Food-Energy-Water Foresight for Sustainable Economic Development & Eco-Resilience in ASEAN Countries

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The Food-Energy-Water (FEW) Foresight for Sustainable Economic Development and Eco-Resilience in ASEAN Countries, guided by the emerging paradigm for innovation and inclusive development for the poor and vulnerable, is based on the ASEAN Krabi Initiative (AKI) framework which was conducted by the APEC Center for Technology Foresight (APEC CTF). Background research and interactions with stakeholders and experts from various countries in Southeast Asia have been elaborated throughout the process of integrated foresight, including real-time Delphi surveys and scenario-building workshops in three member countries of ASEAN — Thailand, Indonesia, and Vietnam.

With a special focus on three of the eight AKI thematic tracks — food security, energy security, and water resource management — the project applied the Three Horizons foresight and focus group methods. A real-time Delphi survey was conducted to cover selected respondents throughout Southeast Asia and a series of scenario-building workshops were convened. Scenarios for food, energy, and water resulting from the group of experts' inputs in Nakorn Pathom (Thailand), Jakarta (Indonesia), and Hanoi (Vietnam) were formulated. Food, energy, and water scenarios applied two variables of actions and constraints to reflect the "effectiveness" or "ineffectiveness" of actions to promote sustainability and resilience. Based on this logic, four scenarios for each theme were developed in a two-by-two matrix manner. The outcome was to confirm that the FEW nexus must be addressed holistically, because of the strong interrelations between the sectors and the strong and potentially disastrous effects on each sector of independent activities in the other sectors. Several necessary features of pathways leading to sustainable and resilient futures for ASEAN including governance, holistic approach, and community-based decision-making were elaborated.

Introduction

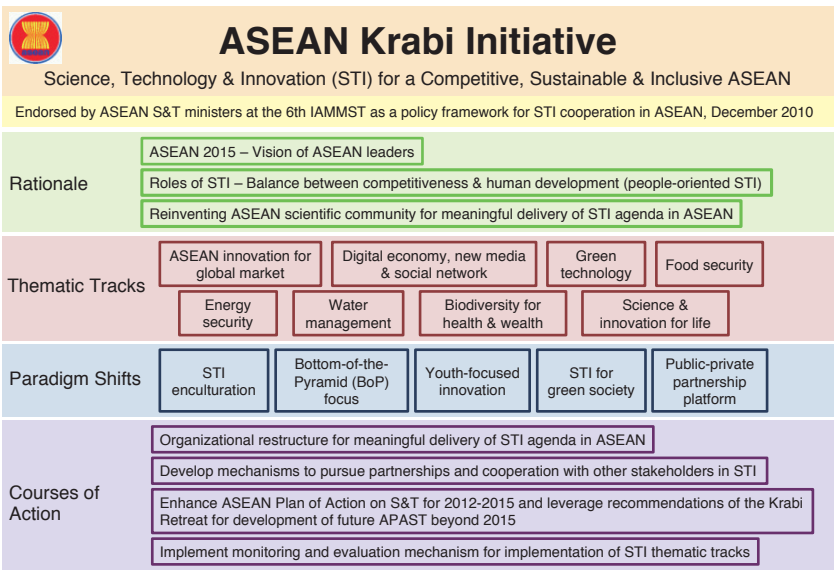
ASEAN is moving towards closer co-operation under the three pillars of the ASEAN Community (AC) framework by the end of 2015. The population of 570 million people with diverse cultures, values, and beliefs in the region will be living together in much closer cultural, geographic, economic and religious proximity — while the challenges mentioned above will define the collaboration among member countries in the long run. Within the next decade, Southeast Asia will have to contend with an aging but healthier population, projected to increase to 700 million by 2030. Relatively young and increasingly affluent populations in Indonesia, the Philippines, and Vietnam will contrast with Malaysia, Singapore, and Thailand, with their aging populations, contributing to new and sophisticated market demands in relation to consumption of food, energy, and water.

