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Effectiveness of Institutional Arrangements for Delivery of Potential Fishing Zone and Ocean State Forecast Advisory Services to Fishers in Tamil Nadu

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Abstract

For the welfare of fishers, the Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, generates three major information services, namely Potential Fishing Zone (PFZ) advisories, Ocean State Forecast (OSF) advisories, and Species-specific advisories — Tuna Fishery Forecast System (TUFFS). In this paper, the effectiveness of various institutional arrangements has been studied at the grassroots level for the provision of advisory services of INCOIS to fishers in terms of generating awareness, and ensuring regular access and usage among the fishers of Tamil Nadu. The study has revealed that among the institutional arrangements, government organisations (DOF)-led initiatives are less effective but more sustainable, whereas non-governmental organisations (NGOs)-led initiatives are more effective but less sustainable, as they critically depend on the external funding support. Awareness on and usage of OSF and PFZ advisories are positively correlated with the level of education. The usage of PFZ advisory is negatively correlated with the type of craft owned, whereas a lower level of usage is associated among the mechanized fishers. The presence of service providers as well as its frequency of service delivery have been found to be the most important factors with respect to awareness on and usage of PFZ advisory services. The study has inferred that measures like effective public-private partnership, validating and integrating local needs through community participation, and usage of most effective ICT tools like mobile phones will further strengthen the institutional arrangements and ensure effective service delivery in this area.

Key words: Potential fishing zone, ocean state forecast, institutional arrangements, fisheries, fishers, Tamil Nadu

JEL Classification: O30, O32, O33, Q22

Introduction

The interface between knowledge seekers (farmers and fishers) and knowledge creators (R&D system) continues to be the critical parameter in bridging the ever elusive yield and development gaps in India. Among the various limitations of public extension

system in the fisheries sector (as documented in Dilip Kumar and Ananthan, 2009; Ramachandran, 2005), the following two are very critical. Firstly, it has remained as desk-oriented, regulation-centric, bureaucratic system providing subsidies instead of a field-oriented, service-centric, professional extension system aiding development process. Secondly, it has failed to forge institutional linkages with Community Based Organisations (CBOs) and grassroots NGOs and harness their comparative advantages to deliver support

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Table 1. Profile of major institutions providing PFZ and OSF advisory services in Tamil Nadu

Institutional type	Non-governmental organisations (NGOs)			Government organisation (GO)
Name of the service provider	MS Swaminathan Research Foundation (MSSRF)	Pondicherry Multipurpose Social Services Society (PMSSS)		Tamil Nadu State Fisheries Department (DOF)
Initiatives to disseminate INCOIS services	Village Resource Centre (VRC)/Village Knowledge Centre (VKC)	Fisher Friend Mobile Advisory (FFMA)	VRC/VKC/VIC	Disaster Management Cell
Current status	Active	Active	Only VRC is active	Active
Full- fledged service since	2005	2007	2005	2005
Area coverage	6 coastal districts through 4 active coastal VRCs (Nagapattinam, Poompuhar, Thangachimadam and Nagercoil)		Cuddalore district	Entire Tamil Nadu state

services effectively, especially given the depleted human resources in State Fisheries Department. In the capture-based marine fisheries sub-sector characterized by open access common property regime, excessive fishing capacity and over-exploitation and increasing conflict between small-scale and large-scale fishers, the role of public extension is both complex and crucial. Among others, this scenario calls for innovations in the institutional arrangements not just to deliver the services more effectively but also to guide a more responsible and equitable development of marine fisheries.

Till recently, fishing was done primarily based on fishers' shared indigenous knowledge that was being transmitted through generations about the location of fishing grounds, ocean currents and wind pattern, life history of fish species, etc. The advent of remote sensing satellites and their ability to map ocean's surface temperature and chlorophyll content have helped in identifying the Potential Fishing Zones (PFZs) in terms of latitudes and longitudes all along the Indian coast. This heralded a major departure in the way fishing is done by arming the fisher with more precise information to locate the fish. However, several challenges remain with respect to awareness, access, usage and utility of this crucial piece of information by fishers, and in finding an appropriate institutional mechanism to provide the information effectively.

