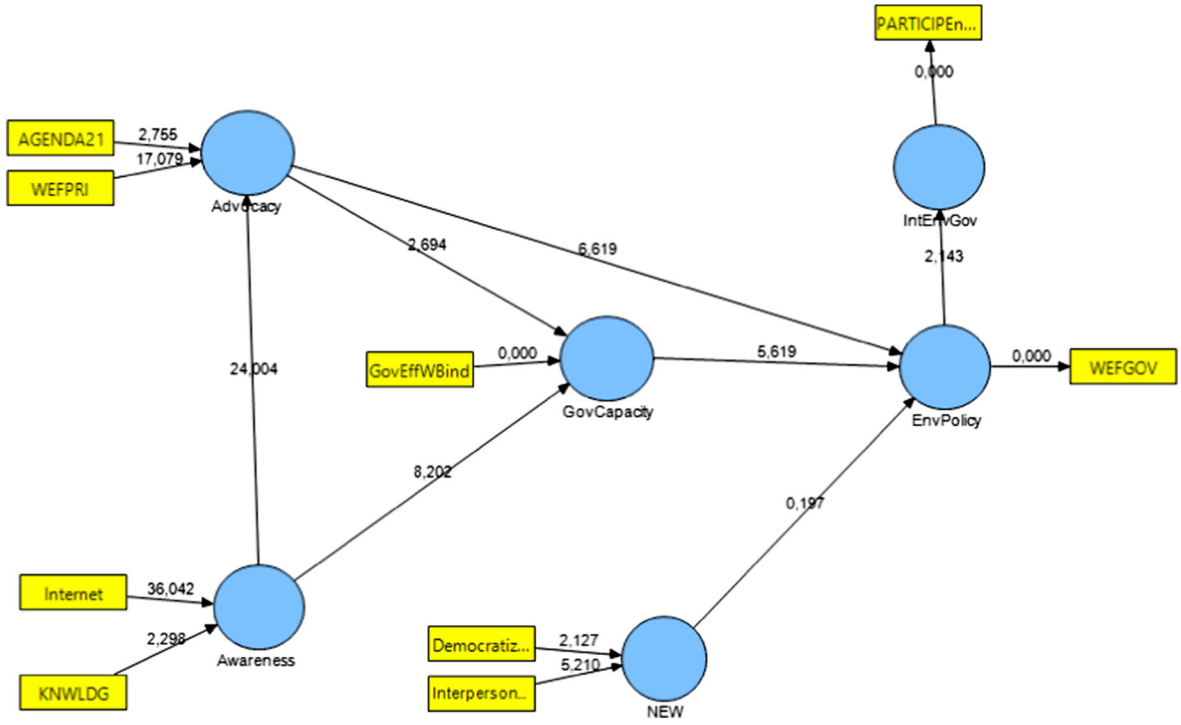

Fig. B 6. T-values of model variant A. Source: based on own calculation using SmartPLS. Threshold values for significance of 1%, 5% and 10% probability of error are 2.57, 1.96, and 1.65 respectively. Singe item constructs do not have a significance level. If we reverse the causality between Environmental Policy and Advocacy (majorly strength of green industry) the R^2 decreases from 0.96 to 0.84 for the construct Environmental Policy (Fig. B 7). Thus, for the purpose to analyse environmental policy capacity we propose to understand the causality in the direction from strength of green industry (WEFPRI) to Environmental Policy.

