Communicating scientific knowledge to actors: how do indicators respond to stakes in relation to the development of the fishery sector in the Guinea Republic?

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Abstract: This paper is concerned with the development of the fishery sector in Guinea. The well-targeted purpose was to provide stakeholders with adequate knowledge items favouring their self-determination of a sustainable sector structure. The approach was to identify and implement an appropriate organisation to transfer knowledge resulting from research, in order to contribute to the development of a common information platform used as an effective basis for a multiparty exchange. Reliable communication methods and components were determined and related to information content, nature, medium, channels and targets with a particular focus on the required diversification of information restoration media and channels. Generally, information appears most efficiently communicated by combining various types of information, set out in different manners according to the various target populations. This approach results in a global communication process where indicators, as quantified and synthetic information, are considered by users as one, among other types, of information release.

Keywords: action research; communication process; fishery industry; Guinea Republic; information; participative approach; stakeholders; sustainable development.

Reference to this paper should be made as follows: Le Fur, J. (2007) 'Communicating scientific knowledge to actors: how do indicators respond to stakes in relation to the development of the fishery sector in the Guinea Republic?', *Int. J. Sustainable Development*, Vol. 10, Nos. 1/2, pp.73–92.

Biographical notes: Jean Le Fur (PhD) is researcher at the IRD. He specialises in the modelling of biological, ecological and social complex fishery systems. He is jointly involved in characterising complex systems in general as well as the means for sustainable development of fishery sectors in developing countries. The models he has developed are mostly individual based models and deal with studying decision processes, negotiation processes, and bio-economic fluxes at the sector level, as well as biological resources or ecological food web dynamics. He has developed several information systems and worked on knowledge typology. He has been head of several funded projects in France, Senegal and Guinea Republic.

1 Introduction

Management based on a participative approach has been established and discussed for a long time in Western countries (Beuret and Pennanguer, 2002), and is now becoming a key approach in developing countries (Leroy and Mermet, 2004). Nevertheless, at this stage, methodologies are not sufficiently well constructed and efficient. Except for some successful implementation examples (e.g. Gonzalez, 1996; Roybin et al., 2001), many failures may still be observed in developed (Ananda, 2004; Mendel, 2003) and developing countries (Leroy and Mermet, 2004). Thus, in the Republic of Guinea, and in particular in the fishery sector whose traditional component is considered as a pocket of poverty in this country, developing this logic is difficult and it has not been applied at this stage; public authorities usually decide and impose (e.g. Gréboval, 1997).

Several protocols have been put forward for implementing participative (e.g. Beuret and Pennanguer, 2002; Piégay et al., 2002) or patrimonial management approaches (Babin et al., 2002; Weber, 1996) in order to specify development plans or methods for a sustainable management of natural resources. These protocols are usually characterised by a sequence of stages (Leroy, 2002) which, with variants, are in general:

- the determining of a common definition of the environment
- the establishing of common objectives
- the implementing of an operational trajectory in which all stakeholders should take part.

Each stage has been the subject of particular research and development, such as the patrimonial approach (Leroy and Mermet, 2004) for the second stage. The submitted, rational and logical protocols focus very often on the downstream protocol. Procedures are usually proposed assuming that the nature and means of information exchange are well-identified and established and are not a source of problems or questions.

The availability of information, nevertheless, appears nowadays to be a main key in decision making and policies (Hammard, 2000; Kelly, 1998; Rivard and Talbot, 1999; Stephenson and Lane, 1995). Consequently, information, which may be perceived as a resource, plays a priori an important role in the smooth running of a productive sector such as the Guinean fishery industry. Questions raised by information issue are numerous such as those concerned with:

- the quality of the available information which strongly influences the quality of associated exchanges, negotiations and decisions it permits
- the means of access to information where, for example, actors are not equal depending on whether or not they have radio, TV, phone, newspapers, whether or not they read in one language or another, whether or not they have the necessary educational level to understand given information, etc.
- the way information circulates: formal or informal, official or unofficial, spasmodic or regular, etc.

- the forming of more or less distinct groups consisting of either information providers and holders or information receivers and users
- gaps between information supply and demand.

This study came within the framework of a programme[1] which, in the first stage of a medium-term process, aimed at providing the knowledge and skills necessary to allow Guinean actors and operators:

- to assimilate the development stakes of their sector
- to determine themselves the specific required solutions, given the particular environment of the Guinean fishery industry dynamics to which they contribute.

The work presented here can thus be included in a co-construction preliminary stage which questions, on the basis of concrete experience, the conditions and constraints linked to the setting up of an environment favourable to the completion and implementation of participative governance.

Sustainable development has been viewed here as a process or an approach rather than as a state to target (Bagheri and Hjorth, 2005). In this context, we have attempted to implement the 'germs' of a process by questioning the most reliable methods given the particular environment characteristic of poor developing countries. In order to do that, we have assumed that:

- research corresponds to an interface adapted for setting up communication as unbiased as possible between hierarchically dependent actors (e.g. administration – operators)
- public research (Doumbouya et al., 2002) corresponds to one of the most sustainable structures to allow the system, if successful, to be fully operational in the medium term.

Several issues have been the guidelines of the programme such as principally:

- the issue of information access inequality and the associated damage or lack of fairness observed (Irwin, 1995; Le Fur et al., 2002; Leroy, 2002) or not (Leroy and Mermet, 2004)
- the role and place of research in the development process (e.g. Brac de la Perrière, 2000; Doumbouya et al., 2002; Funtowicz et al., 1998; Roybin et al., 2001)
- the nature and power of information as a driving force for development (Hammard, 2000; Kelly, 1998), in particular participative development
- the initiative was to develop a new approach and to promote new practices.

In this context, the assimilating of this method by the operators was a key element in achieving sustainable results. It was a matter here of attempting to disseminate acquired knowledge to the widest set of concerned people allowing it to be appropriated for operational ends.

