AN APPROACH TO CO-CONSTRUCT SUSTAINABLE DEVELOPMENT INDICATORS IN AQUACULTURE[1]

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ABSTRACT:

It cannot be said that aquaculture has ignored sustainable development (SD), judging by the number of standards, guides and indicators devoted to it, produced mainly under the aegis of international organizations such as FAO, The European Union and some NGOs. However, these continue to be perceived in large measure as constraints rather than as shared objectives by actors. Faced with this situation, which is not specific to aquaculture but on the contrary quite general regardless of sector, context or scale, the authors seek to propose a generic approach that through a collective process, i.e. a co-construction, promotes the implementation and appropriation of SD. What makes this approach original is not only the participatory nature of the construction, but also the regional nature of the approach which includes both aquaculture systems and their host area. It is based on a selection process that nests principles, criteria and linking indicators to the actors' issues and representations, encourages their appropriation of both SD and the indicators produced. This approach is the fruit of fieldworks undertaken by a group of French researchers in partnership with teams of scientists and actors in France, in Europe and in Southern countries (Cameroon, Indonesia and Philippines). Aquaculture systems, representative of a broad range of farming systems and governance mechanisms, were studied. Designed in a form of an instruction manual that is as flexible as possible, the approach alternates various sequences in order to modulate the range and the involvement of stakeholders and to emphasise the collective learning process. In this paper, the authors first present the postulates which underlie the adaptive and participatory nature of the approach and then outline the linking phases. They conclude with some of the results obtained from the implementation of the method.

INTRODUCTION

Considered marginal compared with fisheries until the 1970s (except in China), aquaculture started to develop rapidly from the 1980s. With 66.750 million tonnes produced in 2006 (FAO, 2006), it now represents half of the aquatic resource production destined for human consumption (120 million tonnes) and tends to compete with fisheries production. Initially, aquaculture created the hope of a technological, nutritional and economic blue revolution. The negative impacts of farming systems and their poorly-controlled intensification process on the environment and on local populations have tarnished its image and led to several crises. Nonetheless, aquaculture development has also led to multiple innovations and adaptations, allowing it to overcome site and market constraints and move towards farming practices that are more environmentally friendly, more mindful of social impacts and better integrated. Aquaculture now faces two major challenges: 1) Satisfy the growing global demand for aquatic products and 2) Develop towards sustainability. Faced with such challenges, it

[1] EVAD (Evaluation of aquaculture system sustainability) Project within the framework of the Agriculture and Sustainable Development federating programme of the National Agency for Research. 2005-2008.

is essential to assist and facilitate the development and/or the evolution of the sector towards more sustainable aquaculture systems. Hence, a group of French researchers in partnership with teams of scientists and actors in France, in Europe and in Southern countries (Cameroon, Indonesia and Philippines) worked on the construction of a co-construction approach to building indicators which is procedural, adaptive and participatory, studying aquaculture systems, representative of a broad range of farming systems and governance mechanisms. The approach aims to promote collective learning in order to implement a sustainable aquaculture. It is built on a generic foundation of principles, criteria and indicators established from a wide diversity of aquaculture systems and countries. It allows appropriate indicators to be chosen by defining combinations and associations that are adapted to each situation. Building indicators for the sustainable development of aquaculture must be perceived not simply as setting up a monitoring system but as an opportunity to define the challenges of sustainable aquaculture development collectively and at various scales. Lessons must be drawn from the many efforts to build sustainable development indicators, often unsuccessfully and resulting, both in aquaculture and in other areas, in "graveyards" of indicators and observatories. The postulate underlying the present approach is that a good indicator is an indicator that is used. Hence, when building indicators their use must be kept in mind. But in order to be used, they must make sense to the actors, which implies that the latter are involved in and discuss not only the indicators or the monitoring variables but also the objectives guiding the implementation of sustainable development. In this paper, the authors first present the postulates which underlie the adaptive and participatory nature of the approach and then outline the linking phases. They conclude with some of the results obtained from the implementation of the method.

I. THE POSTULATES OF AN ADAPTIVE AND PARTICIPATORY NATURE THE APPROACH (REY-VALETTE ET *AL.*, 2010)

Postulate 1: An indicator is not just a measuring tool

The driving force of the approach suggested here is to integrate the multiple functions of the indicators which are the key tools of any evaluation approach in sustainable development. These indicators give the situation (state) or the trend of a variable. Hence, they are traditionally considered as a measuring tool. However, looking at the definition of an indicator shows that all indicators also fulfil an inventory function, highlighting the variable, amongst other possibilities, that must be monitored. It establishes priorities between variables and identifies "models" or "representations" of the important factors to be taken into consideration. Also the indicators can become promotional tools through strategic communication approaches. Building indicators for the sustainable development of aquaculture must be perceived not simply as setting up a monitoring system but as an opportunity to define the challenges of sustainable aquaculture development collectively and at various scales.

Postulate 2: As implementing sustainable development is an innovative process, it is based on organizational learning and a specific co-construction approach.

The implementation of sustainable development implies profound changes in production and consumption methods, in ways of thinking and in the objectives to be achieved. A new way of representing society is being developed and therefore a new frame of reference must be adopted. Argyris and Schön (1996) in their book on organizational learning distinguish between simple changes related to practices or actions (single loop learning) and those which involve changes to the fundamental rules and norms underlying action and behaviour (double loop learning). The changes in values brought about by sustainable development imply a development of "metiers" which concerns not only the way of working but also the objectives and the image of the activity. It is therefore important to promote openness and participation as a broader range of stakeholders increases the multiplicity of representations and, in order to facilitate their convergence, requires that the implicit reference frameworks adopted by the actors be transparent.