The ASEAN Krabi Initiative (AKI) was launched in December 2010 as an important policy framework and a strategic direction to move forward using Science, Technology and Innovation (STI) to raise competitiveness for a sustainable and inclusive ASEAN. It was fully supported by the ASEAN Committee on Science and Technology (ASEAN COST) and later endorsed by the ASEAN science and technology ministers at the Sixth Informal ASEAN Ministerial Meeting on Science and Technology (IAMMST). The approach builds on the AKI developed by the National Science Technology and Innovation Policy Office of Thailand. The AKI represents a new collaborative approach to development in the Southeast Asian region covering integrated, inclusive innovation based on sustainable pillars and principles. This has now been agreed to by all ASEAN nations and the National Science Technology and Innovation Policy Office of Thailand has been tasked to carry forward the implementation. The rationale behind the initiative has three prongs and eight thematic tracks, with five paradigm shifts and four major courses of action as shown in the *Chart*.

An "integrated foresight" approach that can combine social, economic, and technology foresight in support of human and ecological development for increased resilience in the region can be seen as a potential approach for collaboration in order to support the above three elements of innovativeness that will influence the future of ASEAN integration. As a result, the APEC Center for Technology Foresight (APEC CTF) which is hosted by the National Science Technology and Innovation Policy Office of Thailand, in partnership with the Rockefeller Foundation, has developed a project on "Integrated Foresight for Sustainable Economic Development and Eco-Resilience in ASEAN Countries". This project was conceived in agreement with the AKI's vision of the ASEAN leaders in promoting

CHART

Key characteristics of the ASEAN Krabi Initiative



Source: National Science Technology and Innovation Policy Office (STI) of Thailand

"Science, Technology and Innovation for a Competitive, Sustainable and Inclusive ASEAN".

The objective of this project was to give life to this paradigm shift through recommended strategies and actions based on the deliberations of a broad cross-section of ASEAN stakeholders using foresight to envision an ASEAN future that is inclusive in its use of science, technology, and innovation. This was accomplished by focusing on three of the AKI's eight tracks — food security, energy security, and water management — and integrating scenarios in each of these areas into an analysis of the FEW nexus that takes into account the interrelationships between these sectors that must be recognized in developing successful policy strategies and actions. Both the scenarios and the nexus analysis indirectly address a fourth track, green technology.

A series of workshops and surveys were designed to facilitate an integrated approach of foresight to develop strategies and implementable recommendations for future science and technology advancement and innovation for inclusive development of stable, productive and innovative employment prospects in the emerging ASEAN economies, using a set of insights on plausible scenarios of the ASEAN Community (AC) in 2020, five years following the completion of this particular integration.

The FEW Nexus

Managing the scarce resources of food, energy, and water under conditions of significantly increasing demand is one of the most significant challenges of our time. An adequate energy supply underpins both the economic growth of a nation and the quality of life of its citizens. Water is crucial to human survival, but its supply is relatively limited and negatively impacted by the use of water for agriculture, industry and waste disposal. Feeding its citizens is one of the central responsibilities of the state, but over 15% of the current world population are undernourished, and the rapidly growing population will require more.

There are many organizations tasked with addressing these issues, and an abundant literature and supporting research. But it is the nexus between food, energy, and water that perhaps both represents the greatest challenge, and offers the most significant opportunities for substantially improving the way we manage these scarce resources.

While it is apparent that the supply, management and use of food, energy, water are inextricably linked, an approach that may clarify problems and potential policy actions is to focus on the critical relationships between each of the pairs of the triad, followed by identification of activities in which all three elements are centrally involved.

Energy-Water

Generation of energy, particularly the ubiquitous electricity, has very high water demands. Water that is allocated to and used for energy generation is not available for people to drink, for farmers to grow their crops, or for industry to use in manufacturing. All too frequently, under pressure to develop energy supply, the price of water has been subsidized, or in worst cases set at zero. The consequence has been that there has been little incentive to use water efficiently, and there has been no effective market to manage the competing demands for water. A further consequence of the use of water in energy generation has been its return to the supply system polluted, both thermally and by foreign matter. More complex analyses are available that point to the water cost of the various materials used in the distribution of electricity.