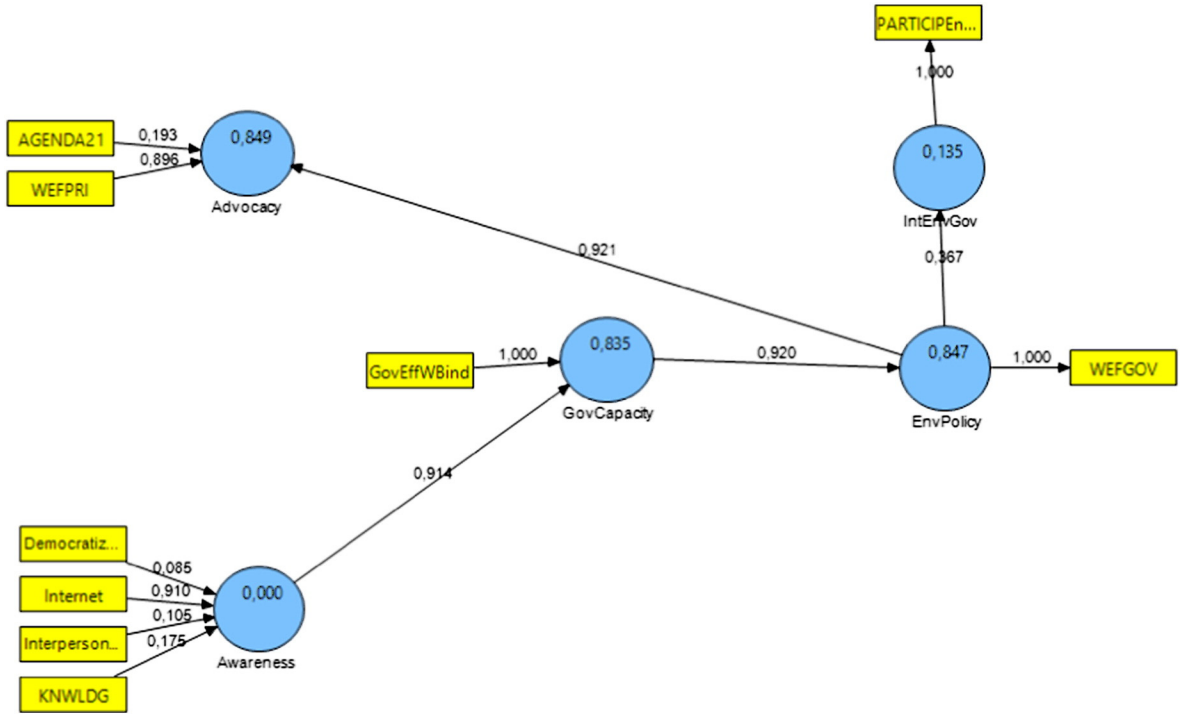

Fig. B 7. Path coefficients of model variant B. Source: based on own calculation using SmartPLS. Threshold values for coefficients are 0.2. The outer loading is always 1.0 in single item constructs. Coefficients in measurement models are always between −1.0 and 1.0. The closer the number is to −1.0 or 1.0 the larger is the effect of the item. Value in circle shows R^2.

