Session

Socioeconomics, Policy, Marketing, Livelihood and ICTs in Fisheries

Theme

Fostering Livelihoods through ICTs excelsior: Future for Fisheries and Aquaculture

Dr. P. Krishnan
Director, BOBP-IGO
Chennai

Lead Presentation

Strengthening Science-Technology-Policy Interface for Effective Fisheries Management

BOBP
www.bobpigo.org

Strengthening Science-Technology-Policy Interface for Effective Fisheries Management

P. Krishnan and Rajdeep Mukherjee
Bay of Bengal Programme Inter-Governmental Organisation,
Chennai – 600 018

Krishnan, P and Rajdeep Mukherjee, 2022.
Strengthening Science-Technology-Policy
Interface for Effective Fisheries Management,
Paper presented in 12th IFAF. Organized by
AFSIB & TNJFU at Chennai during
5-7 May 2022, p.10.

Published by
BOBP-IGO, Chennai

Layout and design
BOBP Design Factory

Strengthening Science-Technology-Policy Interface for Effective Fisheries Management

ABSTRACT

Science, policy, and technology form the holy trinity of sustainable fisheries. Research and development, both from public and private sources, have contributed to the global progress. On the flip side, this has created a situation where research and knowledge generation has grown exponentially while knowledge assimilation remains linear, creating a gap in the science-policy interface. With global fisheries affected by multiple internal and external stressors bringing sustainability at the stake, a transition from the traditional top-down fisheries management to a modern ecosystem-based fisheries management would critically depend on bridging this gap. An effective policy should be based on available scientific evidence and should be under constant monitoring to deal with uncertainties. In this paper, we have stressed the need for strengthening the science-policy interface to meet the requirement for moving towards an ecosystem approach and the constraints in achieving the same. The scope of using information and communication technology (ICT) to streamline the science-policy interface is also discussed.

1. Introduction

The 1995 FAO Code of Conduct for Responsible Fisheries provides a clear direction that fisheries policies should be based on the best available scientific information. This position is further substantiated by growing uncertainties in the fisheries sector due to internal and external factors such as climate change. Another significant change that happened in the fisheries sector is the growing internationalization of the fisheries issues. We have more evidence now on the transboundary and connected nature of fisheries activities. Hence, although countries enjoy sovereignty in their territorial waters and sovereign rights in their exclusive economic zones (EEZ), they cannot unilaterally take fisheries positions that are at odds with global values and positions. Such a unilateral move may draw sanctions and penalties in the international market eroding any benefit from unilateral action. Internationalization implies that the fisheries management system should be evidence-based, responsible, and transparent. It has remolded the science-policy relationship in the fisheries production system from a unidirectional input-output system to the input-output-input feedback loop.

Science, policy, and technology have a co-evolutionary symbiotic relationship. *Science* explores new knowledge methodically through observation and experimentation, while *technology* is the application of scientific knowledge for various purposes. In a true sense, technology is the ultimate outcome, which satiates the needs of the society, wherein the knowledge generated through science is a prerequisite. A recent macroeconomic example of the successful triangulation of science, technology, and policy relationship is obviously the management of the Covid-19 pandemic, wherein – the 'science' aided in understanding the virus and characterizing the receptors, vaccines developed were the 'technologies', and facilitating medical research, global cooperation, managing supply chain, etc., were in the '*policy*' domain.

Scientists and policymakers across the world have a complex interface when it comes to making decisions based on data and evidence. The researchers wish that their science should drive the policy and the policymakers on the other hand know well that their decisions need to be rooted on evidence to be successful, which emanates through a structured enquiry. Despite this seemingly simplistic positive interface between the scientists and policymakers, the outcome of the interactions indicates more scope for further strengthening. One fundamental element in strengthening the interface is that the scientists and policymakers must appreciate the roles and expectations of the other side.

2. Science-Policy Interface in the Marine Fisheries Sector

The new fish variety/breed and packages of practices concerning aquafarming to fish processing across the value chain of fisheries represent the 'technologies'. Each of these technologies was developed by integrating various elements of knowledge generated through scientific enquiry and the same were eventually transferred to the end-users through various support schemes by the policymakers.