Institutional Arrangements for Delivery of PFZ and OSF Advisories

The Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, generates three major information services, for the welfare of fishers, namely Potential Fishing Zone (PFZ) advisories, Ocean State Forecast (OSF) advisories, and Species-specific advisories — Tuna Fishery Forecast System (TUFFS). The INCOIS began providing the PFZ and OSF advisories to fishers from the beginning of 2005. With advances in both technology and research, the quality of information being generated and the way in which it is disseminated (i.e. institutional arrangements) to the fishers across the coastal states have improved.

By both design and choice, INCOIS does not disseminate its information advisories directly to the beneficiaries. Instead it has tied up with various agencies / institutions in both public and private domains, namely State Fisheries Departments, universities/institutions in the coastal regions, reputed non-governmental organisations (NGOs), and even Fishermen Co-operative Societies (FCS).

These institutions (Table 1), in turn, disseminate the advisories through different modes (Table 2), involving innovative use of Information and Communication Technology (ICT) tools. The present study was an exercise to understand the effectiveness

Table 2. Different modes of dissemination of INCOIS advisory services

PFZ advisory and OSF advisory services	TUFFS
<ul style="list-style-type: none"> • Through Electronic Display Boards (EDB) installed at major fishing harbours • By fax to State Fisheries Department, NGOs and R&D institutes, and then by word of mouth to fishers • Means of web and email to all the major stakeholders in the ocean sector (especially OSF) • Numeric data is provided to registered users through the web-GIS (Geographical Information System) of the INCOIS site • Forecast for a specified region and time can be emailed to the user on request • Through information kiosks (VRC, VKC, VIC) of NGOs, All India Radio, FM radio, NGO websites and TV channels in local languages • Through State Fisheries Department, NGOs and R&D institutes 	<ul style="list-style-type: none"> • Sent via email to the registered users (mainly large vessel owners – tuna long liners)

of various institutional arrangements at the grassroots level for the provision of INCOIS' PFZ and OSF advisory services to fishers in terms of creating greater awareness, and ensuring regular access and usage among fishers in Tamil Nadu.

Methodology

The study was conducted in Tamil Nadu considering its early adoption of INCOIS advisories, higher penetration level of ICT tools among public, its relatively high contribution in marine fisheries, and higher concentration of fishers and fishing crafts. A three-level multi-stage sampling technique was adopted for the selection of respondents. In the first stage, three districts were selected based on the total fish landings, fisher population, fishing crafts and equal distance from each other covering the entire stretch. In the second stage, the largest landing centre/fishing harbour in each district (namely Chennai, Cuddalore and Nagapattinam) was selected. The third stage was characterized by the random sampling of 40 respondents from each selected fishing harbour (totalling 120), while ensuring equal distribution of mechanized (large scale, 60) and motorized (small scale, 60) fishers in the sample. Pre-tested structured interview schedule was used to collect the primary data. The requisite data from institutions (service providers) present in each district were collected through a semi-structured interview schedule. In addition to percentage analysis, the Kruskal Wallis test and Spearman's Rank Correlation were used to draw inferences and answer research questions.

Presence of PFZ and OSF Advisory Services Providers

The names of INCOIS advisory services providers to the fishers in north Tamil Nadu are listed in Table 3. In Chennai, only the State Department of Fisheries (DOF) provides these services to fishers, as there is no any active NGO intervention. In Cuddalore, apart from DOF, active intervention is carried out by the Village Resource Centre (VRC). It was established by the Pondicherry Multipurpose Social Service Society [PMSSS] which is a registered social service agency of the Archdiocese of Pondicherry and Cuddalore in collaboration with Indian Space Research Organisation (ISRO). Headquartered in the heart of Pondicherry, PMSSS has been shaping the socio-economic destiny of numerous people, especially fishers in the union territories of Pondicherry and Karaikal and the districts of Cuddalore and Viluppuram in the state of Tamil Nadu for the past 32 years.