Postulate 3: The co-construction approach to building indicators promotes organizational learning and helps dialogue.

It should be recalled that the distinctive innovative nature of sustainable development as a new mode of production implies a learning process to build a new related reference framework and related norms. This learning process requires a reflexivity process between actors. Many evaluations of sustainable development indicators stress the role of dialogue support and of mediation in the collective development of these indicators. The co construction approach to building indicators can then constitute a "deliberative and participatory construction" system (Rudlof, 2006) where the lists of indicators are not only end-products of information systems but also "intermediate objects" used to define a reference framework and a common project for sustainable development, in the sense that they are progressively created and that they promote dialogue. The co construction process suggested is a tool to coordinate and accompany the approach and to share information and knowledge relating to sustainable development. It builds more generally on processes of action research, research in partnership or collaborative research which lead to a wide range of implementation methods.

Postulate 4: The co construction approach is an opportunity and often generates organizational innovation.

The co construction approach to building a system of sustainable development indicators is a way to create new standards in a decentralised way within a group of actors. It is no longer the optimum which is sought but a compromise and this is reached by a dynamic process of progressive adjustment. This type of approach where practices which are considered to be positive or innovative are institutionalised is more likely to suit the diversity of actors' values (Cheron and Ermisse, 2008). They then have an opportunity to air their specificities and their constraints and improve the design of the standard. This also provides an opportunity to develop the image of the profession. Such a pro-active approach to sustainable development can also help to place the industry within more global approaches to sustainable development implementation, such as national sectoral approaches, international ecolabels or local agenda 21 strategies. In this way, this approach constitutes a facilitating element for the inclusion of the activity into integrated management systems and local planning.

II. THE DIFFERENT PHASES OF THE APPROACH AND THE USE OF A PCI APPROACH

A guide to the co-construction of sustainable development indicators in aquaculture has been constructed with actors, based on PCI. This type of approach is used for connecting indicators and interacting individual, collective and scientific knowledge. The major role played by institutional conditions and innovations should however be noted for achieving this type of innovation as it can only be developed and operated if structures, which facilitate the learning process and transform knowledge into local useable know-how have been implemented. (Mickwitz et *al.*, 2005; Fraser et *al.*, 2006; Hilden and Rosenström, 2008).

The different phases and stages of the approach

The use of the generic foundation is based on three phases and ten chronological stages which, depending on the case, follow from specific work by the pioneering group or from participatory work by the stakeholders. The pioneering group refers to the team (often small in size, sometimes a single person) in charge of facilitating and co-ordinating the development of indicators, either as the initiator of the approach or because they have been given the task. As specified previously, the co construction approach suggested here is based on a mode of interaction between the members of the pioneering group and the stakeholders involved, which is deliberately flexible and light. It is possible to imagine closer action-research partnerships in the future. The loop suggested here can then be extended becoming the first loop of a spiral where several loops follow one another. This image of a spiral is often used to illustrate a procedural and interactive process, particularly when the learning function is determinant.

Figure 1 shows the links between phases and stages. Three phases set the pace for the implementation of the suggested approach (figure 1):

- ✓ a preparatory phase (four stages) which tends to be cognitive and comprehensive
- ✓ a principle and criteria selection phase, which is at the heart of the approach (three stages) and tends to be comprehensive and participatory
- ✓ a validation phase (three stages) which may be described as participatory, reflexive and cognitive.

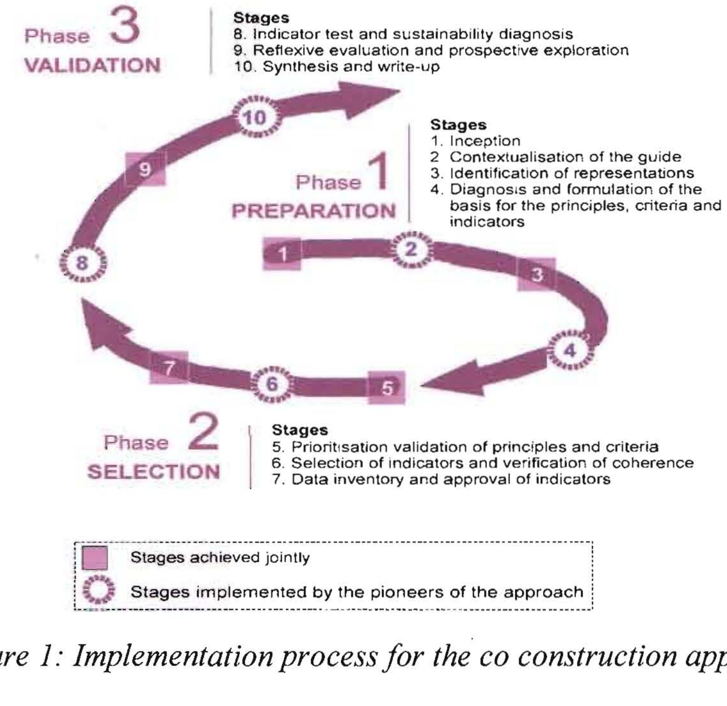

Figure 1: Implementation process for the co construction approach

This implementation process represents an indicative route map which can be amended depending on requirements. The relative weight of the three major phases (as well as the stages within each phase) may differ according to the context and the area. In particular, they may be undertaken in more or less depth, depending on:

- ✓ the level of prior knowledge that the pioneering group has of the aquaculture systems for which sustainable development indicators are being designed (variation depending on the information factor);
- ✓ the level and the types of institutional structure and organization of the aquaculture sector and of their relationship with the exploited areas (variation depending on the governance context).