In the case of marine fisheries, one such example is the identification of an agreed period for closure of the fisheries (seasonal ban) in India. Owing to the fisheries' multiverse, identifying a common period was challenging. This was achieved through the development of multi-species breeding behavior models which were then used to negotiate amongst the stakeholders and arrive at a solution acceptable to the majority of fishers. Scientists also enjoy a positive social perception and are considered impartial, which can catalyze social negotiations in case of difficult choices (e.g., creation of an MPA).

The Potential Fishing Zone (PFZ) advisories represent a case of a happy marriage between science and technology in the marine fisheries sector. The basic knowledge generated by the ecologists, biologists, oceanographers, modelers, and remote sensing and spatial experts from across the world contributed to the development of a steady stream of automated advisory to the fishers as PFZ technology.

3. Nuances of the Science-Policy Interface

Our ability to gather, analyze, and use information regarding fish stocks, the natural systems of which they are a part, and the external factors that affect them have changed dramatically over the last few decades. It is frequently stated that incorporating this knowledge into the construction of fisheries management plans would contribute to the sustainable use of marine resources. However, relative to the rate at which new knowledge is accumulated, the assimilation of new knowledge into such systems has been slow. We look at some of the obstacles that can stymie the adoption of new knowledge, in terms of both in generating official scientific advice and of using that advice to implement fishery management measures based on the analysis as carried out by Cvitanovicr, et al., 2015:

(a) *Institutional barriers*: Absence of an institutional mechanism constraints the regular engagement of policymakers and scientists. Furthermore, the metrics of career progression defined by the organizations influence the priorities of the scientists.

(b) *Science in-accessibility*: The time gap between the data collection and its publication in a peer-reviewed research article, at times, makes the very inference irrelevant to the decision-makers in the changed circumstances. The need for a subscription to access the scientific contents compounds the issues of access to knowledge to decision-makers, which is a major obstacle to science's integration into decision-making.

(c) *Knowledge exchange channels*: The transfer of knowledge in linear and unidirectional knowledge transfer processes, using traditional means of communication, not factoring the recognition of the diversity of social situations among end-users and the plurality of actors involved, prevents the information from entering the decision-making process.

In this context, there is a need to appreciate the characteristics of the policy-making domain contrasting with that of the researchers.

Policymaking process is complex: Scientific results are process-driven and objective, while the decision-making is most often subjective balancing and competing for political and societal goals. This makes it imperative for the scientists to expand their channels of communication to strengthen their communication with the other stakeholders to create wider acceptance of the specific policy change, which has its roots in science.

Spatial scope: The policymakers operate within their defined spatial and technical jurisdiction, while the scientists do not. This provides an immense opportunity for the scientists to engage with various other researchers beyond the frontiers, validate their findings, and provide the best knowledge for the given spatial scope essentially matching with the interest of the policymaker.

Diverse sources of evidence available for policy makers: Studies have shown that personal knowledge and experience as well as secondary sources that are different from the scientific evidence most often guide the decision-makers, which could compromise the effectiveness of their decisions. When the policymakers look for guidance for their decisions, there are multiple sources of knowledge, which are largely grouped into three categories as under:

(a) Independent Knowledge Generators: There are independent think tanks that generate knowledge of all shades and put it in the public domain for the potential users to pick and use; The academic institutions, universities, and Centres of Excellence which are in pursuit of pure knowledge or blue-sky research would fall under this category. This would also include independent researchers, NGOs, and private think tanks.

(b) State-funded National Laboratories: They are largely in the 'pursuit of actionable knowledge' or agenda-based research; they undertake strategic research and generate/synthesize knowledge to directly influence state action.

(c) Expert Opinion: The most often relied source for evidence by the policymakers for their decisions is '*expert opinion*'- which could be an individual or a group of individuals/institutions. This option is resorted to when there is no prior established knowledge and the decisions are required to be taken based on available knowledge, particularly in situations when there are multiple shades of possible solutions.

4. Strengthening Science-Policy-Technology Interface

4.1 General Strategies

It is worth noting that, after a few repeated interactions without a successful outcome, a policymaker would shift to readily available 'expert knowledge', even if it is not rigorous. As this gap would increase over time, there is a greater onus among the scientists to strengthen the science-policy interface, through conscious efforts.

