"Electronic ECOWAS
for
Decision-Making with Distributed Simulation
on
Clean Energy Transition"

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PROJECT SUMMARY

1. Overview:

This Project will assist developing countries to attain their Sustainable Development Goals (SDGs) with the use of advanced Decision Engineering/Intelligence (DE/I) methodology, which uses system dynamics (SD) (Reference (1)) as a major tool for rational/scientific policy analysis and decision-making. The United Nations now aims to attain the SDGs by every country by 2030. The basic idea is that people make decisions based on understanding how actions lead to outcomes. Decision intelligence is a discipline for analyzing this chain of cause-and-effect, and decision modeling is a visual language for representing these chains. The coordination of policies among countries can influence the whole region. Education and training on the impacts and benefits of effective policies for transition to clean and renewable energy is necessary for government officials, employers, workers, and university students. However, most nations need to improve significantly their current pledges and plans for clean and renewable energy. Such ongoing plans, education, and training require new tools with rigorous simulation and online e-learning to meet each developing country's SDGs. This will require regular and transparent global cooperation with collective and shared responsibilities in a democratic fashion.

2. Objectives:

2.1. Intellectual Merit:

The most significant contribution of this project is its transformational use of stakeholder-crafted models for developing sustainable strategies and leveraging an unprecedented critical mass of global expertise for national level problem solving. The multi-disciplinary, multi-institutional project team consists of academics, researchers, and business persons with substantial experience in using modelling and simulation for development objectives. We will develop a global network of federated and standardized systems models of national sustainable development that can collect and share data on complex energy, healthcare, food security and natural resource management problems. This will be an unprecedented effort that could transform the effectiveness of sustainable development and foster global collaboration in solving "wickedly complex" problems.

The Project will select major universities as the focal points of each country to form a consortium of educational and healthcare institutions. The Global University System (GUS) of each country is part of the UNESCO/UNITWIN/Networking/Chair Program at the University of Tampere, Finland, formed in the summer of 1999 with funds from the World Bank. To start the Project has selected four major universities for GUS/Nigeria, GUS/Ghana, GUS/Burkina Faso, and GUS/Pakistan.

The SDGs have 17 sectors. For the sake of accuracy on local needs and data input, Project colleagues overseas will form task teams of local experts for the construction of SD simulation models of each sector. The Project will interlink the sector models with SD solver and/or NASA's Distributed Observer Network (DON) to form a comprehensive country model. The Project then will interlink this regional simulation model of ECOWAS countries via broadband Internet with its proprietary technology to form the "Electronic ECOWAS." The Project may later expand the ECOWAS model to "Electronic African Union," and eventually "Electronic United Nations." A similar SD simulation model will start soon for "Electronic Arab" initiated from GUS/Pakistan and connecting Iran, Afghanistan, Kuwait, and Iraq, etc. No organization has ever developed a model for a globally distributed simulation using a virtual super-computer through broadband Internet for a socio-economic-energy-environment system.

2.2. Broader Impact:

This initiative is unique in that it integrates advances in understanding complex development problems through modelling, simulation, and negotiations with training and educating young decision-makers from developing nations in systems thinking for sustainable development. Given its developing country focus and gender empowerment objective, the initiative will both engage and serve underrepresented population groups and potentially enhance broader societal welfare within the target countries. It also creates an infrastructure for building an unprecedented global network of academics, decision-makers and practitioners who can share knowledge, expertise and data, as well as the cyber infrastructure necessary to allow large-scale education and training of students and citizens across the globe in sustainable development strategies through gaming and simulation. Later as a different project, we will leverage resources to develop national sustainable development models for additional countries, creating a larger global network in the form of the **Global Early Warning System (GEWS),** forming the core of an "**Electronic African Union**" and eventually, the "**Electronic United Nations**."

For the successful implementation of the SDGs, it is necessary to have spirit of togetherness with sharing and collaboration among participants on every level. However, the SDGs are still a very new concept, especially in developing ECOWAS countries. The Project will provide comprehensive and intensive education about SDGs among faculties and graduate students at selected higher educational institutions in those countries. This education will include not only every subject of SDGs but also negative/positive feedback and cause-and-effect mechanisms of SD models based on Cybernetics Theory. The Project will assist the universities to construct scenarios for normative (role-playing) qualitative gaming and model-based quantitative simulation. People will benefit

from the combined use of gaming and simulation for effective online education and policy evaluation. The execution of the country model using laptop computers and cell phones will be available in repetitive mode – even at WiFi spots -- to form a simulator/trainer for hands-on training, which will transform the acquired knowledge to wisdom. The Project will implement education about the SDGs, SD methodology, and simulator/trainer for the capacity building of federal and local government officers and young aspiring future leaders in civil society organizations – particularly along the conduct of "Peace Gaming" on the issues of Winners and Losers of climate change, in order to transform the adversaries to collaborators.

The participating GUS academic groups will submit an application to the Japanese ODA for their further development with the use of comprehensive study based on the SDGs simulation models they have developed. This Project will then become tri-lateral with the US, Africa, and Japan. Examples are the "High-Speed Rail System" in Ghana and "Transition from Fossil Fuels to Clean Renewable Energy" in ECOWAS African countries with Japanese technology and ODA funding.

The Project expects substantial coordinated development of global e-learning and e-healthcare along with the use of simulator/trainer, networking strategies with sharing information and ideas. "Peace Gaming" for trial-and-error community decision-making will foster synthesis and new collaborations on the SDGs. Development of formal standardization of simulation modeling, administrative procedures of GUS for federated networking of academicians and professional experts, will advance science and education through communication and sharing of ideas.