2 Methodological issue

In this light, the aim of the project was more precisely to structure the national fishery research so as to help the fishery sector in identifying the best development alternatives. The aim was not to define the alternatives, but rather to contribute by providing scientific and technical items useful for stakeholders (including the management level) to identify, and above all, appropriate, the best alternative.

To implement this approach, the work has been divided into several interconnected steps, which were almost successively: gathering available knowledge on the field; designing protocols to acquire new knowledge necessary for an integrated understanding of the fishery sector; developing specific computer based tools to gather, integrate, articulate and deliver knowledge; elaborating a framework of communication between stakeholders and national fishery research; trying to deliver knowledge using various means; and training scientists to keep the skills on the mean term.

The selected approach was then of a methodological and exploratory nature: with a sustainability aim, we have attempted to deal with different solutions in order to provide a range of alternatives for each step allowing all beneficiaries to choose and to reuse the most efficient channels according to environments, national potential (in particular, implementing costs) and the target beneficiaries.

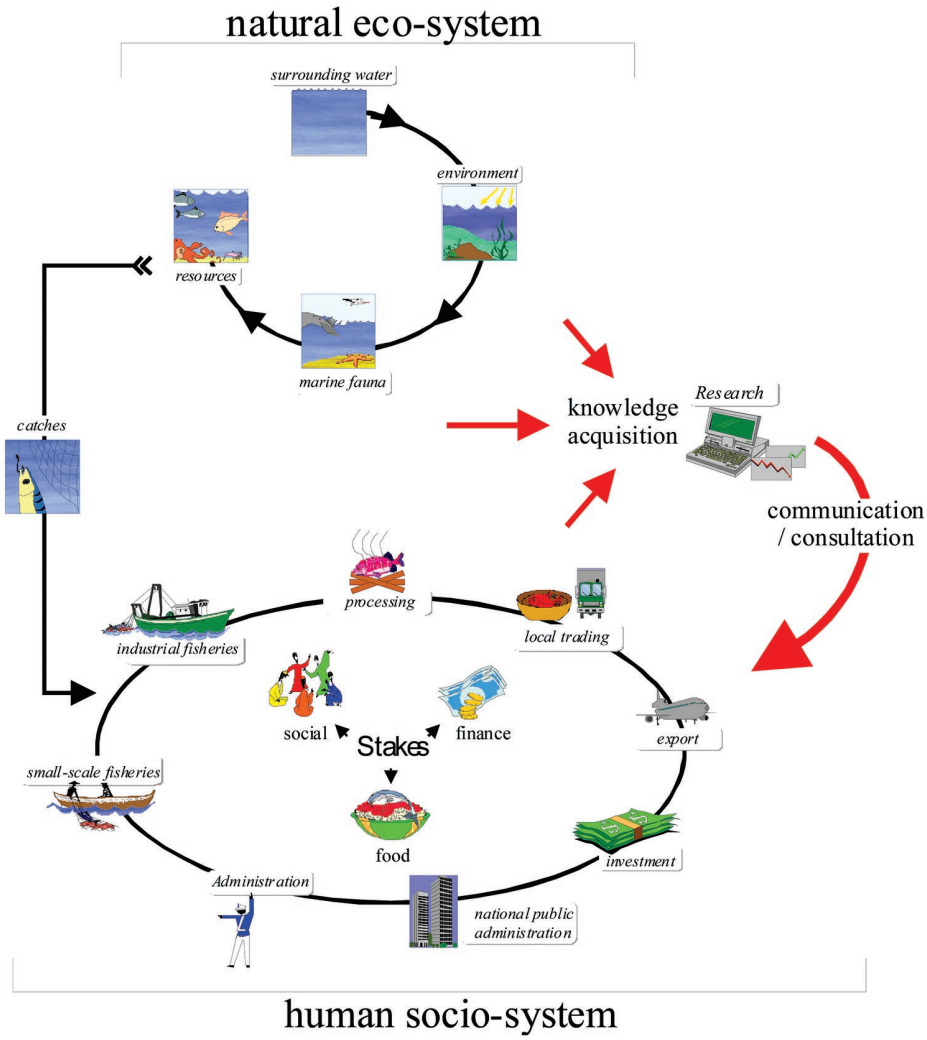
The relevant parts of this approach are presented here, in particular the large scope of the field to be considered, the diversity of information types to be taken into account, the diversifying media process related to given information, and how different channels of information restoration are implemented. Finally, we will discuss the several lessons drawn from past experience, and the reaction of the actors to this initiative.

3 The characteristics of the studied domain

The sustainable development of a fishery sector corresponds to a large-scale, medium-term enterprise. The domain to be considered relates to the complete industry, which, in a figurative sense, ranges from nutritive plankton in the sea to fish on the consumer's plate. According to this viewpoint, we have assumed the possibility of structuring the domain into three large components (Figure 1). The first component corresponds to the natural eco-system, such as surrounding water, environment and marine fauna allowing the determination of the actual exploited resources. The second component corresponds to the human socio-system with the different types of actors involved such as small-scale fisheries, industrial fisheries, processing activities, local fish trade, fish export activities, investment sponsors, national and local administrations.

This group of socioeconomic actors is involved in the setting up of institutions constituting in their turn the stakes of the sector which are, in the context of the Guinea Republic, social, economic and food stakes. The combination of the two is made by means of catches (third component) allowing these populations to live.

Figure 1 The characteristics of the domain related to a sustainable development issue in a fishery sector (for colours see online version)



The sustainable development of the sector consists in working on all these aspects and research must play a role in this (Funtowicz et al., 1998). Firstly, it is a matter of gathering knowledge on all the elements. We then arrive, in the first phase, at an approach of research considered as a 'fount of knowledge', which however is not sufficient. The research has to then constitute an actor involved in the dynamics of the sector by making available acquired information and knowledge in such a way that the actors may develop and establish the ad hoc terms for the development of the sector ('action-research').