These two aspects may suggest different variations in the application of the suggested approach. In fact, the information factor will determine the importance of preliminary surveys and the need to strengthen the preparation phase, whilst the governance factor will determine how to organize actors' involvement in the process and will principally affect the selection and validation phases. Changes might also be contemplated according to distance and the geographical dispersion of the actors. If the actors are too widespread, it may be necessary to reduce or cancel collective meetings and replace them with bilateral discussions. Such a situation would necessarily require strengthening the involvement of the pioneering group, which would play an increased role in facilitation and in transmitting information and opinions that are put forward. Finally, it must be stressed that the phases and stages are presented in a linear fashion so as to show the linkages between the stages and to facilitate the comprehension of the approach from an educational point of view. However, the stages are interactive in the sense that retroactive loops can occur with some of the elements which have already been defined in previous stages having to be re-assessed depending on the results achieved at a given time. The process is not set in stone and can develop along the way both in its implementation methods and its objectives.

The Principles, Criteria and Indicators (PCI) approach

Using a cascading approach requires first the definition of the principles expressing the values and issues that underlie sustainability. These principles are then expressed through criteria corresponding to the variables that are appropriate to express these principles (monitoring of states) and to the "forcing" variables that determine the impacts on sustainability (monitoring of interactions). Finally, indicators are the tools used to measure these variables in the form of indices and threshold values which depend on available information and on the social acceptance of the standards they establish. This nesting chain allows for a "traceability" of indicators which then promotes their adoption. The following figure presents this nesting and the types of analyses that were carried out to design the generic basis underlying the PCI.

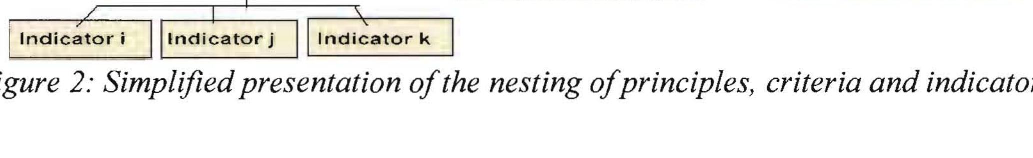

Figure 2: Simplified presentation of the nesting of principles, criteria and indicators

The 13 principles identified (table 1) derive from the identification of the major challenges faced by aquaculture, based on two complementary and interactive approaches:

- ✓ Taking into account the representations of producers and stakeholders in aquaculture systems concerning both aquaculture and the possible and desirable ways to develop towards sustainable aquaculture,
- ✓ Analysing international and national standards represented by existing sustainable aquaculture reference frameworks, and by the recommendations for the implementation of sustainable aquaculture formulated by international organizations, research institutes, professional organizations or NGOs related to the sector or to aquatic ecosystems (Mathé et *al.*, 2006).

Table1: Aquaculture sustainable development principles by dimension of sustainability[2]

Technico-economic dimension	P6- Increase the capacity to cope with uncertainties and crises P7- Strengthen the long term future of exploitations P2- Develop approaches which promote quality
Environmental dimension	P3- Ensure that natural resources and the environmental carrying capacity are respected. P4- Improve the ecological yield of the activity P5- Protect biodiversity and respect animal well-being
Social dimension	P1- Contribute to meet nutritional needs P8- Strengthen sectoral organization and identity P9- Strengthen companies' social investment
Institutional dimension	P10- Strengthen the role of aquaculture in local development P11- Promote participation and governance P12- Strengthen research and sector-related information P13- Strengthen the role of the State and of public actors in putting sustainable development into place

The criteria suggested for each of the thirteen principles identified are listed. It is recommended to set up a standardised numbering system to facilitate classification and links between criteria and principles. The criteria are deliberately simplified to help the memorisation process. They are complemented by a section containing observations specifying their scope. Two columns, respectively S for sector and T for territory (region), refer to the scales and specify whether a criteria refers to the sustainability of aquaculture farms and/or to the contribution that these systems make to the sustainability of the regions where they operate.

A list of indicators corresponding to each criteria (from 1 to 5 indicators) and to each type of approach to sustainability (sectoral and territorial) is established and validated by the actors through interviews and working groups. In total, this involved 188 actors, of whom 70 were producers, 25 were actors in the value chain, 19 represented civil society (NGOs, associations) and 74 belonged to various administrative services. This list constitutes a reference check-list (13 principles, 81 criteria and 234 indicators) whose purpose is to facilitate the choice of sustainable development criteria and indicators whatever the system. It is possible *"as required, by using multiple*

[2] The principles were organized under dimension headings and their numbering corresponds to the frequency with which they were mentioned during interviews.

combinations, to produce various functions of the elements within this list" (Laloë, 2007). The sub-sets of principles, criteria and indicators selected in each of the sites attest to the various make-ups associating 8 to 11 principles, for a number of criteria ranging between 19 and 36 whilst there are between 27 and 87 indicators. This initial common reference framework facilitates comparisons and correlations. A number of similarities emerge in the choices made in the six aquaculture systems studied. It should be stressed again that these correspond to very different aquaculture systems both in their characteristics and in their development paths and states of the aquaculture value chain. Thus, there are 28 criteria common to at least four of the six systems within the 46 criteria concerning the sustainability of the aquaculture enterprises and 13 common criteria among the 27 selected to convey aquaculture's contribution to territorial sustainability. The criteria selected in several sites and/or mentioned by the main reference frameworks, in particular the European Consensus reference framework (EU, 2005), are highlighted in bold text in the check-list in order to increase their chance of being selected and hence to strengthen this feature of convergence.