To resolve the current problems of undervaluing of water resources and competition with other uses, data is needed on the quantity of water used per unit of electricity generated, the effect on water quality, and the end use of the electricity. Recommended actions are to monitor the source(s) of water used, determine the extent to which water waste is produced, whether water can be recycled, and whether the quality of water is reduced, and evaluate opportunity cost by defining the uses of water that have been ruled out by its use for electricity generation. These are actions that should be taken at the country level, but the development of standard practices throughout ASEAN would be helpful.

Food-Water

Agricultural production constitutes on average 70% of a nation's water consumption. The usually simple processes of subsistence

and small farming may be appropriate at the site, but collectively lead to high levels of wastage and inefficiency. Open channel irrigation has very high losses through seepage and evaporation. Only if water is scarce (e.g., through drought) or has a significant cost is innovation likely to occur. Effective action will be necessary at the community and family level, but needs to be guided and supported by simple schemes that increase the efficiency of water use. In addition, if fertilizers or pesticides are applied to increase production, run-off will pollute the remaining water sources, often to a destructive level.

Decisions on which crops to grow and how to irrigate the fields have implicit effects on the quantity and quality of water available for other uses. Recommended actions are to evaluate water needs in a holistic manner, taking into account the effects on other sectors. While the conditions are different in different countries, ASEAN could establish standard practices for performing the evaluations and provide models for comparative analysis.

Food processing is an intensive user of water, like all process industries. While food processing may require high quality water in some uses, in many lower grade water could be used. But without a regular supply, and differential pricing, there is little incentive to encourage its use. Again, a consequence of this usage can be further pollution, sometimes with dangerous chemicals. The promotion of closed cycle processing, as necessarily practiced in the petrochemical industries, could be one long-term approach.

Food-Energy

Agricultural production uses energy, largely in the form of fuel for on-farm activities and transport to market. The availability of this energy in suitable form, time and place can act as a major facilitator, or constraint.

Recommended actions are to evaluate the energy efficiency of equipment and processes used for irrigation and fuelling farm machinery and evaluate their cost-effectiveness and the potential for improvement taking into account the local context and available resources.

Food processing is an energy-intensive enterprise. There may be considerable scope in the design of foods and the operations of food processors to achieve significant efficiencies in energy consumption.

As for water, energy for food processing should be held to the same standard as energy for other industrial processes, while energy for food distribution likely uses existing commodity transportation infrastructure and supply chains, with refrigeration a special requirement. Recommended actions are to monitor and evaluate energy use to look for places where inefficiencies exist and can be eliminated.

Nexus

Some activities inherently involve all three sectors and highlight the trade-offs and opportunities that need to be evaluated and addressed in a holistic manner. Here we briefly discuss three that were of special concern to participants in all three workshops and the final symposium: land use, irrigation, and biofuels. The key concerns in all three cases revolved around the importance of taking into account the local context in the development of policy strategies and actions and implementing practices that affect local communities.

For land use, the key issue is how to ensure that local communities have a voice in decisions that determine whether land will be devoted to farming, energy production, commercial development, or other uses, and that these decisions are consistent with local culture and interests and advance social equity. For irrigation, there are trade-offs between crop choices, yields, and irrigation methods that both determine requirements for energy and water and can have lasting effects on the life and livelihood of local farmers.

For biofuels, there is a necessary trade-off between food crops and energy crops, with water requirements in both cases, and the efficiency and social equity ramifications are different in different countries and localities, and must be transparently evaluated and discussed with the local community. Recommended actions in all three of these cases are to involve the local community in decisions and to provide detailed and transparent evaluations of the options for local decision-makers. Cooperation between ASEAN governments and non-governmental organizations in the development of data, models, and sustainability practices would be useful here.

Methodology

The methodology had five major components:

i) Pre-analysis — a wide range of data and reports were examined to build a strong knowledge base about approaches and barriers to food, energy, and water security in the ASEAN region.

ii) Participative Scenario Workshops — three two-day workshops were held, one each in Nakorn Pathom, Jakarta and Hanoi, between January and April 2013.

iii) A final Symposium on Oct. 1-2 in Bangkok, in which the findings of the project were presented, and the nexus between food, energy, and water and its implications for policy in the context of ASEAN 2015 were explored in detail, with senior representatives from the great majority of ASEAN nations, and with experts in food, energy, and water policy and management.

iv) A real-time Delphi survey of participants across the ASEAN region — on the basis of the findings of the three workshops, a Delphi instrument was constructed and distributed to a wide range of respondents across the ASEAN region.

v) An impact evaluation exercise which captured the perspectives and experiences of the participants at each meeting about the foresight processes used and their potential application.