(a) Nothing succeeds like success: The scientists and policymakers need to develop joint impact studies and success stories on instances of collaborative evidence-based decision making so that the partnerships would be strengthened. A Case Study on the economic, social, and ecological impact of fisheries regulation (*e.g.*, mesh size regulation) by the state based on scientific inputs from an organization, would incentivize occasions of partnerships.

(b) Deliver in time: The research results would have value only when delivered in time, for it to influence policies. The time frame fixed for a scientific enquiry is mostly for the process and experimental design and not for the outcome, which will invariably be uncertain. It is worth noting that policy decisions are taken based on the best available knowledge at a given point of time, while the need for continuous enquiry is not undermined. The outputs in the form of peer-reviewed publications and the interim decision-related scientific inputs shall be shared as a discussion document, and piloting the decision may be needed on a limited scale to decide the effectiveness of the knowledge provided.

(c) Focussed input: The scientists generate knowledge and draw inferences based on observations and experiments. However, the data/observations which form the base for the inferences are only as good as the methods through which they are collected. Further, the data collected through the best methods would not mean the same to all scientists.

Thus, it is incumbent upon the scientists to consider all available knowledge from all sources and provide the 'single best option' for an issue at a given time, with necessary riders, as applicable, to aid in effective evidence-based policymaking.

(D) Deliver in the readily usable format: The researchers shall endeavor to provide accurate and reliable information in a readily usable format to suit the needs of the policymakers. Many of the data generated through application research can be operationalized by effectively leveraging geospatial tools and information and communication technology (ICT), including artificial intelligence and the internet of things.

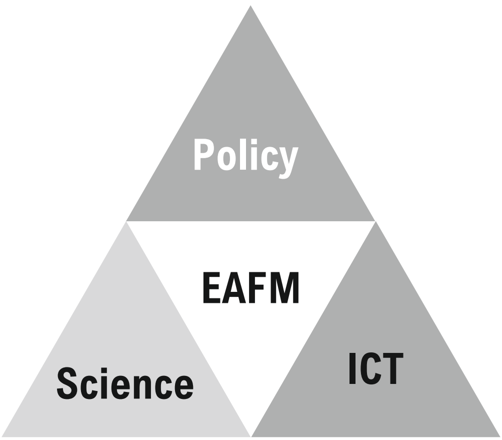
4.2 EFAM as a Tool for enhancing Science-Technology-Policy trinity

In recent years, the ecosystem approach to fisheries management has emerged as the desirable governance framework to deal with sustainability issues in fisheries. EAFM draws its strength from landmark international instruments such as the 1995 FAO Code of

Conduct for Responsible Fisheries and Convention on Biological Diversity. In terms of implementation, EAFM offers a systematic procedure that ensures the interplay of science-policy and technology to arrive at the best possible solutions.

The EAFM process usually involves four overall stages: (i) developing a clear description of what is to be managed and/or assessed; (ii) identifying all the issues that need to be assessed across all components; (iii) determining, using risk analysis, which of these issues needs to be managed directly; and (iv) establishing the levels of measures that are acceptable, the management arrangements that will be used to achieve these levels, and the review processes needed to assess measures for those issues requiring management. The EAFM does not replace the traditional fisheries management system but improves it through integrating informed decision-making and evaluation at every step of implementation.

While fisheries research programmes in the region and elsewhere in the world do contribute to addressing specific gaps, a cohesive framework is not available to link research and broad policy objectives. EAFM in this regard, provides an institutional mechanism to regularize conversation amongst the trio, viz., researchers, technologists and policy makers. A schematic diagram showing the interaction is shown below:



Science and ICT provide the grounding for EAFM while policy provides the necessary support and direction. EAFM is a bottom-up approach. Therefore, it is a prerequisite that science and ICT are remodeled to reach the masses, namely the fishers and other stakeholders. However, this cannot be achieved overnight. EAFM starts with the capacity enhancement of the scientists to enable them to communicate in a different situation from a rural setting to the highest level of urban-centric policymaking. Scientists then, in turn, help other stakeholders to build their capacity and in the process develop a shared language and goal.

EAFM also provides clear direction on research needs and evaluation, which helps the policymakers to contextualize the knowledge when it is made available and appreciate its value within the system.