III. SOME RESULTS OF THE IMPLEMENTATION STAGE

Applying the approach to six aquaculture systems, deliberately diversified in terms of technique, species, territorial type and regulatory system, enabled its functionality to be validated and generated results at several scales.

Sustainability diagnoses at the scale of each aquaculture system

At the level of each aquaculture system, the implementation of the co-construction approach made it possible to establish diagnoses of assets and constraints in relation to sustainable development and sometimes showed different profiles according to the type and size of enterprises. Once a list of indicators for each of the selected criteria has been established, they must be measured in order to produce a diagnosis and set up monitoring. The method used to measure indicators depends on their quantitative or qualitative nature and on the availability and reliability of necessary data. Data used to build indicators can come from several sources (existing institutional and standardised databases; specific data collection: surveys or centralisation of information gathered from different types of actors; construction of standard sectoral or regional accounts; estimations based on expert opinion). Due to their innovative nature, sustainable development indicators cannot always benefit from existing information systems. However, it must be stressed that it is not the measured value (the datum) that is the indicator, but rather its relative position on a scale indicating graduation thresholds or classes that express sustainable development. Therefore, this final approach by sustainability class leads to the recommendation that efforts should be focused on widening the range of measured indicators rather than improving the precision of actual measurements. Indicator measurement is based on the transformation of all quantitative and qualitative data into classes organized in increasing order with respect to sustainability objectives.

The analysis of the number of criteria selected, as a function of the dimension and taking into account the cleavage between a sectoral conception of aquaculture centred on the enterprise (46 selected criteria) and a territorially-integrated approach (27 criteria), led to some interesting findings, in particular the preponderance of enterprise-based criteria. Thus, although the sectoral criteria are quite evenly distributed across the various dimensions, the territorial or area-based approach is particularly related to the environment (carrying capacity) especially as regards the institutional dimension and the economic dimension with respect to the adaptive capacity of enterprises. It should be noted that some principles were rarely selected, in particular those of biodiversity protection, respect for animal well-being and social investment of enterprises. Participation, governance and quality promotion were also mentioned relatively little although the quality approach is often the way in which to engage the social responsibility of enterprises and to implement sustainable development though marketing certification standards and schemes.

This indicates that they considered this project on the sustainable development of aquaculture as an actual management tool that can lead to an improvement of their aquaculture systems. This is fundamentally different from the approaches undertaken in the contexts of labels or standards, where the emphasis is laid on assets rather than on weaknesses.

The detailed analysis of the criteria selection approach showed a tendency for producers to select sectoral criteria whereas stakeholders, especially institutional actors, tended to select territorially-based criteria. This difference justifies the need to use a collective approach with a broad range of actors in order to fulfil the need for a cross-sectional vision and the integration of all the dimensions of sustainable development; this goes beyond the participatory conditions advocated by sustainable development approaches.

Table 2: Number of criteria selected by the 6 sites according to the principles and dimensions of sustainable

	Sector	Territorial		Sector	Territorial
Environment			**Economic**		
Ensure that natural resources and the environmental carrying capacity are respected	**4**	**5**	Increase the capacity to cope with uncertainties and crises	**6**	**5**
Improve the ecological yield of the activity	**4**	**1**	Strengthen the long term future of exploitations	**5**	**0**
Protect biodiversity and respect animal well-being	**1**	**1**	Develop approaches which promote quality	**2**	**1**
Social			**Institutional**		
Contribute to meet nutritional needs	**5**	**3**	Strengthen the role of aquaculture in local development	**2**	**4**
Strengthen sectoral organization and identity	**6**	**1**	Promote participation and governance	**1**	**3**
Strengthen companies' social investment	**1**	**0**	Strengthen research and sector-related information	**5**	**0**
			Strengthen the role of the	**4**	**3**

			State and of public actors in putting sustainable development into place		

Furthermore, through the significance given to the governance dimension and its participatory character, this approach has highlighted the organizational conditions for the appropriation of such a sustainable development policy.Thus, several individual or collective learning approaches may be identified, with reference to Agyris and Schön's learning process (1996). In many cases, working groups have not only brought actors closer together but have also generated requests for institutionalisation of these dialogue mechanisms. In this innovation approach framework (in which the social character becomes central), the multiple and complex relationships existing between innovation and learning will be examined (Mathé et al. 2008).

Comparing sustainability diagnoses at the scale of each aquaculture system

Comparing sustainability profiles at the level of global principles and for both the sectoral and territorial-based approaches shows several types of profile (figures 3 and 4).