In Nagapattinam, apart from DOF, these advisory services are provided by Village Resource Centre (VRC) established by M S Swaminathan Research Foundation (MSSRF), which is a non-profit research organization, in collaboration with ISRO. MSSRF-VRC is very actively disseminating the INCOIS advisory services through implementation of the innovative project, "The Fisher Friend Mobile Advisory (FFMA) project", which was designed by MSSRF to integrate mobile technology for a quicker and easier flow of such information to the fishers in Tamil Nadu and Pondicherry. The t-test indicated that the presence of INCOIS advisory services among the respondents differed significantly across the locales and the type of craft owned (Table 4).

Table 3. PFZ and OSF advisory services providers to fishers in the study locales in Tamil Nadu

INCOIS services	PFZ and OSF advisory services providers to fishers (n=120)		
	Chennai (n ₁ =40)	Cuddalore (n ₂ =40)	Nagapattinam (n ₃ =40)
Potential Fishing Zone (PFZ) advisories	DOF [^]	NGO* (PMSSS~) and DOF	NGO(MSSRF#) and DOF
Ocean State Forecast (OSF) advisories	DOF	NGO (PMSSS) and DOF	NGO(MSSRF) and DOF

Note: [^]DOF = Tamil Nadu State Department of Fisheries; *NGO = Non-governmental organisation; # MSSRF = M S Swaminathan Research Foundation; ~PMSSS = Pondicherry Multipurpose Social Service Society

Table 4. Difference in presence of INCOIS advisory service providers with respect to locales and craft type

Service provider	Locale/type of craft owned	Mean rank	Asymptotic significance (P)
Locale			
INCOIS advisory service providers	Chennai	20.50	0.000
	Cuddalore	60.50	
	Nagapattinam	100.50	
Type of craft owned			
INCOIS advisory service providers	Motorized fibre-reinforced plastic (FRP) catamarans	20.50	0.000
	Motorized FRP Vallams	80.50	
	Mechanized fishing boats (MFB) of <15 m length	60.50	

Note: The total sample of 120 is represented by 20 FRP, catamaran, 40 FRP Vallam, 60 MFB(<15m)

Frequency of Service Delivery

As the INCOIS itself does not generate PFZ advisories on all the days of a week (they are unavailable on cloudy days due to technological limitations), its availability has been rated as 'occasional' by all the respondents in locales where NGOs were operational and as 'rarely' in Chennai where only DoF is present. However, INCOIS provides OSF advisories regularly on a daily basis. But, its frequency of availability was found to vary across districts based on the type of service provider. While the fishers have rated the availability of OSF advisories through DOF as 'occasional' (100%) in all three locales, especially in the form of Cyclone / Tsunami alerts, they have rated its availability through NGOs as 'regular'. Table 5 details the frequency of service delivery by institutions in the study area.

In Cuddalore, regular (100%) service of OSF advisory is provided by PMSSS through its tie-up with Hello FM, Pondicherry and INCOIS. The OSF advisory

is broadcasted nearly 2-3 times daily through the FM radio. In Nagapattinam, it was observed that fishers who are registered with MSSRF-VRC, received regular (47.5%) updates of OSF advisory through its FFMA project, whereas the remaining (52.5%) received occasional service through contact/friendship of the beneficiaries and volunteers/staffs of MSSRF-VRC. The t-test (Table 6) indicated that the frequency of services from INCOIS advisory services among the respondents differed significantly across the locales and the type of craft owned.

Awareness and Usage of PFZ and OSF Advisory Services among Fishers in North Tamil Nadu

The level of awareness about INCOIS advisory services among fishers in the study area has been depicted in Table 7. All the fishers were aware about both PFZ and OSF advisories but their level of awareness varied with sector and locale. Comparatively, fishers of Nagapattinam (65%) had

Table 5. Frequency of service delivery from the service providers

INCOIS services providers	Frequency of service delivery from the service providers (n=120)		
Potential Fishing Zone (PFZ) advisories	Chennai (n ₁ =40)	Cuddalore (n ₂ =40)	Nagapattinam (n ₃ =40)
State Department of Fisheries (DOF)	Rarely	Occasional	Occasional
Non-governmental organisations (NGO)	#	Occasional	Occasional
Ocean State Forecast (OSF)			
State Department of Fisheries (DOF)	Occasional	Occasional	Occasional
Non-governmental organisations (NGO)	#	Regular	Regular (47.5)^ Occasional (52.5)

Note: ^Regular service is received by the fishers who are in regular contact with the NGOs by enrolling themselves for SMS / Voice mail from the respective NGOs; # No NGO provides INCOIS advisory services in Chennai; Figures within the parentheses refer to percentage and no mention of figure means 100 per cent.