The main idea of the project was based on the concept of legitimacy (Beuret and Pennanguer, 2002; Castillo, 2006): objectively, neither research, nor government authorities, nor investment sponsors (whilst this is often the case) have the necessary legitimacy to consider in depth, and as a whole, the industry in all its diversity and

specificity and to propose the appropriate solutions. It is then up the various operators to assimilate this (e.g. Weber, 1996, 2000). With this logic verging on a democratic governance (Heurgon and Landrieu, 2000), the only way a foreign project could play a part in the Guinean industry would not be by setting the methods of the programme, but only by providing the information necessary for the stakeholders to find the best terms for the development of the industry. The key point in the achievement of such an aim is to assimilate as well as possible the multiplicity of the actors who are stakeholders with different, presumably legitimate, reasons and with diverse perceptions of the situation. This position assumes being able to reach them all equally, which is a difficult task.

4 Research material and method: assimilating the diversity

The process has been divided into three stages. We have attempted to:

- gather and/or acquire knowledge related to the whole system presented here (see Figure 1)
- elaborate tools enabling the beneficiaries, the actors of the sector, to gain access to this knowledge
- establish a two-way relationship between fishery research and all the components of the sector.

4.1 Acquiring knowledge

The first stage aimed at building a corpus of versatile and diversified knowledge. This knowledge had to be primarily versatile as, in the long-term, it must be possible for research to adapt its production of knowledge to the evolution of the fishery sector as well as of the related questions (overexploitation, governance, profitability, environment, poverty, etc.), and to the progress of available techniques for collecting data. The selected method was thus a methodological approach whose main purpose was not acquiring knowledge, but providing Guinean researchers with the means required for obtaining this knowledge. The aim of the whole project was then firstly to extend Guinean scientific skills by means of the development of research practices and by implementing functional and useful research techniques enabling the development of the fishery sector in this country.

As regards the necessary diversification of knowledge, it was justified for two reasons. The first reason was related to the necessity of taking into account all of the relevant elements of the industry dynamics and development. Although given knowledge may not necessarily be easy to summarise (prerequisites associated with an indicator-based approach[2]), it may nevertheless be potentially legitimate, since, according to the complexity and evolution of systems (Allen, 2000; Allen and McGlade, 1987; Kelly, 1998) and in some contexts, it may prove crucial and therefore useful for defining the terms of sector development. Consequently, all types of knowledge must be accounted for, or at least made available (this is not usually the case, as fishery research is still too often mostly focused on the condition of

resources). With respect to the second reason, diversifying knowledge is also necessary with the aim of exchanging information with all of the stakeholders involved in these dynamics. For example, in order to develop his action or his argumentation during a negotiation process, a tradesman will need information which is different from that required for a fisherman, or a minister, etc.

We thus worked towards the development of a multidisciplinary research centre, the CNSHB,[3] covering all the components of the fishery sector and enabling us to obtain, in an adaptive way, data, information and knowledge concerning all of these elements. Without going into details, but regarding the question of 'indicator supply', the main conclusion is that the nature and presentation of information varies according to the type of related field (diversity 1). Thus, data and knowledge formats will vary (photo, book, note, article, map, graph, etc.) according to the type of information being processed (historical aspects, business data, resource conditions, etc.).

A specific tool, the fisheries information centre in the Guinea Republic, was developed in order to take this heterogeneity into account. Based on an integrated approach, this computer tool was developed to provide relevant information, which was well-documented in terms of sources, confidence levels, dates, locations, etc. This tool was designed for taking into account all types of past, present and future information, whatever the related field, source or medium employed. It is used for restoring information on several types of media: internet search engines,[4] paper archives, thematic booklets and posters, some of which are discussed below.

4.2 Transferring knowledge

The stakeholders' diversity, even defined in a limited scope (Hill and Jones, 1992; Mercier, 2006), is also cultural. Thus, it was necessary to meet and consider various representative groups of people such as government authorities, police forces, shipping companies, port managers, the Minister of fisheries, groups of wholesale fish merchant women, researchers, foreign importers or exporters, etc. In order to ensure that all these actors have access to information, the following means are required:

- diversified communication *media* impacting a community including a large population of illiterate actors, as well as a decision-making sphere with higher educational and experience levels
- diversified communication *channels*.

4.3 Media

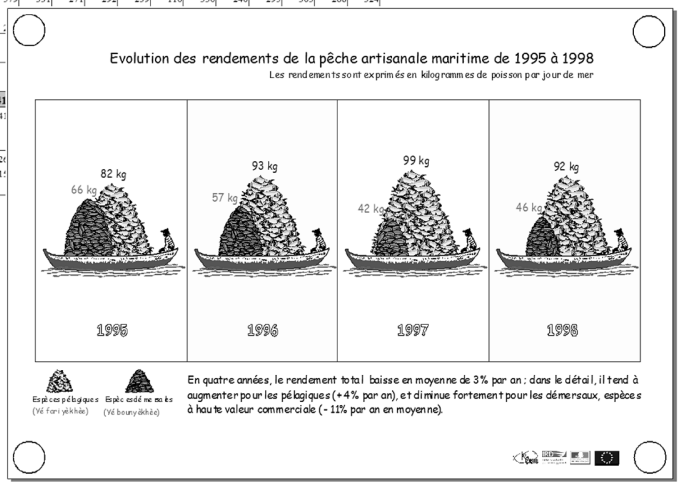
In order to allow given knowledge to be available for all types of actors, based on a fair information access approach, we have attempted to present given knowledge as different formats: statistical chart data, even with limited target population (at the beginning of the project, this was almost the only communication means employed), or vulgarisation work with illustrations consisting of pictograms (Figure 2).