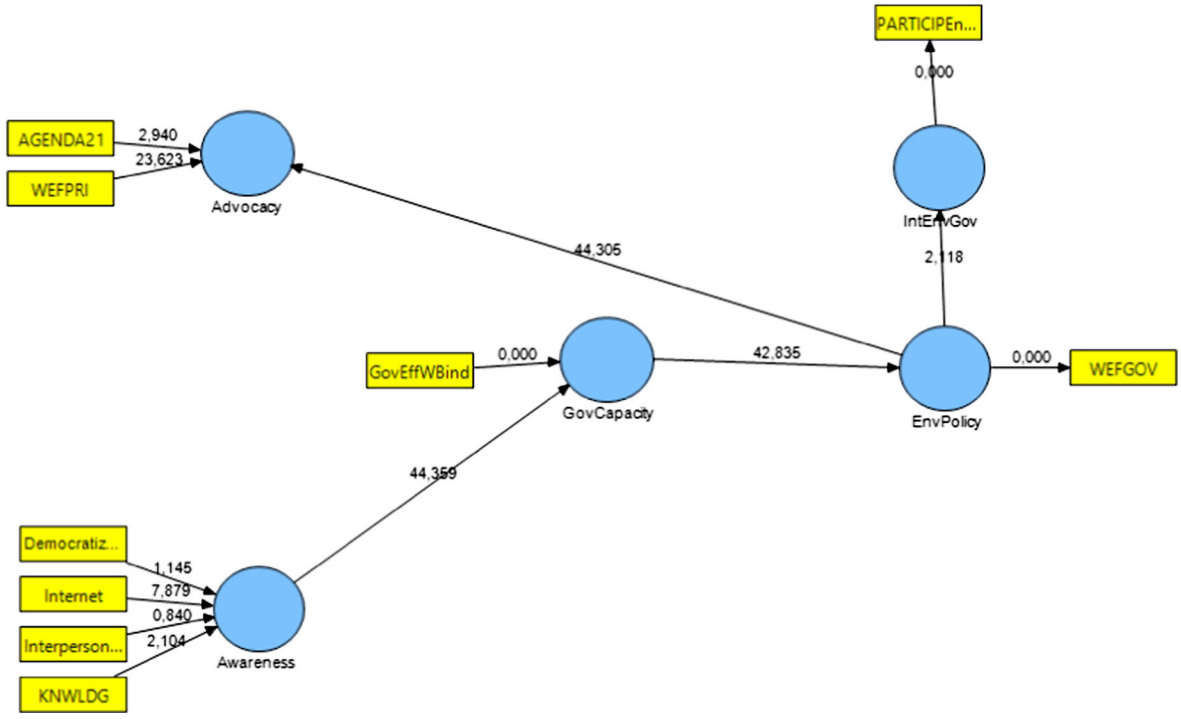

Fig. B 8. T-values of model variant B. Source: based on own calculation using SmartPLS. Threshold values for significance of 1%, 5% and 10% probability of error are 2.57, 1.96, and 1.65 respectively. Singe item constructs do not have a significance level. Inserting Democratization into the political–institutional framework conditions does not yield any better result (Figs. B 9 and B 10). Thus, it can be assumed, that Democratization is part of the cognitive-informational framework conditions, facilitation the exchange of information and knowledge.

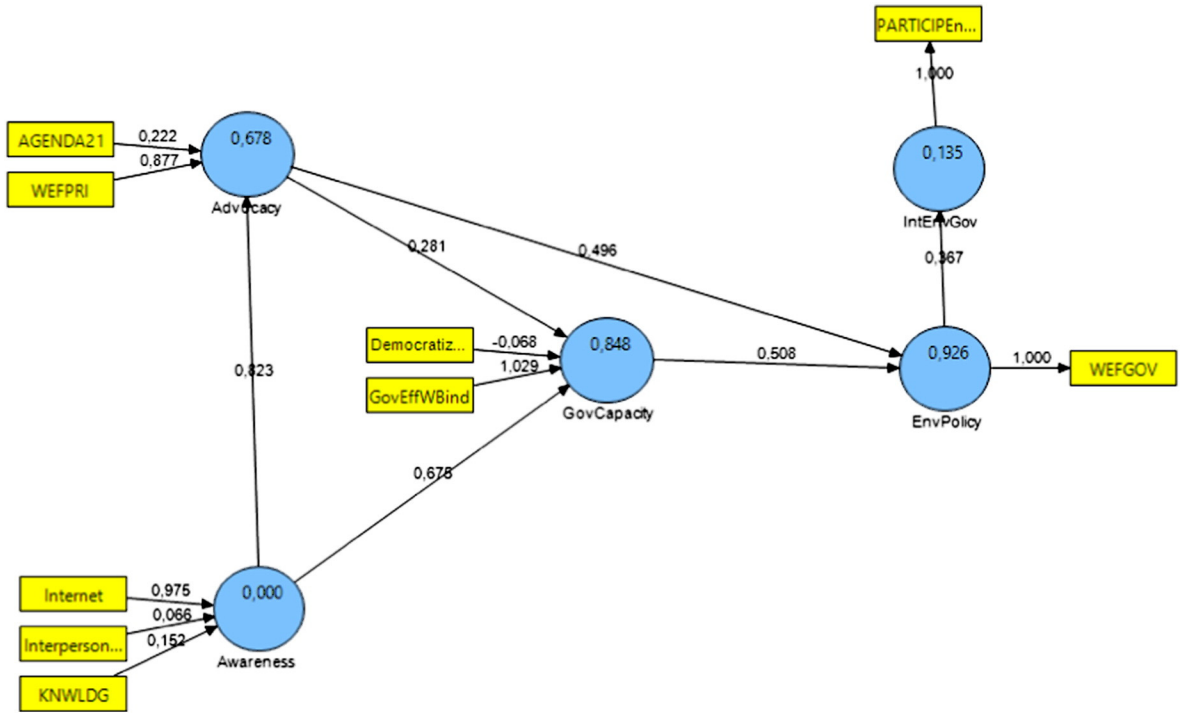

Fig. B 9. Path coefficients of model variant C. Source: based on own calculation using SmartPLS. Threshold values for coefficients are 0.2. The outer loading is always 1.0 in single item constructs. Coefficients in measurement models are always between −1.0 and 1.0. The closer the number is to −1.0 or 1.0 the larger is the effect of the item. Value in circle shows R^2.