Table 6. Differences in frequency of service delivery with respect to service providers and craft type

Frequency of service	Service providers/Type of craft (owned)	Mean rank	Asymptotic significance(P)
	Service providers		
Frequency of service	DOF/Chennai	20.50	0.000
	PMSSS/Cuddalore	80.50	
	MSSRF/Nagapattinam	80.50	
	Type of craft (owned)		
Frequency of service	Motorized Fibre-reinforced plastic (FRP) catamarans	20.50	0.000
	Motorized FRP Vallams	80.50	
	Mechanized fishing boats(MFB) of <15 m length	60.50	

Note: The total sample of 120 is represented by 20 FRP catamaran, 40 FRP Vallam, 60 MFB(<15m)

higher awareness about the PFZ advisory service than the Cuddalore (42.5%) and Chennai (30%) fishers. Such a scenario may be attributed to the presence of MSSRF in Nagapattinam and active implementation of its FFMA project, under which they disseminate potential fishing zone, whereas in the case of Cuddalore, the main focus of PMSSS-INCOIS-Hello FM tie-up is on disseminating OSF, giving less importance to occasionally received PFZ advisory.

These are the main reasons for difference in the high awareness about INCOIS advisory services between Cuddalore and Nagapattinam. In the case of awareness about Ocean State Forecast (OSF) advisory, fishers of Cuddalore (100%) had higher awareness than the Nagapattinam (70%) and Chennai (20%) fishers had. It was because apart from PMSSS intervention in Cuddalore through its Village Resource Centre (VRC), dissemination of OSF advisory is broadcasted daily 2-3 times through Hello FM, Pondicherry.

Apart from DOF, there is no exclusive INCOIS advisory service provider to the Chennai fishers, even then high awareness was noted among them, which reveals the fishers own interest to know about these services, especially among the mechanized boat owners of Chennai who were more aware about PFZ (40%) compared to motorized boat owners. The level of awareness about OSF services, was found same among motorized and mechanized boat owners (20% -highly aware, 80% -aware). The t-test (Table 8) indicated that awareness about PFZ and OSF advisories among the respondents differed significantly across the locales and the type of craft owned.

Usage of PFZ and OSF Advisory Services among Fishers

The study on the usage of INCOIS advisory services among fishers in the north Tamil Nadu revealed that irrespective of the fishing sector and

Table 7. Awareness about PFZ and OSF advisory services

INCOIS advisory	ServicesAwareness about PFZ and OSF advisory services among fishers (n = 120)	
	Highly aware	Aware
Potential Fishing Zone (PFZ)	✓ (45.84%)*	✓ (54.16%)*
Ocean State Forecast (OSF)	✓ (63.34%)*	✓ (36.66%)*

Note: * High awareness about the both services is seen among the fishers of Nagapattinam fishing harbour

Table 8. Differences in awareness levels of OSF and PFZ advisories with respect to service providers and craft type

Awareness	Service providers/Type of craft (owned)	Mean rank	Asymptotic Significance(P)
	Service providers		
Awareness about OSF advisory	DOF/Chennai	34.50	0.000
	PMSSS/Cuddalore	82.50	
	MSSRF/Nagapattinam	64.50	
Awareness about PFZ advisory	DOF/Chennai	50.50	0.007
	PMSSS/Cuddalore	59.50	
	MSSRF/Nagapattinam	71.50	
	Type of craft (owned)		
Awareness about OSF advisory	Motorized FRP catamaran	34.50	0.000
	Motorized FRP Vallams	72.00	
	Mechanized Fishing Boats (<15 m length)	61.50	
Awareness about PFZ advisory	Motorized FRP catamaran	44.50	0.032
	Motorized FRP Vallams	62.50	
	Mechanized Fishing Boats (<15 m length)	64.50	

locale, there was regular usage of OSF advisory service by all the respondents, as it has the maximum potential to influence the fishers' decision to venture into the sea.

