Creating a linkage between "Environment" and "Socio-Political" blocks in the International Futures model

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Abstract – In the article were reflected the structure of International Futures model and modelling of carbon emissions with major blocks of model. New components for better modelling climate change and climate mitigation policies were also proposed. The link between "Environment" and "Socio-Political" blocks were developed.

Key words – International Futures, climate change, climate mitigation, policies, Gender Empowerment, Democracy, carbon emissions, potential to adapt climate mitigation policies.

I. Introduction

Integrated assessment models are used for modelling climate change and climate mitigation policies as they connect knowledge from different branches [Easterling, 1997, 10]. International Futures combine knowledge from politic, environment, economic, social, cultural spheres, although it is not complete in representing climate change. In this case, "Environment" block has only linkages with "Agriculture", "Energy", "Population", "Economic" (taxes). But there are socio-political factors, which make an influence on climate mitigation process.

II. The General Structure of International Futures (Ifs) model

Global integrated model International Futures (Ifs) is used for cross disciplinary investigations. It consists of such major conceptual blocks as Demographics, Economics, Energy, Socio-Political systems, The Environment and Agriculture. There are 4 already developed scenarios (Economy first, Policy first, Security first, Sustainability first) and possibility to create new, due to user's interest; time horizon for forecasts is from 2000 till 2100 years. Figure 1 describes interactions within the model [Hughes, 2004, 1].

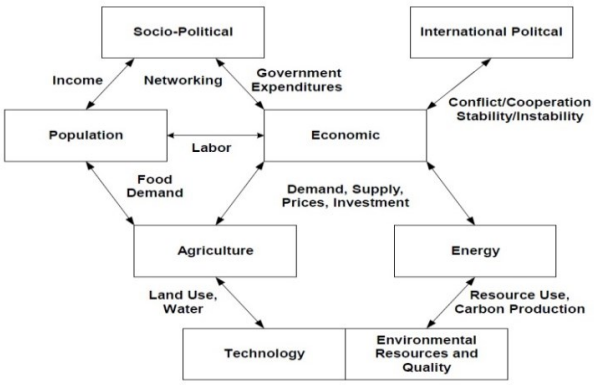

Fig. 1 Interactions within the model [1]

III. Carbon Emissions Estimation

Fig. 2 illustrates Ifs "The Environment" block [Hughes, 2016, 4].

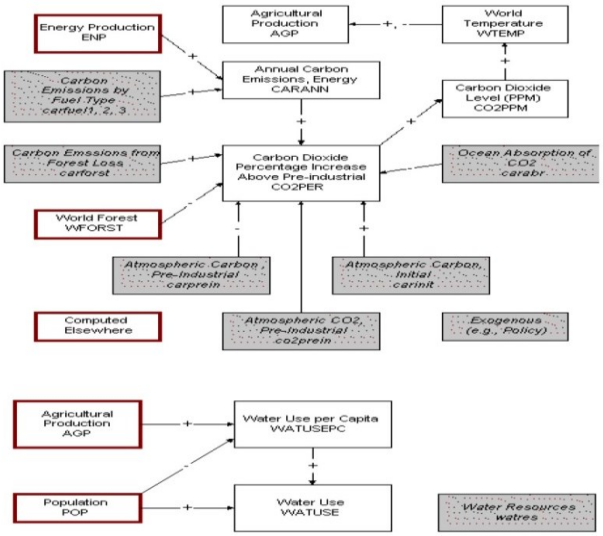

Fig. 2. "The Environment" block of model [4]

The process of modelling CO_2 and its influence on increasing world temperature is following:

1. Calculating impact of global energy production (WENP) and coefficients which represent carbon emissions by fuel type (carfuel(n)) on annual carbon emissions from energy (CARANN).

$$CARANN = WENP_{e=1} * \boldsymbol{carfuel1} + WENP_{e=2} * \boldsymbol{carfuel2} + WENP_{e=3} * \boldsymbol{carfuel3} \quad (1)$$

2. Using CARAN, parameter which reflects influence deforestation or reforestation (carforst), absorbing carbon by oceans (carabr), model calculates cumulative tracking of carbon (SACARB) [Hughes, 2016, 4]. World forest area (WFORST) is calculating in "Agriculture" block, after all use change as result of competition between cropland, grassland, forest, urban and other land [Hughes, 2014, 2].

$$SACARB = SACARB_{t-1} + CARANN + (WFORST_{t-1} - WFORST) * \boldsymbol{carforst} - \boldsymbol{carabr} \quad (2)$$

3. Due to Fig. 2, CO2PER is CO_2 percentage increase above the pre-industrial level. It's calculated

$$CO2PER = \frac{SACARB - carprein}{carprein} * 100 \quad (3)$$

Where, carprein is pre-industrial level of carbon in the atmosphere by weight.

4. For estimating influence of increasing carbon emissions on world temperature, is used "atmospheric level of carbon dioxide in parts per million" (CO2PPM).

$$CO2PPM = co2prein + co2prein * \frac{CO2PER}{100} \quad (4)$$

$$WTEMP = AnalFunc(CO2PPM) \quad (5)$$

"Environment" connected with "Demographics" block trough "Population" (population growth, urban population growth), which is used for calculating municipal water

demand (water use per capita and water use) as shown on the Fig.2 [Hughes, 2016, 4].