Figure 2 Example of the diversification of media used to illustrate given information (media were presented in French to stakeholders)

Pêche artisanale. Efforts et captures *(en tonnes)*, toutes préfectures confondues
Résultats mensuels et totaux
1997

	TOTAL	JANV	FEV	MARS	AVRIL	MAI	JUIN	JUIL	AOUT	SEPT	OCT	NOV	DEC
Nombre de jours de mer	343752	31311	29001	29108	29759	25702	25301	23675	28113	29551	33481	28715	30035
CHINCHARDS	0	0	0	0	0	0	0	0	0	0	0	0	0
MAQUEREAU	0	0	0	0	0	0	0	0	0	0	0	0	0
SARDINELLES DIVERSES	3154	269	306	125	716	213	487	688	58	6	7	34	245
ETHMALOSE	29529	2252	3137	3122	1502	2807	1616	1042	1452	2841	3309	2935	3514
MULETS	1244	86	47	120	83	84	280	188	99	84	66	27	80
PETIT CAPITAINE	50	1	1	2	0	32	0	2	3	2	0	2	5
BOBO	2745	230	235	217	214	239	176	139	184	287	252	277	295
BARS DIVERS	2181	291	220	167	169	221	184	89	128	175	156	188	193
MACHOIRONS	2338	127	157	197	334	205	215	186	119	159	205	193	241
SOLES	255	20	28	47	31	17	21	14	15	16	14	20	12
GRONDEURS	76	6	3	5	3	5	2	6	10	13	3	6	14
DISQUES DIVERS	39	3	7	2	0	2	7	11	0	0	2	5	0
DORADES DIVERSES	3582	579	331	271	292	239	110	330	240	295	303	268	324
DIVERS POISSONS	240												
AUTRES CATEGORIES DE POISSONS	3111												
CREVETTES	0												
AUTRES CATEGORIES DE CRUSTACES	0												
SEICHES	0												
AUTRES CATEGORIES DE	0												
TOTAL DES CAPTURES	48544	41											
dont POISSONS	48544	41											
dont CRUSTACES	0												
dont MOLLUSQUES	0												
dont PELAGIQUE	33866	2											
dont DEMERSAL	14438	1											
dont DIVERS POISSONS	240												

a)



b)

Note: Based on the official statistical tables prepared for the fishery administration (a), we copied the key points representing a comparative analysis describing the trend of catches in industrial and small-scale fisheries, over the last years, for the main noble species. This type of presentation was developed to impact illiterate people (fair access to information).

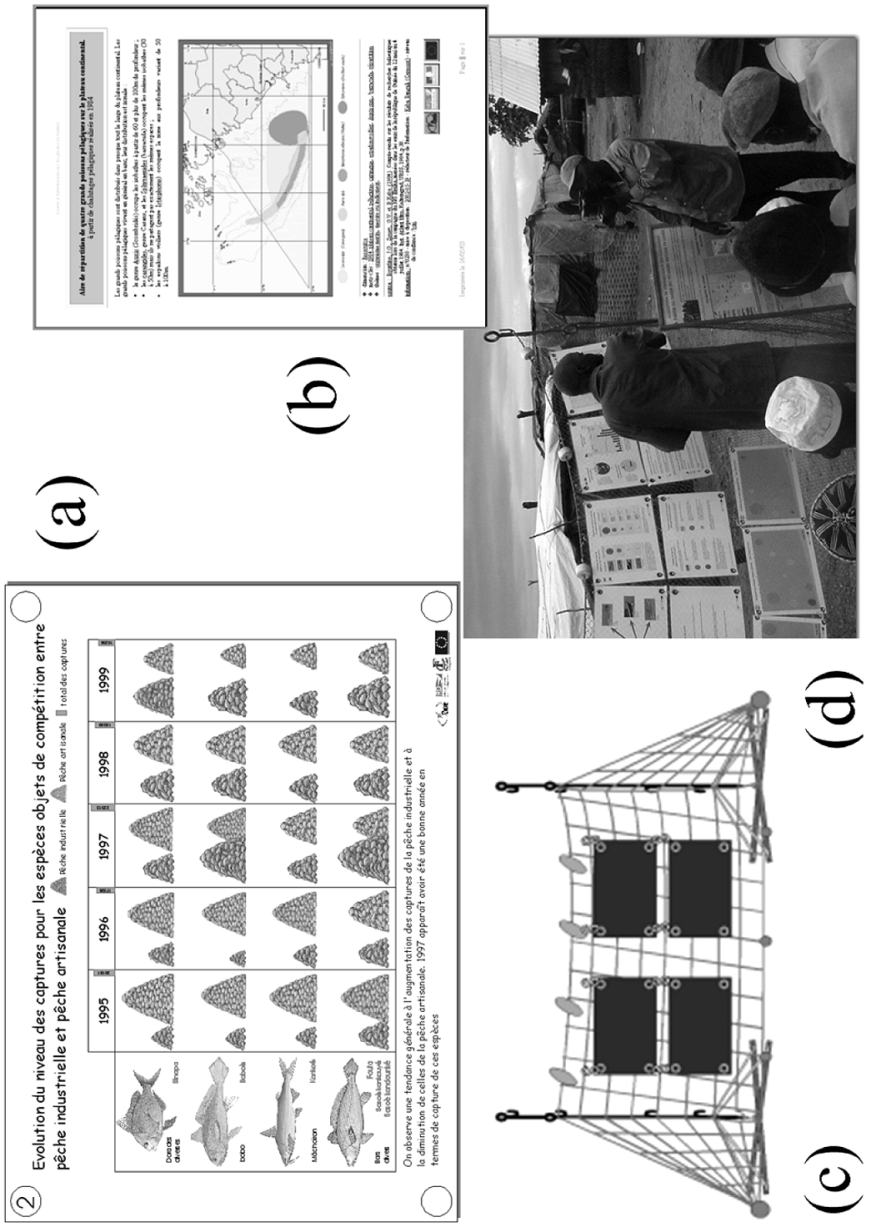
4.4 Channels

We then attempted to present the information acquired and formatted on various media, using various communication channels in order to reach the different types of populations.