3. Implementation:

When this project-proposal is awarded, we will embark on the "Transition from Fossil Fuels to Renewable Energy" Project (hereinafter "Energy Transition Project"), which is a part of our "ECOWAS Energy Transition Project". We will initially develop the Nigeria and then Ghana Energy Transition simulation models and adapt them to other ECOWAS countries. The ECOWAS Energy Transition Project will provide clean and renewable energy (solar, wind, biomass etc.) and reduce emissions of carbon dioxide and pollution, but will also help develop country policies to create new jobs and economic growth, e-learning education, and e-healthcare in cities and remote areas of Africa.

Phase 1: Develop Energy Dynamic Simulation Models for Sustainable Development in African countries
We will develop dynamic simulation models using the iSDG model structure and methodology (References (1) and (2)), adapted for each country and the pertinent sectors and SDGs (Reference (3)). The iSDG model will be adapted for each country to transition from use of high-carbon fossil fuels in 2015-17 to low-carbon natural gas by 2020 and to zero-carbon renewables by 2030. We will simulate transition to clean and renewable energy by collecting and assessing various data inputs: Change fossil fuel capacity, production, consumption, and trade; Stop flaring natural gas and stop dumping waste byproducts from industrial facilities; Decrease energy use in key sectors; Increase efficiency and capacity based on levelized cost of energy, industrial and transport use of fossil fuels; Increase energy efficiency and capacity; Lower cost of energy use for lighting, cooking, water and space heating in urban and rural areas; Integrate operations of oil/gas production, refining, chemicals, and agriculture; Co-locate solar, wind, and biomass capacity at natural gas power plants; Increase power generation from renewables by 2030 and lower power from fossil fuels; Locate sites in African countries for manufacturing of equipment to produce renewable energy.

Phase 2: Measure Impacts on SDGs from Transition to Clean and Renewable Energy for countries and ECOWAS
We will measure through the dynamic simulation model the results from Transition to Renewable Energy and impacts on SDGs: clean energy and clean water; carbon and other emissions; pollution and waste; climate change; good health and e-healthcare due to lower carbon emissions and pollution; electricity and energy innovation and infrastructure; sustainable cities, rural areas and communities; jobs created and economic growth due to transition to clean energy; quality education, e-learning, and vocational training for clean energy; and partnerships required to achieve these goals. Link the country models and their social-economic-energy-environmental sectors to create the Africa ECOWAS model (Reference (4)). Each of the country models will be interlinked for their collaborative international policy analysis, decision-making, and scientific thinking to assist government officials and aspiring leaders to further their co-prosperity.

Phase 3: Perform Energy Simulations, Negotiations, Surveys, Technical Analysis, and Results
We will summarize the results of the iSDG simulation models and describe the positive benefits and negative side effects for each country. We will propose the investments required for energy efficiency, renewable resources, e-learning, and e-healthcare: We will survey and collect data from short-listed vendors of efficient and renewable energy equipment to maximize energy efficiency, minimize carbon emissions, and lower clean energy costs. We will evaluate and suggest improvements in urban and rural areas at fuel and industrial facilities, residential areas, hospitals, universities, government buildings, public and private transport systems. The main objective of the survey study will be to recommend a short list of technical vendors who can measure and

suggest improvements in urban and rural clean energy efficiency for cooking, heating, cooling, lighting, power generation, transportation, manufacturing, and carbon emissions. We will evaluate vendors for their ability to train, install, and manufacture renewable-energy equipment in Africa using local workers educated and trained for these new jobs.

Phase 4: Educate and Train via e-learning and e-healthcare modules

We will recommend certain African universities to become prototypes with on-site entrepreneurship incubator laboratories that have operational renewable energy equipment, courses, and online e-learning. Quantitative measurements, tests, and computer operations will train and empower local African personnel for better jobs, energy management, higher efficiency, lower costs, and lower carbon emissions. We will propose educational programs at universities in Africa based on courses and e-learning on role-playing qualitative negotiations used by US universities and quantitative simulation models used by US think-tank and policy-making institutions. We will include "what if" scenarios for evaluating clean energy transition policies and recommended investments. We will use these African universities for teaching technical and business energy operations via on-campus and e-learning courses on renewable energy for power generation, clean transport systems, and smart grid installations. We will provide to ECOWAS countries global e-learning and e-healthcare which would be available from; Columbia University, New York NY; Stevens Institute of Technology, Hoboken, NJ; Tandon School of Engineering of New York University, New York NY; University of Tampere, Finland; Mayo Clinic, Rochester, MN; University of California, Chico, CA; United Nations Development Economic and Social Affairs (UN-DESA), NY City; NASA (Simulation Exploration Experience & KSC), Melbourne, FL; International Research Society on Methodology of Societal Complexity, Amsterdam, The Netherlands, etc. Higher educational and healthcare institutions which would work with our project would affiliate with the Global University System of the UNESCO/Unitwin/Chairprogram at the University of Tampere, Finland.

4. Funding and Timing

Funding and Timing requirements to be mutually agreed based on the scope of project and simulation models.

5. References:

(1) Nine-minute Video on You-Tube on the iSDG Model: <https://www.youtube.com/watch?v=Kc9rBwtrV00>
(2) Description of "integrated SDG" (iSDG) Model: <http://www.isdgs.org/#!documentation/kri3x>
(3) United Nations Sustainable Development Goals: <http://www.un.org/sustainabledevelopment/>
(4) Electronic ECOWAS for Decision-Making with Distributed Simulation (December 3, 2016)

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