IV. Ideas for Improving

Due to the Ifs creator's claim "The Environment" block isn't "extensive" and it can be improved [Hughes, 2016, 4]. After analyzing reports and scientific articles, are revealed some repeated barriers in front of effective implementation programs and plans on national or local levels. Mostly, they are concern non-developed or developing countries such as Kenya [Ajuang, 2016, 5], Uganda, Ghana, Bangladesh [Jost, 2015, 6], Indonesia [Howell, 2015, 9] etc.

There are lots of findings devoted to the understanding role of women in climate mitigation actions. They are less educated, getting much less of information, although they are revealed to be a target group for more effective adoption of climate mitigation policies.

There are several reasons for it:

1) women are taking care of all household and health of their families;

2) men are concentrated on work and money, often they move to another place for work;

3) women possess strategical way of thinking, in contrast men expect immediate result [5, 6, 9].

Ifs already have had "Gender empowerment" in "Governance and socio-cultural" sub-model, which is positively influence on "Democracy" and negatively on "Corruption" (Socio-Political systems) [Hughes, 2014, 3]. This existing links is appropriate for connecting with "Environment" block too. The democracy level is one of the factors for climate mitigation policies, totalitarian or post-totalitarian countries not accustomed for involving specialists and not easily change their pattern of behavior. In the countries with high level of corruption a big part of money from International projects settles in the pockets of officials. In countries with strong legislative and Legal System, compliance with laws is also on higher level [Howell, 2015, 9].

For linking "Socio-Political" and "Environment" blocks can be used already existing factors or trough created new one, for example "Potential to adapt climate mitigation policies", Fig.3

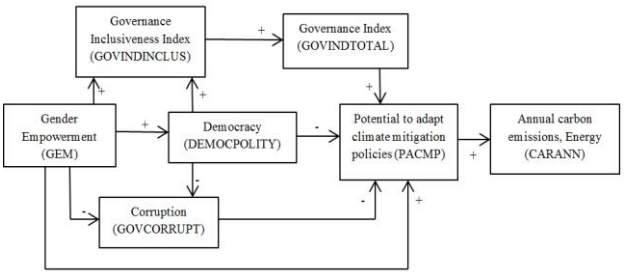

Fig. 3. Interaction "Environment" and "Socio-Political" blocks

This scheme can be improved by involving non-government organizations, activists who will represent ordinary people and their interests. Also, it is necessary to develop a role of different values in adoption and implementation of climate mitigation policies.

Conclusion

After analyzing Ifs model, particular, "Environment" block, several improvements were made. In accordance with recent investigations, gender empowerment, corruption, democracy, effective governance influence on adoption of climate mitigation policies. This influence can be reflected in International Future. This factors already exist in "Socio-politic" block, however are not connected with "Environment".

For this purpose were developed scheme of "Interaction between "Environment" and "Socio-Political" blocks. To this scheme also should be included social values, which describe beliefs and stereotypes. Mostly, Climate Mitigation Programs are aimed to change behavioral patterns of current society. This role, partly, can be delegated to activists and ecological organization.

References

[1] Barry B. Hughes, Anwar Hossain, Mohammod T. Irfan. The structure of International Futures (IFs) // University of Denver. — July 2004. — Working paper 2004.07.19.

[2] Barry B. Hughes, Dale S. Rothman. IFs Agriculture: Model documentation// University of Denver. — April 2014. — Working paper 2014.04.28.

[3] Barry B. Hughes, José R. Solórzano. IFs Governance and socio-cultural: Model documentation// University of Denver. — March 2014. — Working paper 2014.03.05.a.

[4] Barry B. Hughes, Steve Hedden. IFs Environment: Model documentation// University of Denver. — March 2016. — Working paper 2016.03.21.

[5] Chadwick O. Ajuang. Determinants of climate change awareness level in upper Nyakach Division, Kisumu County, Kenya// Chadwick O. Ajuang, Paul O. Abuom, Esna K. Bosire, Gabriel O. Dida, Douglas N. Anyona. — SpringerPlus (2016) 5:1015. .— DOI 10.1186/s40064-016-2699-y

[6] Christine Jost. Understanding gender dimensions of agriculture and climate change in smallholder farming communities, Climate and Development: research article // Christine Jost, Florence Kyazze, Jesse Naab, Sharmind Neelormi, James Kinyangi, Robert Zougmore, Pramod Aggarwal, Gopal Bhatta, Moushumi Chaudhury, Marja-Liisa Tapio-Bistrom, Sibyl Nelson, Patti Kristjanson. — Climate and Development. — 2015. — DOI: 10.1080/17565529.2015.1050978. — URL: http://dx.doi.org/10.1080/17565529.2015.1050978

[7] Gaoussou Diarra, Sebastien Marchand. Environmental compliance, corruption and governance: theory and evidence on forest stock in developing countries // CERDI. — Etudes et Documents. — E 2011.01

[8] Patricia Kristjanson, Quinn Bernier, Elizabeth Bryan. Gender and climate change adaptation in Uganda: insights from Rakai // International Food Policy Research Institute (IFPRI). — Project note No. 03. — October 2015.

[9] Signe Howell. Politics of appearances: Some reasons why the UN-REDD project in Central Sulawesi failed to unite the various stakeholders// Asia Pacific Viewpoint. — Volume 56. — Issue 1 April 2015. — Pages 37–47. URL: http://onlinelibrary.wiley.com/doi/10.1111/apv.12081/full

[10] William E. Easterling. Why regional studies are needed in the development of full-scale integrated assessment modelling of global change processes// Global Environmental Change. — Volume 7, Issue 4. — December 1997. — Pages 337-356.