The first channel was implemented by means of travelling exhibitions, organised and carried out in the actors' workplaces (see Figure 3). The different media were published in large format, plastic-coated and displayed on a board enabling the different researchers to present their results. According to our indicator approach, in addition to the information displayed on its medium, a scientist was there to provide further details about the meaning of presented data and how they were collected and synthesised.

Regarding a second channel, similar information was given on the internet, by using new information and communication technologies, and made available according to different procedures. Available information about the fishing industry in the Guinea Republic thus impacted another sphere of actors, such as, for example, foreign investors (e.g. fish importers at the international level), international investment sponsors, foreign flotillas, etc.

Figure 3 Channels and media: information diffusion by means of travelling exhibitions



Note: The travelling exhibition consists in a set of A3 plastic-coated prints. (a) Relevant research results are popularised so that they are accessible for everyone, by considering the high illiteracy rate of operators in small-scale fisheries. (b) The information provided within the information centre may be published in this format, and displayed in thematic exhibitions when accurately gathered. (c) A metal structure and a set of nets were installed so that the travelling exhibition could be easily set up on hard ground (fishery administrations) or soft ground (beach sand). (d) A specialist responsible for presenting and explaining the posters, and recording comments is always part of the travelling exhibition.

A third channel consisted in publishing the same information as paper documents, which can be easily transmitted to individually targeted actors (administration, collective or decision-making officials, etc.).

Similarly, direct and oral information exchanges and discussions about acquired knowledge were carried out by organising different events, such as research-based open days, educational short film projections describing research activities and issues, as well as the organisation of a national conference on research contribution to the fishery sector development. During the latter, about a hundred representatives from all of the structures forming the Guinean fishing industry were invited to attend the presentation given by the Guinean researchers on the progress status of their knowledge in this sector. Each time, discussions were numerous and apparently mutually rewarding.

The last channel of communication that has been explored consisted in forming a team of operators and actors representing all the different structures of the sector, the Monitoring and Steering Committee (Comité de Suivi et d'Orientation (CSO)).

4.5 Monitoring and Steering Committee (Comité de Suivi et d'Orientation (CSO))

The project was supposed to involve a participative research approach enabling the implementation of a sustainable development of the fishery sector in the Guinea Republic. It rapidly became clear that a consultation structure including fisheries research and actors from the fishing industry (i.e. traditional and industrial operators, administrations, stakeholders in industry development) was missing. The initial incentive was based on a similar approach implemented in some French institutional programmes (Pavé, 1994, 1997) in aim of forming teams, in which each member is able to provide different points of view (lights) regarding a multidimensional issue. This process was then developed based on a proprietary approach (Leroy and Mermet, 2004; Mermet, 1992; Weber, 1996) or a democratic governance approach (Heurgon and Landrieu, 2000; Castillo, 2006), in which actors co-construct a representation based on open information exchanges.

By analogy with the stakeholder theory stemming from the industrial structure world (Mercier, 2006; Pesqueux, 2006), the key point was to neutrally connect the main types of actors on the basis of the information provided, so that exchanges and discussions may take place and possibly lead to the determination of generally agreed directions or solutions contributing towards the sustainable development of the sector. In order to meet these needs, the programme decided to organise a committee including representatives of the main actors involved in the Guinean fishery sector.

The setting up of this committee began with:

- definition of the selection criteria (reading and writing in French, good personal experience in the domain of the fishery sector, their representativeness)
- several discussions with members of the personnel department of the fishery sector administration in order to identify potential applicants for selection
- organisation of a meeting with the heads of the main small-scale fishing ports, thereby allowing these managers to choose themselves their Committee representative
- selection of the other members of the Committee on the basis of the defined criteria and the various propositions.

Finally, the CSO was set up, composed of eight members representing small-scale and industrial fisheries, small-scale processing, local and export fish trades, administration, investment sponsors and research (Table 1).

Table 1 Composition of the Monitoring and Steering Committee of the PEG project

Position	*Representing ...*
President of the Cooperative of Women Fish Processing of the Bonfi area	Small-scale processing
Member of the Union of Fish Traders Women in the wholesale trade of the Guinea Republic	Local fish trade
Rural Development Counsellor, European Commission delegation in the Guinea Republic	Investment sponsors
Researcher*	Research
Technical Counsellor of the Ministry of Fishing and Fish Farming	Administration
Vice-president of the National Confederation of Professional Fishermen in the Guinea Republic	Industrial fishing
Head of the Kaporo harbour (chosen by all the port managers of the Guinea Republic gathered together to this end by the project)	Small-scale fishing
Executive Secretary of the Guinean Association of fish product exporters	Export fish trade

Note: *As an experiment, the research representative was changed at each meeting.

During the meetings, information was given out to the members of the Committee asking them to react as to its nature, medium and interest. The different reactions depending on the types of information could then be discussed.

Works carried out during the course of the project were considered as preparatory/exploratory, aiming at exploring different methods and defining the best way of running the Committee after the project, in the light of the development goals of the sector.

In terms of organisation, the CSO met together for a regular session two or three times a year depending on the busy timetable of the members. A copy of the minutes of the meeting was sent to the General Secretary of the Ministry of Fishing and Fish Farming for his information. The agenda changed at each session.

The main purposes for setting up this Committee were:

- sharing the information produced by research with the actors of the fishing industry
- the direction of research in information production according to the expressed needs of the actors on the subject
- the actors' contribution to the fisheries information centre in the Guinea Republic
- taking into account the constraints of the fishery sector and the confrontation of different points of view
- the ability to propose solutions made and agreed upon jointly, for problems arising within the fishery sector which have a negative effect on the possible success of the actors' goals.