Results

FEW scenarios applied two variables of actions and constraints to reflect the “effectiveness” or “ineffectiveness” of actions to promote

sustainability and resilience. With this scenario logic, four scenarios for each theme were developed in a two-by-two matrix manner.

1. A positive future was named "Smooth Sailing" by all three groups.
2. A future in which actions are effective, but constraints are too strong to be fully mitigated, was named "Navigating Tough Conditions" by the energy and food groups and "Navigating Difficult Waters" by the water group. These scenarios are not that desirable compared with "Smooth Sailing", but it still illustrated the positive efforts to minimize the effect of constraints, especially the impacts of climate change, by promoting sustainable and inclusive practices involving energy, water, and food. The water group saw it as the most likely outcome for ASEAN in the coming decade.
3. A difficult and most undesirable future in which the constraints are strong and actions are ineffective was named "Constraint Domination" by the energy group, while the water and food groups adopted names that were more descriptive of their sectors, "Disaster" and "Green Is Mean (Tough World)", respectively. All participants perceived this set of futures as an undesirable option to be avoided, but some expressed fears that some ASEAN countries may be unable to avert it unless effective policies are enacted and implemented quickly.
4. The fourth scenario, in which the constraints are weak and the actions are ineffective, was called "Future Is Past" by the energy group, because this future is one in which policies and actions in the future are the same as those of the past, with little effort to address constraints that turn out to be weak. The water and food groups called this scenario "Water Waste" and "Sinking Slowly", respectively, to reflect the negative impacts of continuing on this path. The water group argued that we are presently in this scenario and the most likely pathway if effective action is taken is to move diagonally to the "Navigating Difficult Waters" scenario.

The current and plausible future of ASEAN countries from this scenario logic was debated in all three workshops and in the final symposium. The outcome of these discussions was to confirm that the FEW nexus must be addressed holistically, because of the strong interrelations between the sectors and the potentially disastrous effects on each sector of independent activities in the other sectors.

Conclusions

The scenarios and results from a real-time Delphi survey have shown how the formidable challenges today, which will increase markedly in the future, will shape the directions of Southeast Asia's economic inclusiveness and eco-resilience. The results from the Delphi survey also reflect that awareness of the constraints, capacity, and costs of engaging with people at the Bottom of the Pyramid (BoP) and encouraging long-term sustainability are high, while availability of policies and capability to implement them are varied. National capacity building to enhance regional collaboration seems to be an inevitable pre-requisite toward these sustainable and resilient pathways. The findings also elaborate on how stakeholders differently respond to FEW issues. Many common goals can be achieved with robust feature pathways for the FEW nexus aim of upgrading technological capability and diffusion of knowledge for all benefiting groups. Under the AKI framework, there is a need to develop an innovation system for inclusive development and to build-up national capabilities to associate with other peers in Southeast Asia and beyond.

The focus groups in food, energy, and water, the real-time Delphi survey, and discussions all point toward several necessary features of the pathways leading to sustainable and resilient futures for ASEAN:

Governance: Improved governance that balances the use of resources for economic development with the needs of citizens and recognizes the opportunity costs associated with alternative uses of energy and water, including uses that support food production and distribution;

Holistic approach: The need for a holistic approach to the FEW nexus, recognizing that actions taken with respect to any one of these sectors will inevitably affect the others, and without careful evidence-based planning, are likely to be detrimental to one or more of them;

Community-based decision-making: The recognition that achieving inclusiveness and promoting social equity will require the development and implementation of effective practices for community-based decision-making, as well as local capacity building that involves outreach, education and training, and investment. In each workshop, local examples of inclusive innovation were described, most involving cooperative organizations or ecology/poverty action groups that were able to create innovative solutions to pressing problems linked to land allocation and use, introduce new crops or food markets to serve changing consumer tastes, or demand more effective local resources management, usually with the result being more efficient approaches to nexus issues as a whole.

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