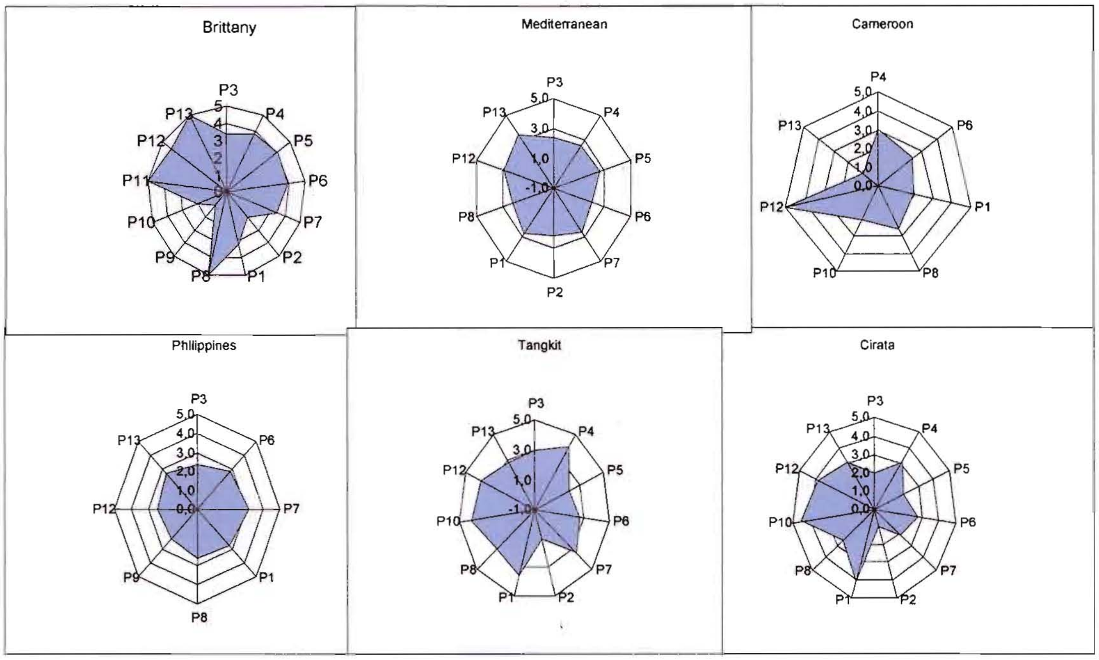

Figure 3: Comparing area sustainability measures by principle at sector level

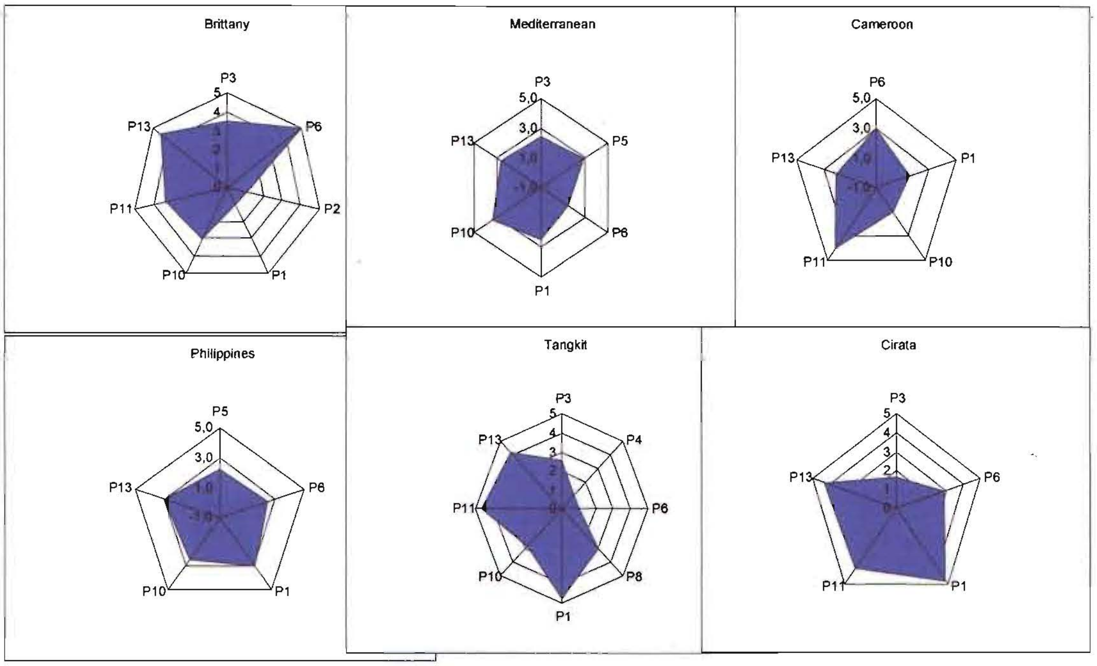

Figure 4: Comparing area sustainability measures by principle at territory level

Three categories by area implying different methods of action can be noted:
1- One area with irregular profile (assets and constraints) but rather well located on sustainability scale (Brittany)
2- Two areas with regular profiles (homogeneity of results) so without specific asset or constraint (Mediterranean, Philippines)
3- Two areas with irregular profiles (assets and constraints) but rather poorly situated on sustainability scale (Cameroon, Indonesia)

These results light the fact that it is possible that the systems which have met with opposition, where the markets are sensitive to signs of quality and are very controlled, are "ahead" in their search for a more sustainable mode of exploitation. This hypothesis is consistent with a definition of sustainable development which emphasises control and responsibility. Taking these aspects into account will progressively lead to changes in profiles. The profile situation (rather well or poorly situated) corresponds to the same hierarchies as the LCA… It goes against a representation based on the contrast between intensive and extensive (results obtained in Brittany and in the Philippines reject the "*preconceived ideas*" against intensive). In fact, LCA analyses questioned the paradigm stating that intensive systems are less environment friendly than nature-like extensive systems. The best scores (highest ecological efficiency and lowest impact on the environment) were obtained for the industrial feed based farms in Brittany, Mediterranean region and Indonesia, and the lowest scores for the enhanced natural productivity based systems in Cameroon and the Philippines. This heterodox ranking established on an environmental basis is nevertheless in good agreement with the results of the multi-criteria evaluation. This finding seriously questions the well accepted typology of aquaculture systems that is conventionally based on the degree on intensification of the system.