In the case of usage of PFZ advisory, only occasional usage (32.5%) was seen, as the advisory service itself was occasional. INCOIS had plans to provide the service on every Monday, Wednesday and Friday in a week which is not possible many times due to factors like cloud cover over the area. Around 67.5 per cent of the study population do not use the PFZ advisory. The usage of PFZ advisory was found more among motorized boat owners (55%) than mechanized boat owners (10%). The difference in usage pattern of these two advisories reveals the fact that OSF service is more needed for fishers than the PFZ advisory.

The t-test (Table 9) indicated that the usage of OSF advisory among the respondents did not differ significantly across the locales and type of craft owned, whereas the usage of PFZ advisory differed significantly only across the type of craft owned.

Relationship among Educational Level, Fishing Experience and Type of Craft Owned with Awareness and Usage of PFZ and OSF Advisories

In the sample population, 33.3 per cent were non-literates, 44.2 per cent had primary schooling and 22.5 per cent had secondary schooling. The average years of schooling of motorized boat owners (4.05 years) were found higher than of mechanized boat owners (2.58 years), while fishers from Nagapattinam district had the highest average years of schooling (3.45 years)

Table 9. Difference in usage of OSF and PFZ advisories with respect to service providers and craft type

Advisory	Service providers/Type of craft (owned)	Mean rank	Asymptotic significance(P)
	Service providers		
Usage of OSF advisory	DOF/Chennai	60.50	1.000
	PMSSS/Cuddalore	60.50	
	MSSRF/Nagapattinam	60.50	
Usage of PFZ advisory	DOF/Chennai	55.35	0.274
	PMSSS/Cuddalore	60.52	
	MSSRF/Nagapattinam	65.50	
	Type of craft (owned)		
Usage of OSF advisory	Motorized FRP catamaran	60.50	1.000
	Motorized FRP Vallams	60.50	
	Mechanized Fishing Boats (<15 length)	60.50	
Usage of PFZ advisory	Motorized FRP catamaran	59.50	0.000
	Motorized FRP Vallams	82.00	
	Mechanized Fishing Boats (<15 length)	46.50	

as compared to other districts. Statistically, education had a significant and positive correlation (Table 10) with awareness about OSF and PFZ advisories, usage of PFZ advisories, and usage of ICT tools to access OSF and PFZ advisories.

In the sample population, 53.3 per cent had more than 20 years of fishing experience, while 45.9 per cent had 10-20 years of experience. Comparatively, the boat owners of Chennai (72.5%) had a longer fishing experience with average fishing experience of 23.83 years than the boat owners of Cuddalore (42.5%) and Nagapattinam (45%) with average fishing experience of 21.88 years and 21.68 years, respectively. The less-experienced respondents (5%) were seen only among the mechanized boat owners of Chennai.

Awareness as well as usage of OSF and PFZ advisories were positively correlated with level of

education, whereas higher level of education was associated with higher awareness levels. On the other hand, a negative correlation between advisory services and experience indicated that awareness and usage levels were lower among the more experienced (i.e. more elderly) fishers. The usage of PFZ advisory was negatively correlated with the type of craft owned, whereas the lower level of usage was associated among the mechanized fishers (as PFZ advisory is mainly relevant to identification of pelagic fisheries resources, which is the main target of motorized fishers).