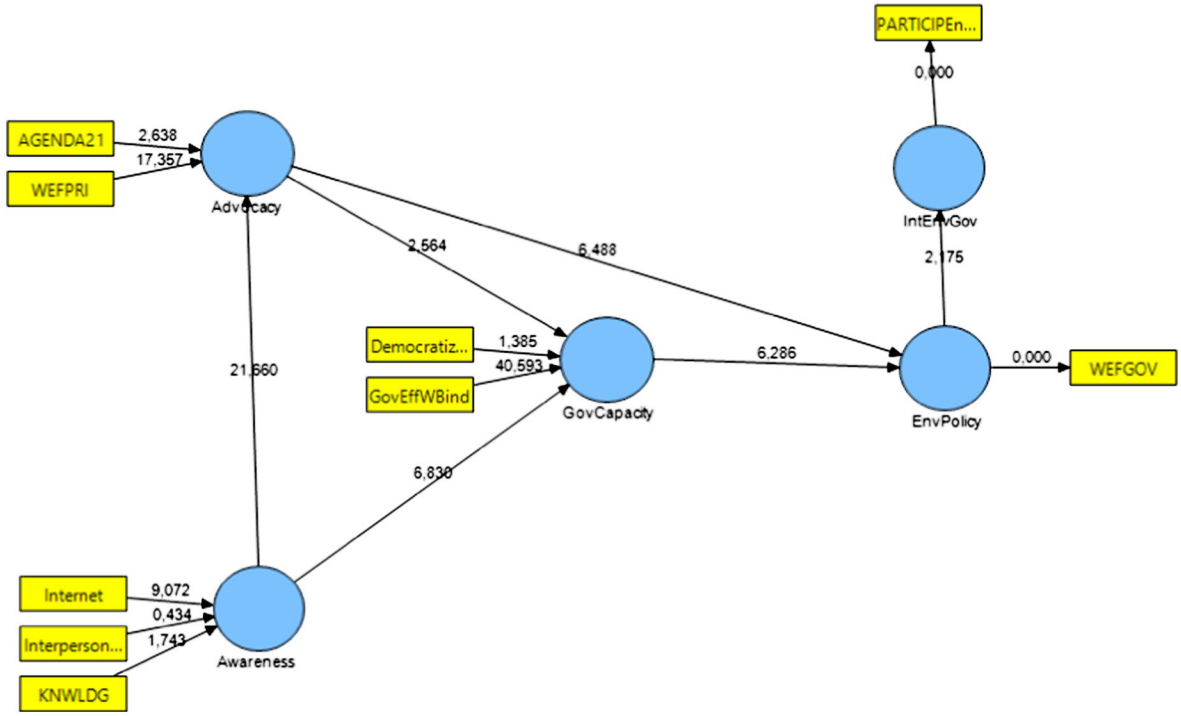

Fig. B 10. T-values of model variant C Source: based on own calculation using SmartPLS. Threshold values for significance of 1%, 5% and 10% probability of error are 2.57, 1.96, and 1.65 respectively. Singe item constructs do not have a significance level. We also investigated the influence of economic conditions such as trade openness or dependency on international financial inflows, measured as Foreign Direct Investment (FDI). If we add a latent variable representing economic conditions in our model, the results do not change and the influence of those economic conditions on environmental policy is not significant (Figs. B 11, B 12). This exemplifies that our core model, based on structural conditions regarding the institutions and actors is robust to alternative specifications.