CONCLUSION

This paper has described how the co-construction protocol for sustainable development indicators has been developed with actors, using participation and association structures appropriate to each research phase. The PCI system on which is based the construction of the approach represents an organizational innovation. This type of approach is used for connecting indicators and interacting individual, collective and scientific knowledge. The major role played by institutional conditions and innovations should however be noted for achieving this type of innovation as it can only be developed and operated if structures, which facilitate the learning process and transform knowledge into local useable know-how have been implemented. The approach is therefore presented as a guide (Rey-Valette et *al.*, 2008) which has been deliberately designed to be as flexible as possible in order to facilitate its use. It is in fact a kind of route map suggesting some co-ordinates as obligatory control points whilst leaving some freedom as to possible routes between these points and a wide choice of principles, criteria and indicators. It should be noted that the generic framework in no way constitutes a "ready to use" list but rather a reference framework where the most relevant principles, criteria and indicators can be selected according to the challenges, the areas and the types of aquaculture concerned. Finally, looking beyond aquaculture, the authors sought to be pragmatic and educational throughout this guide, enabling the latter to be also a useful reference for regional approaches to building sustainable development indicators relating to other activities or to integrated approaches at the scale of a region. The conclusions of the project clearly emphasise that the sustainable development should not be fractal, especially in view of the contribution of the fish farms to their local, regional or national territory. It is also strongly encouraged to pursue the approach pioneered in this project by taking into account the services returned by and to aquatic ecosystems. The multi-level approach that was implemented during EVAD, and in particular the principle approach was adequate, since it permitted to broaden considerably a scope and vision that otherwise would have been narrow-minded or restricted to the short term. These findings justify the importance given to governance in the suggested approach, both in the implementation method (governance of the indicator construction system promoting the participatory dimension) and in the dimensions of sustainable development where governance is integrated as the fourth dimension of sustainable development. One original feature of this approach is that it can be implemented at different levels and in different sectors. Thus in the Mediterranean, the approach has attracted the interest of the General Fisheries Commission for the Mediterranean (GFCM-FAO) which implemented the INDAM project in November 2008 (Co-production of INdicators for sustainable development of Aquaculture and guidelines for their use in Mediterranean) based on the methodology of SD indicator co-construction developed by the EVAD project. Furthermore, the group of ewe's milk cheese producers from Pyrénées Atlantiques, which is moving towards sustainable development, wishes to adopt this approach.

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Program - Colloque IIFET - 13-16 juillet 2010

Monday

17:30>19:30	Registration (Joffre Area)

Tuesday

8:00>8:45	Registration (Joffre Area)
8:45>10:45	Opening Ceremony (Auditorium Pasteur)
10:45>11:15	Coffee Break (Joffre Area)

11:15>12:45

Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8
SS **Global ocean fisheries (Dyck)**	SS **Recreational fishing (McElroy)**	SS **Integrated modelling (Raux)**	FM **Fishing rights**	FA **Contribution of fisheries to socioeconomic wellbeing**	FA **Fisheries dynamics**	AQ **Aquaculture development**	MO **Fisheries modelling**
Session Chair: Tony Charles	284 Gentner	63 Melaku Canu	295 Sakai	119 Bene	79 Janofsky	17 Kim Anh Nguyen	192 Prellezo
506 Sumaila	286 Bowen	68 Sustersic	332 Dahl-Jørgensen	405 Thilo Stoeven	22 Gordon	129 Jingjie Chu	264 Ling Huanh
509 Dyck	245 McLeod	222 Douguet	354 Yamashita	24 Mafimisebi	449 Le Floc'h	324 Salayo	322 Andersen
519 Munro	380 Abbott		365 Min-Yang Lee	468 Dunham	56 Onestini	352 Franz	307 Run Yu
Panel discussion Gunnar Haraldsson (OECD); Rolf Willmann (FAO), the presenters and members of the UBC Global Ocean Economics project.	522 Gates J.M.		293 Kailis		201 Arias de León		

13:00>14:30	Lunch (Central Room)

14:30>16:00

Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8
SS **Rebuilding fisheries (Khwaja)**	SS **Recreational fishing (McElroy)**	SS **Integrated modelling (Raux)**	FM **Fishing rights**	FA **Contribution of fisheries to socioeconomic wellbeing**	FA **Fisheries dynamics**	AQ **Aquaculture development**	MO **Fisheries modelling**
515 Khwaja	521 Lindner		61 Higashida	173 Kelling	200 Gilbert	97 Villasante	335 Aanesen
Lent	80 Hilger	465 Failler	128 LaRiviere	401 Ling Huang	418 Sigurdsson	109 Adeolu Alabi	475 Zimmermann
Holland	406 Stoeven	ID not Raux	233 Hatcher	348 Takamune Fujii	156 Doering	331 Guettler	327 Steinshamn
Larkin	404 Talhelm	ID not Mongruel	278 Gislason	104 Mafimisebi	409 Da-Rocha	234 McElroy	171 Udumyan
Meere	304 Thébaud						