Relationship among Service Providers, Frequency of Service Delivery with Awareness and Usage of PFZ and OSF Advisories

The relationship among type of service providers, frequency of service delivery and locales with awareness and usage of INCOIS advisories has been

Table 10. Relationship among education, fishing experience and type of craft owned with awareness and usage of PFZ and OSF advisories

Particulars	Education	Fishing experience	Type of craft owned
Awareness about OSF advisory	0.373**	-0.461**	NS
Awareness about PFZ advisory	0.682**	-0.531**	NS
Usage of OSF advisory	NS	NS	NS
Usage of PFZ advisory	0.423**	-0.289**	-0.408**

Note: **Significant at one per cent level; NS – Non-significant

Table 11. Relationship among service providers and frequency of service delivery with awareness and usage of INCOIS advisories

Particulars	Service providers	Frequency of service delivery
Awareness about OSF advisory	0.483**	0.636**
Awareness about PFZ advisory	0.282**	0.236**
Usage of PFZ advisory	NS	NS
Usage of OSF advisory	NS	NS

Note:**- Significant at one per cent level; *- Significant at five per cent level; NS- Non significant

depicted in Table 11. At 5 percent level of significance, service providers and frequency of service delivery were positively and significantly correlated with awareness about OSF and PFZ advisories. The correlation values indicated that both service providers and frequency of their service delivery had a major role with respect to awareness of PFZ and OSF advisories, whereas usage of these advisory services remained insignificant.

Conclusions

The study has revealed that among the institutional arrangements for delivery of INCOIS advisory services to the fishers, government organisations (DOF)-led initiatives have been found less effective but more sustainable, whereas non-governmental organisations (NGO)-led initiatives have been found more effective but less sustainable, as they critically depend on external funding support. The presence of service providers as well as the frequency of their service delivery have been found to be the most important factors with respect to awareness and usage of PFZ advisory services. Based on the inferences drawn from the study, there is no doubt that effective public-private partnership, validating and integrating local needs through community participation, usage of most effective ICT tools like mobile phones, etc. will

further strengthen the institutional arrangements and will ensure effective service delivery.

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Appendix-1**Explanatory Background Note****INCOIS Advisory Services**

The three INCOIS advisory services are briefly described below:

(1) Potential Fishing Zone Advisory

The commissioning of satellite OCEANSAT in 1999, which provides the real-time pictures of ocean colour (chlorophyll-A) along with Sea Surface Temperature (SST) has helped the organisation in identifying the Potential Fishing Zone (PFZ), which was one of the main pre-requisites for economical fishing activity. The multi-lingual PFZ Advisories are generated and disseminated by INCOIS on every Monday, Wednesday and Friday to about 500 fish landing centres / fishing villages, covering the entire coast line of India under 12 sectors, viz. Gujarat, Maharashtra, Karnataka & Goa, Kerala, South Tamil Nadu, North Tamil Nadu, South Andhra Pradesh, North Andhra Pradesh, Orissa & West Bengal, Lakshadweep Islands, Andaman and Nicobar Islands. The PFZ advisories are being disseminated to 26 and 36 landing centres in the North and South Tamil Nadu, respectively.

The PFZ advisories are generated for the use of artisanal, motorized and small mechanized sector fishermen engaged in pelagic fishing activities such as ring seining, gill netting, etc., to help them in reducing the searching time which in turn results in the saving of valuable fuel oil and also human effort.

(2) Ocean State Forecast (OSF) Advisory

INCOIS has brought out a novel integrated Indian Ocean Forecasting System (INDOFOS), which is capable of predicting the surface and subsurface features of the Indian Ocean well in advance. At present, INCOIS is providing Ocean State Forecasts on wave height and direction, sea surface currents, sea surface temperature, mixed layer depth, depth of the 20 degree isotherm (as a measure of thermocline). The forecasts are generated by a suit of state-of-the art numerical models, which are customized to simulate and predict the Indian Ocean features realistically.

(3) Species-Specific Advisories

As there was no specialized fishing fleet in India for tuna harvesting, the Marine Products Exports and Development Authority (MPEDA) has started implementing a scheme for assisting the conversion of existing fishing vessels to tuna long liners for augmenting production of oceanic tuna since 2006. However, there is lack of skilled skippers for identifying the tuna abundances in the ocean. The industry and MPEDA have requested INCOIS to develop a forecast system on similar lines to the PFZ Advisory Services exclusively for tuna fisheries named as Tuna Fishery Forecast System (TUFFS).