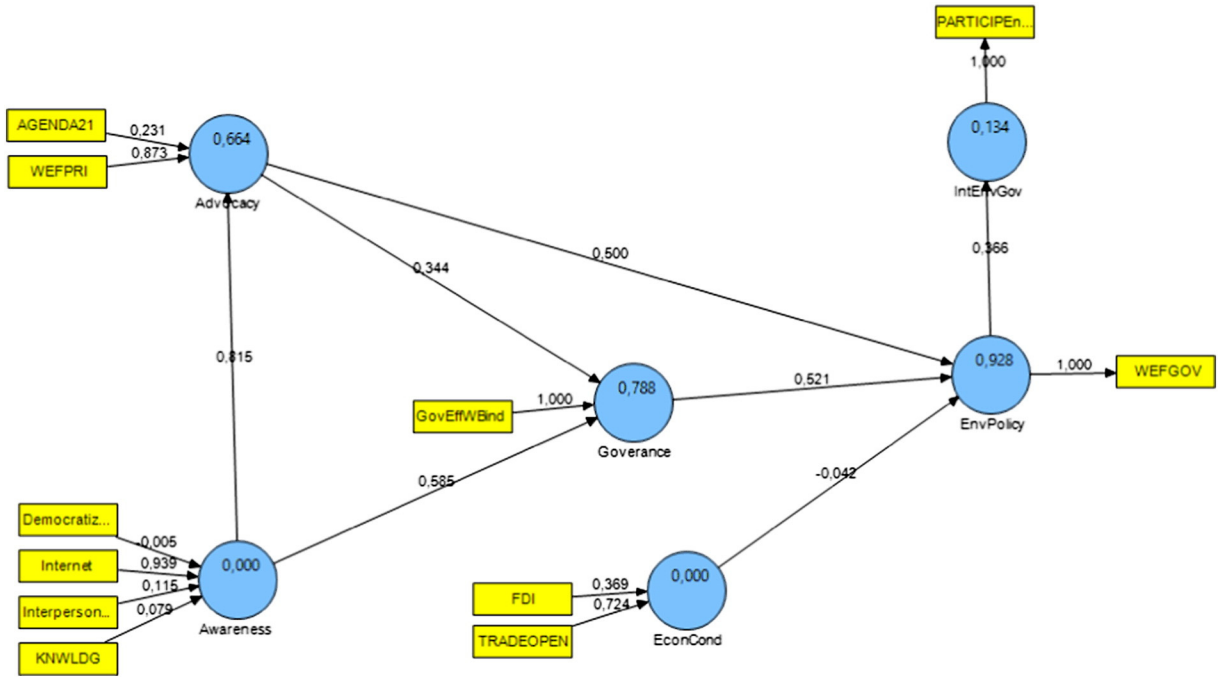

Fig. B 11. Path coefficients of model variant D. Source: based on own calculation using SmartPLS. Threshold values for coefficients are 0.2. The outer loading is always 1.0 in single item constructs. Coefficients in measurement models are always between −1.0 and 1.0. The closer the number is to −1.0 or 1.0 the larger is the effect of the item. Value in circle shows R^2.

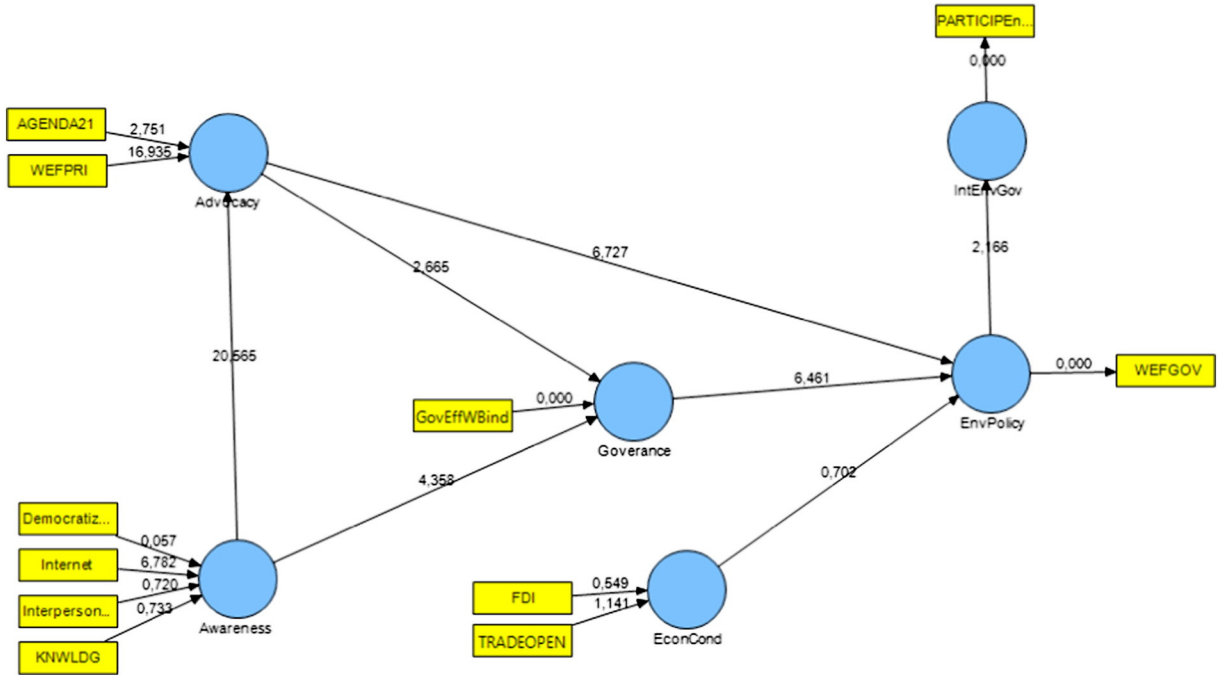

Fig. B 12. T-values of model variant D. Source: based on own calculation using SmartPLS. Threshold values for significance of 1%, 5% and 10% probability of error are 2.57, 1.96, and 1.65 respectively. Singe item constructs do not have a significance level.

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