Almost all these goals were able to be reached or considered to be attainable thanks to this Committee. The actors of the fishing industry paid tribute to the initiative of the setting up of the CSO. The former need for discussion and partnership between research and final users as well as between the actors of the fishery sector began to be met by means of this Committee.

It is worth noting that, in terms of impact, from the birth of this Committee, the Ministry of Fishing intervened several times in order to justify that the Committee be placed under state supervision rather than being dependent on research and a North–South project. Consequently, within the context of this experimental project and in agreement with the members of the Committee, the idea of state supervision was always resisted in order to avoid the growing ascendancy of the fishing administration and in order to preserve free expression of unbiased ideas, fairness and balanced legitimacy which form the foundations of the CSO approach.

5 Results

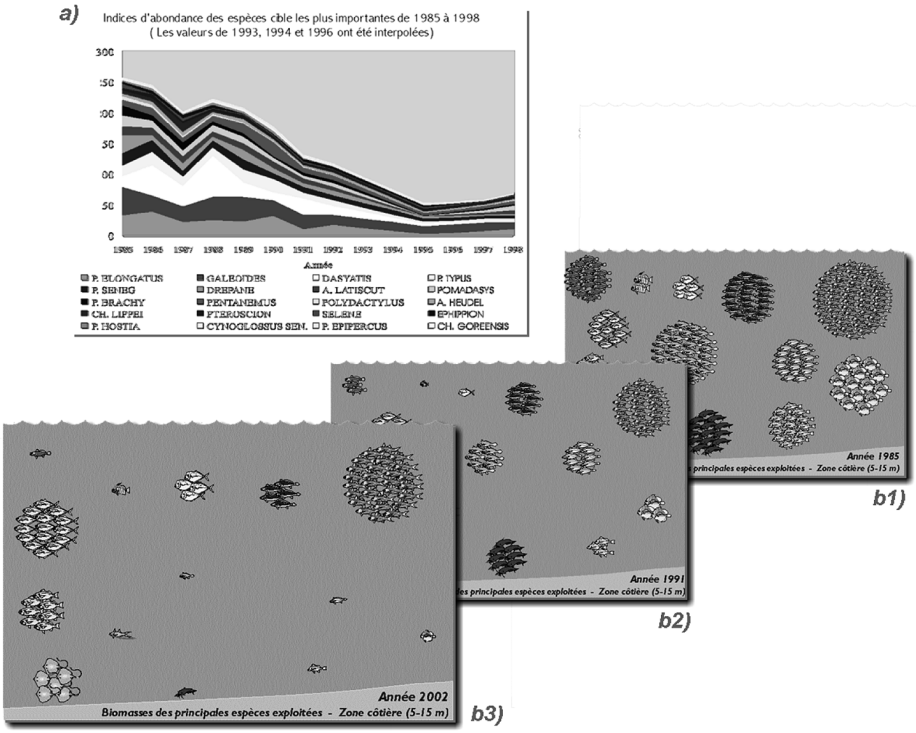
Each of the experiments carried out was the occasion to provide actors with information in a variety of fields, media, types and channels, and to evaluate in which terms the interaction could be made possible between research and actors with a view to transmitting information. Certain lessons were able to be drawn concerning the use of knowledge, the relevance of a given indicator and the need for diversified media.

The impact of knowledge is extremely dependent on the adaptability of the medium. For example (Figure 4), it turned out that the indicator which was the most critical and the most debated concerned the resource condition and development. The indicator shown in graph form was thus significant for a certain number of types of actors, but it has to be shown in another way for other types of actors who did not necessarily understand these biaxial graphs. We have developed here a visual and dynamic graph on the sizes of available fish stocks in the sea in 1985, 1991 and 2002 (the data comes from oceanographical research campaigns during which resources were directly evaluated by means of graded trawling). The different ways of presenting the same information allowed the different types of actors with their different levels of culture to equally react to these key data. It was thus very clear that the choice of one medium or another could render given knowledge inaccessible to certain types of actors nevertheless concerned by the question.

The multiplicity of the actors and levels of culture to be reached thus theoretically justifies the need for a diversification of media for given knowledge.

As far as relevance is concerned, the quality of an indicator is not assessed, as we may be inclined to think, on the basis of objective criteria related to the nature of the indicators (representativeness, exactitude, synthesizing role) but rather on the consequences and activity it can cause, for example discussion, action or decision making. Figure 5 shows, for example, an indicator which has turned out to be extremely relevant – this is a picture providing further details as to the working conditions in which women fish-smokers find themselves – this indicator is not at all quantified but is nevertheless very informative which has permitted lengthy dialogue between the actors on related sanitary problems.

Figure 4 The necessity of diversifying the formats when faced with a community of heterogeneous actors



Note: The resource abundance levels were presented using whether biaxial graphs or figured animation of fish stocks relative to their size.

Figure 5 A photo showing working conditions of women fish-smokers and health risks which this activity comprises: qualitative information can be more effective in encouraging a discussion than syntheses of scientific results

Source: Photo credit: Didier Bazzo

In another way, it was clearly obvious that knowledge was useful depending on the context and the receiver. This point, far from being insignificant, constitutes one of the main problems raised by this approach. In effect, when we study both the diversity of contexts and receivers above-mentioned, we find ourselves confronted with a multitude of information potentially useful for the drawing up of the terms of sustainable development. On an international scale, after having recommended a multitude of indicators to quantify (Eurostat, 2005; IFEN, 1999), the current trend is towards a reduction of indicators, thus based on several pillars of development (Rey-Valette et al.,. 2006). In a multi-actor context, the whole group forms a constellation of interest (Donaldson and Preston, 1995; Pesqueux, 2006), the interest of each stakeholder having an intrinsic value. All the components of the sector are thus likely to be interesting, maybe leading to a solution, a potential bottleneck, a deciding factor in the dynamics, etc. relating to the sustainable development of the industry. In this multi-actor context, one actor will be interested by one set of information, while another will be concerned by a different set without it being possible to identify one set as being more legitimate than another. We therefore find ourselves once more confronted with a plethora of indicators to control and structure. Some examples attempt to illustrate this point in Figure 6.