Time	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8
16:00>16:30	Coffee Break (Joffre Area)							
16:30>18:00	**SS Fisheries aid (Arbuckle)** Leal Neiland Bortey or Nunoo Bâ Tenreiro	**FA Recreational fishing** 28 Lew 81 Hilger 113 Jarvis 256 Olaussen 433 McElroy	**FM Fisheries indicators** 73 Stohs 254 Shallard 377 Cusack 367 Ikerne del Valle	**FM Fishing rights** 195 Gordon 298 Townsend 213 Hamon 292 Van Putten	**FA Contribution of fisheries to socioeconomic wellbeing** 408 Sumaila 107 Bene 434 Chin-Hwa Jenny Sun	**AQ Aquaculture structures and management** 51 Bhattacharya 120 Kusumawati 253 Theodorou 349 Girard	**MA Consumers behavior** 48 Muni Reddy 239 Mesnildrey 261 Fernández-Polanco 460 Mariojouls	**MO Fisheries modelling** 291 Thébaud 99 De Lara 94 Ramirez 473 Lindroos Marko
18:30>20:30	Cocktail (Salon Citadelle Corum)							

Wednesday

H	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8
8:00>10:00	Plenary Session (Auditorium Einstein) (Two keynotes lectures) And Prizes/Awards							
10:00>11:30	Poster Session and coffee break (Joffre Area)							
11:30>13:00	SS **Bycatch reduction (Haynie)** 508 Abbott 510 Haynie 511 Haynie 512 Wilen 513 Holland	SS **Yamamoto prize (Matsuda / Mitsutaku)** VHS Video on Building a 96 Villasante	FM **Fisheries indicators** 230 Van Iseghem 275 Felthoven 483 Ma 130 Stilwell	FM **Fishing rights** 467 Logan 422 Soboil 344 MacLauchlin 430 Knapp	FA **Contribution of fisheries to socioeconomic wellbeing** 141 Voisin Sylvestre 443 Kelleher 462 Lamine Mbaye 312 Eggert	AQ **Aquaculture and environment** 46 Rahman 187 Mathé 238 Yajie Liu 288 Ancev 448 Nielsen	MA **Prices determination** 25 Mafimisebi 110 Thong Tien 441 Chin-Hwa Jenny	MO **Fisheries modelling** 246 Ngwenya 469 Thébaud 315 van Dijk 101 Lindroos 477 Herrera
13:00>14:30	Lunch (Central Room)							
14:30>16:00	FM **Bycatch, discard, selectivity** 77 Hilger 252 Georgianna 269 Sharp 362 Diekert 299 Pascoe	SS **Yamamoto prize (Matsuda / Mitsutaku)** 125 Thiao 72 Pedroza 446 Watanuki	FM **Fisheries indicators** 310 Sampson 323 Lehuta 338 Kitts 476 James Anderson	FM **Fishing rights** 16 Stewart 102 Van Putten 210 Gallagher 424 Rountree 383 Abbott	FA **Small scale fisheries** 170 Uddin 131 Niang Ndeye Astou 385 Britz 218 Fauzi 317 Sourisseau	AQ **Contribution of aquaculture to socioeconomic wellbeing** 55 Mohan Adhikary 211 Khondker Jahan 391 Vagneron 437 Lango	MA **Prices determination** 144 Jinghua Xie 178 Tamaki Morita 457 Thong Tien	TI **Climate change** 224 Ekerhovd 258 Lisa Pfeiffer 343 Hermansen 359 Millerd
16:00>16:30	Coffee Break (Joffre Area)							
16:30>18:00	FM **Bycatch, discard, selectivity** 294 Lallemand 303 Hutton 300 Pascoe 425 Haynie	FM **Fisheries and coastal zone management** 108 Gunawardhana 232 van de Walle 251 Roy 296 De Silva	FM **Fisheries indicators** 161 Steinback 122 Esmaeili 250 Duy Ngoc Nguyen 313 Lalith Amaralal	FM **Fishing rights** 206 Gilbert 290 L.Anderson 350 Uchida 358 C. Anderson 395 Scheld	FA **Small scale fisheries** 381 Macher 36 Pazhani Kanthiah 153 Hospital 219 Zuzy Anna 157 Laloë	AQ **Contribution of aquaculture to socioeconomic wellbeing** 13 Ogundari 62 Bhattacharya 214 Mahfuzul Haque 445 Espaldon	MA **Markets and labels** 86 Tiotsop 139 Cormier-Salem 142 Tsutom Miyata 342 Mongruel	TI **Climate change** 69 Muzaffar Ahmed 138 Norman-López 461 Voss

Thursday

8:00>10:30 — Plenary Session and Prizes/Awards (Auditorium Einstein) (Two keynotes lectures)

10:30>11:00 — Coffee Break (Joffre Area)

11:00>12:30

Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8
FM Bycatch, discard, selectivity	FM Fisheries and coastal zone management	FM Fisheries management plans	SS Food security (Bene)	MO Fisheries modelling	AQ Aquaculture efficiency and management	MA Markets and labels	TI Value of ecosystem services
124 Kahui	217 Berkenhagen	159 Galletti/Chaboud	497 Kawarazuka	135 Doyen	12 Onumah	270 Hiroki	208 Smith Elisabeth
494 Bisack	266 Speir	154 Le Kim Long	498 Troell	155 Flaaten	23 Mafimisebi	340 Razafimandimby	333 Armstrong
306 Kulmala	302 Guyader	314 Metz	520 Josupeit	255 Nøstbakken	65 Olajide	414 Lamprakis	451 McIlgorm
143 Vestergaard	403 Larkin	121 Esmaeili	517 Scholtens	311 Curtin	82 Nasir	480 Young	325 Wattage
		98 Villasante		429 Lazkano	308 Kularatne		

12:30>14:00 — Lunch (Central Room)