The use of ICT and various ICT tools such as big data analytics, data mining, digests, data-based storytelling, dashboard, and key performance indicators can play the role of an effective facilitator here. Machine learning can help scientists to automate much of their analytical information, what is otherwise, their research data or field observations, for better communication. The readily convertible translational tools provide for near-real-time translation of available knowledge into multiple vernacular languages, thus enabling their use by all stakeholders. At the same time, space technology also can be used for monitoring and predictive modelling to support policy decisions.

The following lessons can be drawn from global experience in EAFM:

1. Exposing scientists to the grassroots problems including problems in adapting 'scientific solutions'.
2. Understand the communication channel among scientists, policymakers, and other users including its diversity and inadequacy.
3. Building the capacity of scientists to communicate in a fractural system by banking on their technical expertise while appreciating traditional and system knowledge.
4. Building customized solutions for different stakeholders.
5. Contextualize research to address observable problems and thus gain the attention of the policymakers.
6. Engaging with stakeholders at every stage of research and thus alienating the technical barrier.

4.3 Using ICT to enhance the reach of science

An emerging aspect of the internationalization of fisheries is the innovative use of ICT to enhance science outreach. All stakeholders have strived to leverage the use of ICT with varying degrees of success. While at the macro level, ICT has been in use in diverse sectors, their diverse utility is gaining ground in the fisheries sector as well.

FishBase, as the most comprehensive repository of fisheries information, exemplified the use of ICT in fisheries in the global scale. It still remains the largest and most extensively accessed and cited online fisheries database on the web. SeaAroundUs (www.seaaroundus.org) which reports reconstructed fisheries data along with various sustainability indicators, is another successful demonstration on the use of ICT in scale. Other such examples are Ocean Health Index, IUU Fishing Index, etc.

Apart from the direct use of ICT in production technology, more innovative uses of ICT can aid the scientists in leveraging to reach multiple stakeholders at the same time. At the international level, FAO has developed several models for fisheries management and for science communication using ICT.

5. Conclusion

Fisheries is a sunrise sector in the region that significantly contributes to the states' economies, food, and nutritional security and ensuring gender balance, which generates millions of livelihoods in the process. To usher in the blue revolution, creating a conducive framework for knowledge exchange and technology diffusion is a necessary condition. However, at the same time, it is necessary to provide a focused direction to science and technology development so that they are in tune with the sustainable development goals and thus create a self-reinforcing mechanism to ensure achievements.

Global experience shows that while science and policy are great enablers, they have been also responsible for accentuating inequality and distorting distribution. The role of the policy is considerable in this context. The policy should provide a framework for science and technology integration so that they can contribute to the development of the masses than just a few.

Works Consulted/ Suggested Reading

Cvitanovic, Christopher, et al. "Improving knowledge exchange among scientists and decision-makers to facilitate the adaptive governance of marine resources: a review of knowledge and research needs." *Ocean & Coastal Management* 112 (2015): 25-35. https://www.sciencedirect.com/science/article/pii/S0964569115001167

Frost, Matthew, et al. "Reporting marine climate change impacts: Lessons from the science-policy interface." *Environmental Science & Policy* 78 (2017): 114-120. https://www.sciencedirect.com/science/article/pii/S1462901117307979

Mabey, Christopher, and Shasha Zhao. "Managing five paradoxes of knowledge exchange in networked organizations: new priorities for HRM?. "*Human Resource Management Journal* 27.1 (2017): 39-57.

Nthane, Tsele T., et al. "Toward sustainability of South African small-scale fisheries leveraging ICT transformation pathways." *Sustainability* 12.2 (2020): 743.

Saville, Ramadhona, Katsumori Hatanaka, and Masaaki Wada. "ICT application of real-time monitoring and estimation system for set-net fishery." *OCEANS 2015-MTS/IEEE Washington*. IEEE, 2015.

Spaey, Jacques, and Jacques Defay. *Science for Development: An essay on the origin and organization of national science policies*. UNESCO, 1971. https://unesdoc.unesco.org/ark:/48223/pf0000000740.locale=en

Vimala, D. Deboral, and T. Ravisankar. "Fisher Friend Mobile Application-An Innovative and Promising ICT Tool in Fisheries e-Extension." (2012).

BOBP

www.bobpigo.org