Figure 6 The necessity for a diversity of indicators in a multi-actor context

a)

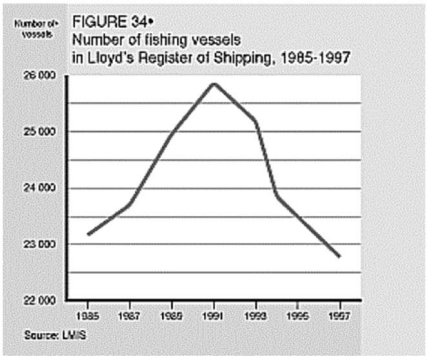
Investissements et amortissements par type d'engin de la pêche artisanale

	Intrants	Pirogue	Moteur	Engin	TOTAL
	Durée de vie	5 ans	4 ans	*	
FMCgm	Inv.	4 000 000 F	1 900 000 F	2 150 000 F	**8 050 000 F**
	Amort.	800 000 F	475 000 F	- F	**1 275 000 F**
FMCtgm	Inv.	4 000 000 F	2 500 000 F	2 440 000 F	**8 940 000 F**
	Amort.	800 000 F	625 000 F	- F	**1 425 000 F**
FMDEm	Inv.	1 200 000 F	1 700 000 F	1 537 500 F	**4 437 500 F**
	Amort.	240 000 F	425 000 F	- F	**665 000 F**
FMDEnm	Inv.	1 200 000 F	- F	510 000 F	**1 710 000 F**
	Amort.	240 000 F	- F	- F	**240 000 F**
FT	Inv.	4 000 000 F	2 500 000 F	6 300 000 F	**12 800 000 F**
	Amort.	800 000 F	625 000 F	- F	**1 425 000 F**
LIG	Inv.	1 200 000 F	1 700 000 F	75 000 F	**2 975 000 F**
	Amort.	240 000 F	425 000 F	- F	**665 000 F**
Pa	Inv.	1 200 000 F	1 700 000 F	155 000 F	**3 055 000 F**
	Amort.	240 000 F	425 000 F	- F	**665 000 F**

FMC: Filet Maillant Calé (gm: grande maille, tgm: très grande maille)
FMD: Filet Maillant Dérivant (Em: à ethmalose)
FT: Filet Tournant
Li: Ligne (G: glacière)
Pa: Palangre

b)

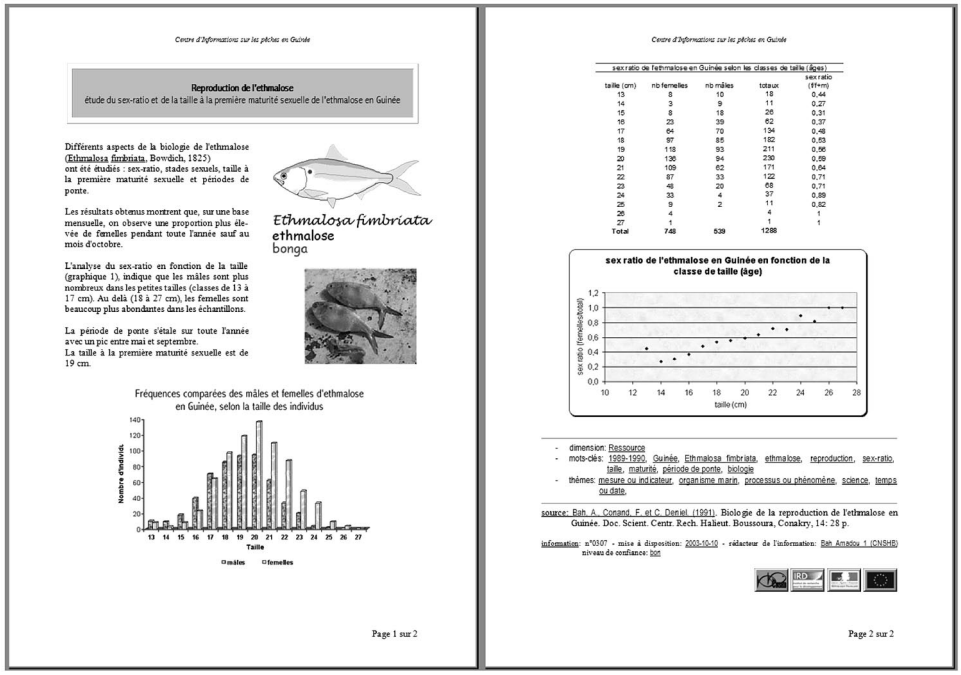
c)



Notes: (a) a performance indicator provides a comparative analysis of different fishnets; (b) an indicator of resource overexploitation used to show the very small size of the sharks caught; (c) in this example, the fishing administration came up against problems regarding the failure to declare foreign vessels fishing in Guinean waters. The proposition of working out indexes from statistics collected directly at the level of international insurers allowed the introduction of discussions about new work protocol with regard to this problem.

Finally, for the combined diffusion of all the aspects of a problem to all the communities involved in the dynamics, a diversity of media needs to be available. This conclusion may call into question the methodology inasmuch as the production of limited sets of indicators may attenuate a problem and thus lessen the possibility of identifying solutions to resolve it. The example presented in Figure 7 illustrates this point. The information presented contains a title with a commentary, a text, a diagram, a photo and the development of a double indicator; a table, keywords, sources, … The indicator only constitutes, in fact, one element of a piece of information, this latter being more comprehensive, complete and many-sided.

Figure 7 Construction of composite information allowing an aspect of available knowledge to be put in perspective



6 Discussion

In this exploratory type project, we have multiplied information supply solutions to actors by attempting to define the best communication procedures. Among the proposed procedures, the difference between information and indication remained unclear (and not very significant?). The important issue appeared to be the supply of active information, i.e. which result in a discussion and generate, as mentioned by Bateson (in Bougnoux, 1993, p.227), a difference with respect to the previous situation.