14:00>15:30

Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8
SS Marine conservation (Chaboud)	FM Fisheries and coastal zone management	FM Fisheries management plans	SS Productivity measurement (Walden)	FA Bioeconomic analysis of fisheries	AQ Aquaculture efficiency and management	MA Supply and value chains	TI Value of ecosystem services
228 Pascal	417 Galligan	341 Simmonds	78 Squires	41 Belhabib	442 Esobhawan	158 Barclay	411 Wallmo
463 Binet	243 Lesueur	466 Barrett	136 Walden	204 Holland	127 Poot-Lopez	172 Agbebi	413 Lucas
488 David	416 Fraga	287 Ngwenya	486? Pascoe	353 Frésard	263 Hernandez	223 Kelling	276 Harte
490 Chaboud		421 Kinadjian	487? Metzner	220 Kaspersen Wigdahl	447 Mahfujul Haque	371 Guillen	
						169 Tunazzina Sultana	

15:30>16:00 — Coffee Break (Salle Joffre)

16:00>17:30

Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8
FM Ecosystem-based approach to fisheries	SS Co-management (Bene)	FM Enforcement of fisheries management rules		FA Bioeconomic analysis of fisheries	AQ Aquaculture and risk	MA Supply and value chains	TI Marine protected areas
162 Brinson	493 Diemuth Pemsl	147 Abusin		112 Gates	20 Giap Nguyen	319 Gestsson	133 Chaboud
281 Kasperski	518 Mafaniso Hara	167 Arnason		190 Gourguet	126 Loisel	328 Knútsson	262 Rosemary
376 Wilen	140 Pomeroy	427 Lazkano		369 Macher	235 Mcleod	386 Olafur	301 Innes
397 Pincinato	516 Cinner	148 Abusin		273 Cerda-D'Amico	259 Theodorou	410 Trondsen	15 Flaaten
478 Duan		168 Arnason		337 Cisse		412 Ahmed Khan	

18:30>24:00 — Departure by bus to banquet (Level 1 Corum)

Friday

Time	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8
08h00>09h45	**FM** **Fisheries and environment** 180 Makino 184 Baggio 225 Castilla Espino 363 Seijo	**FM** **Fisheries co-management** 67 Rathnaweera 209 Md Golam 309 Takumi Mitani 182 Ha Xuan Thong 320 Firoz Khan Khan	**SS** **Forage fish (Herrick)** 489 Hannesson 491 Fissel 499 Herrick	**FM** **Taxation of the fishing industry** 45 Emami 166 Arnason 267 Smith Martin 268 Murray	**FA** **Fishers behavior** 85 Salas Silvia 114 Jarvis 277 Abernethy 188 Teh 226 De Silva	**AQ** **Aquaculture and risk** 196 Le Bihan 361 Abdulai Fofana 375 Theodorou	**SS** **Global Tuna (Squires)** 271 Minling Pan 339 Kennedy John 345 Jiménez-Toribio 436 Chin-Hwa Jenny	**TI** **Marine protected areas** 283 Rich Little 221 Weigel 207 Alban 330 Kinadjian
9:45>11:00	**Poster Session and coffee break (Joffre Area)**							
11:00>12:30	**FM** **Fisheries and environment** 152 Baggio 185 Ikerne del Valle 282 Chaboud 265 Smith Martin		**SS** **Forage fish (Herrick)** 500 Herrick 504 Hoagland 502 Gakushi Ishimura	**FA** **Risk and uncertainty in the fishing industry** 2 Campos 456 De Alessi 146 Thunberg 3 Metzner R. 84 Salas	**FA** **Fishers behavior** 202 Quillerou 305 Soile Kulmala 356 Bartelings 336 Pérez-Pérez 212 McLeod	**MA** **Seafood processing and international trade** 423 Nóhpal 472 Stringer 474 Simmons 21 Chen Sun 197 Dengjun Zhang	**SS** **Global Tuna (Squires)** ID not Mongruel ID not regist Janofsky ID not Campling Miller ID not Campbell	**TI** **Marine protected areas** 199 Boncoeur 318 Nobuyuki Yagi 132 Conde 260 Enriquez-
12:30>14:00	**Lunch (Central Room)**							
14:00>15:30	**FM** **Subsidies to the fishing industry** 334 Thanh Thi Duy 357 John Anderson 399 Foley 419 Carvalho		**SS** **Forage fish (Herrick)** 501 Hilger 507 Sumaila 514 Walden	**FA** **Risk and uncertainty in the fishing industry** 428 McElroy 198 Woodward 244 Vestergaard 485 Chris Kennedy 60 Thi Thanh Thuy Pham	**FA** **Fishing capacity and buyback programs** 203 Holloway 229 Castilla Espino 316 Coglan 378 Mamula	**MA** **Seafood processing and international trade** 19 Giap Nguyen 100 Somasekharan 280 Dabbadie 285 Gentner 440 Fu-Sung Chiang	**SS** **Global Tuna (Squires)** Run table (Susan Jackson, Bill Fox, Robin Allen, Merryl Williams, Rebecca Lent, Yongil Jeon, Julio Moron ou Michel Goujon)	
15:30>16:00	**Coffee Break (Joffre Area)**							
16:00>17:30	**Closing Ceremony (Auditorium Einstein)**							

Note: when a special session stretches over several slots, the allocation of presentations between these slots is purely conventional. The session time-table will have to be precised by the session organiser.

SS	Special Session
FM	Fisheries Managment
FA	Economics of fishing activities
AQ	Aquaculture Economics
MO	Modelling
MA	Markets and marketing of seafood products
TI	Transversal issues