Although this work was at a relatively preliminary stage, it could prove useful to examine an initial assessment of benefits met by the actors in relation to this initiative. As could be expected for a North–South development project, benefits are not as predicted. The following anticipated and verified benefits were noted.

The first modification resulting from this work was that operators became aware of the exact nature of the research. Up until now, investigators collecting data on the unloading centres were mistaken for government officials responsible for monitoring the activity in order to determine the taxes to be charged to the operators. This perception resulted in negative impacts on the quality and representativeness of collected data. Initiatives such as 'Research Open Days' enabled us to conclude that collected data could be used for a better understanding of the activity and identify means for improving it. This awareness was very positive because operators then agreed to facilitate data collection (and monitoring) for the investigators. In the same frame of mind, when the operators were invited to the conference, most of them firstly declined. They believed that all invitations to attend national meetings resulted in operators being used as alibis and that their opinions would not be taken into account. Finally, they took part in the conference and experts noted that their assiduity was remarkable. They were involved in discussion forums during which each party expressed its doubts, needs, expectations or recriminations to the other actors of the sector. The Guinean fishery research department was thanked on many occasions during interviews with the numerous protagonists.

Due to the multiplication of communication channels and media, a certain amount of information circulated in areas which had not been reached before. Operators realised that interesting information on the activity of the other components in the sector existed, and that research could contribute to its transmission. These components could significantly influence the context in which operators worked.

On the other hand, actors noticed that research could be used as an information channel for their activity with respect to other activities. This fact corresponds to a co-construction logic. This point was mostly observed within the CSO, in which, for instance, fish traders wished to transmit their information concerning the volumes of fish processed by their community, or an exporter having received funding for the development of a new activity wished to transmit information on this subject in order to develop partnerships in the sector. Guinean fishery research thus slowly ensured a mediation function between the various parties involved in the sector. In addition, research received a positive input as a new corpus of diversified information which otherwise would have been difficult, or at least expensive, to obtain using its own resources. We have thereby come nearer to reaching a distant target; obtaining a truly bi-directional relationship. It is not only researchers who are attempting to approach the fish professionals in order to supply knowledge, but the fish profession which aims in turn to:

- express needs liable to influence future research projects
- spontaneously propose knowledge enabling to significantly increase available information at the research level
- contribute in this way to the implementation of a wider common platform of shared additional information from various sources.

The last positive point, an aim which has not yet been verified, is that because actors from the different components of the sector are confronted on the basis of a common information platform, it was possible for awareness to emerge due to the fact that a collective development approach was possible and that an alternative solution to the 'top-down' interventionist approach could be considered.

7 Conclusion

In the end, the tested device appeared as a composite and combined assembly of *various knowledge fields* (environmental, exploitation, trading, management, politic fields, etc.), *formats* (maps, graphics, videos, drawings, tables, texts, etc.), *media* (scientific reports, exhibitions, digital information systems, plastic-coated posters, short films), *channels for recovering information* (broadcasting on internet, transmission of reports, series of displays/presentations, implementation of a discussion committee, organisation of open-day sessions, national conferences for recovering information, travelling exhibitions in administrations and unloading centres) and *users* (small-scale and industrial fisheries, small-scale processing, local and industrial export fishing trade, administration, investment sponsors, research, NGO representatives, etc.).

Thus, it was necessary to question a certain number of approaches regarding methodology to ensure the combined broadcasting of information on all aspects of a problem to every component (actors) involved in the dynamics. Thus, we are in a situation where for an amount of given work, it was necessary to decide whether to:

- supply a small quantity of detailed information with a significant added value, i.e. data presented based on several aspects (nature) using various presentation procedures (media) and supply procedures (channels) each time
- provide a maximum amount of data in a single format for a limited and informed community; this was formerly the case in the Guinea Republic through sending yearly statistical bulletins (see Figure 2(a)) mainly to the central fishing administration.

As mostly expected, consequences and impacts resulting from either approach are sufficiently distinct for their simultaneous development to be recommended; this was attempted in the Guinea Republic fishery sector. This desirable implementation remains dependent upon financial and human resources which may be implemented.

In the general case, the exposed methodology appears an efficient approach to explore the best way to communicate profitably knowledge to stakeholders. Nevertheless, the result that will be finally obtained and the choice of the operating conditions will be specific to the context, to the nature of the problem, to the knowledge bound as well as to the targeted stakeholders.

Acknowledgements

The author wishes to thank the team of biologists, ecologists, economists, fishery scientists, engineers, technicians and administrative officials who have contributed to the elaboration of the research system; the stakeholders who kindly contributed to the elaboration of the research initiative; the Ministry of Fisheries and Aquaculture (MPA) of the Guinea Republic through the CNSHB research centre, which provided all the facilities for the execution of this study; as well as the investment sponsors who allowed this experiment to be fully completed. The author is also grateful to Hélène Rey-Valette for her help in the elaboration of the document and Joëlle Vincent for most of the iconographic work presented.

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Notes

[1] FACII Programme (French cooperation funding no. FAC92/CD/98/GUI), Ecological Fishing in Guinea Programme (Projet Pêche Écologique en Guinée) – PEG (European Commission funding No. B7-6200/99-03/DEV/ENV).

[2] At the start of the study, an indicator was meant as a quantified fluctuating value synthesizing a set of phenomena simultaneously intervening in the sector; the resulting value having a sense for at least a part of the stakeholders' community. In the discussion, we finally go beyond this definition by questioning the boundary between indication and information.

[3] CNSHB: National Centre of Fishery Science of Boussoura (Centre National des Sciences Halieutiques de Boussoura).

[4] http://www.mpl.ird.fr/weblefur/indexG.htm.