

IMPACT OF FISHERIES MANAGEMENT SCIENCE: EXPERIENCES FROM DFID'S FISHERIES MANAGEMENT SCIENCE PROGRAMME.

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ABSTRACT

A central objective for UK Department for International Development (DFID) funded research on renewable natural resource systems has been that the research commissioned results in significant positive developmental impacts. This paper describes the outcomes of activities employed by the DFID funded Fisheries Management Science Programme to assess the developmental impact of fisheries management research achieved by projects commissioned under the Programme during the last 11 years. Fisheries pose a particular challenge for the attribution of impacts. A variety of approaches to impact assessment are required, as the systems are characteristically complex, dynamic and heterogeneous. Typically fishery systems operate across multiple scales, involving a wide range of stakeholders with different, and sometimes conflicting, objectives. Fisheries management, usually faced with multiple uncertainties about the system and its dynamics, has to occur at a scale that accounts for both the biophysical scale of the resource and the scale at which there exists the capacity and capability to manage. The paper will illustrate some of the impacts that have been achieved and highlight some of the lessons learned regarding uptake, adoption and impact assessment that should be of interest to researchers and those funding developmental research.

Keywords: Fisheries research, impact assessment, lessons learned, developmental impact

INTRODUCTION

Fisheries, because of both their nutritional benefits and their importance as a traded commodity, can make an important, and often direct, contribution supporting diverse livelihoods. In large areas of South and Southeast Asia, the Pacific, Caribbean and West Africa, fish is particularly important, providing a vital constituent of the rice-based diets of the poor and often represents the main source of animal protein. While fisheries can provide an important source of income, employment and nutrition, they are also at risk from overexploitation. Indeed it is estimated that over 70% of world fisheries are currently fully exploited, overexploited, depleted or recovering and that those resources that are underutilised are often not accessible to poorer fishers [1]. There is therefore an urgent need for better fisheries policies and management strategies that are based on sound information about the status and trends in the resource base, the needs, objectives and constraint of those dependent upon the resource and most appropriate governance arrangements. However, fisheries, and in particular the small-scale fisheries common to many developing countries, are complex, dynamic and diverse socio-ecological systems characterised by considerable management uncertainty. Fisheries management research therefore has an important role to play in reducing the uncertainty and generating the required information in order to ensure that fisheries are exploited sustainably and are able to contribute to improved livelihoods for the world's poor into the future.

Recognising the important contribution that fisheries can play, the UK Department for International Development (DFID) made a ten year commitment to funding management science through the Fisheries Management Science Programme (FMSP). The position of the FMSP within DFID's wider research

strategy has been described [2]. The resulting purpose of the FMSP has been to provide “Benefits for poor people generated by application of new knowledge to fisheries management systems”. In order to achieve this purpose the FMSP sought to achieve four Outputs:

1. Improved understanding of marine and freshwater capture and enhancement fisheries and their contribution to the livelihoods of the poor developed and promoted.
2. Management tools and strategies for marine and freshwater capture and enhancement fisheries most likely to support improved livelihood outcomes of the poor developed and promoted.
3. Mechanisms for the implementation of pro-poor capture and enhancement fisheries management developed and promoted.
4. FMSP research products disseminated and promoted to relevant stakeholders at all levels.

The first three Outputs form the core research themes against which projects commissioned by the FMSP are clustered. The fourth recognises the importance of disseminating and promoting research products generated under the first three.

The approach that the FMSP has taken considers the role that fisheries play in people’s livelihoods (Output 1) and the constraints that exist to improving livelihood benefits. Technical management tools and strategies for capture and enhancement fisheries that will benefit the poor (Output 2) need to be placed in the appropriate institutional environment, and mechanisms for implementing pro-poor management need to be developed (Output 3). Output 4, recognises that the management tools and new knowledge developed by the Programme need to be developed and promoted in order to achieve wider developmental impact.

The FMSP has yielded a number of important lessons about fisheries management and uptake promotion that may be of value to future research activities and programmes in achieving positive developmental impact within both *capture* and *enhancement* fisheries management systems. The identification and description of these lessons and key recommendations will be the focus of this paper.

Assessing developmental impact

It is important to establish from the outset what we mean by the **impact** of the research. While a research project, or series of research projects (described here as a project cluster), may be effective (i.e. achieve or deliver the intended project **outputs**), and may be **efficient** in doing so, they may still have little or no developmental impact. In other words, impact assessment needs to go beyond the project outputs and consider the **context**^a that may be affected by the project activities and outputs and what changes have occurred within this. The impact of a project or cluster is therefore considered to be the resulting change in the context that can be plausibly attributed to the project or cluster activities and use of the associated research outputs.

One way of looking at how research can bring about a change in context is to consider the chain of events required to bring about a change in context (Figure 1). This chain, in its simplest form, involves 1) the **generation** of information, 2) the **sharing** of this information and 3) the **utilisation** of this information. In the first place the information generated by the research project through the activities undertaken, i.e. the research messages and outputs, usually need to be appropriately packaged and promoted to encourage uptake. Once these messages and outputs have been adopted, and/or implemented, then some form of contextual change can be expected.

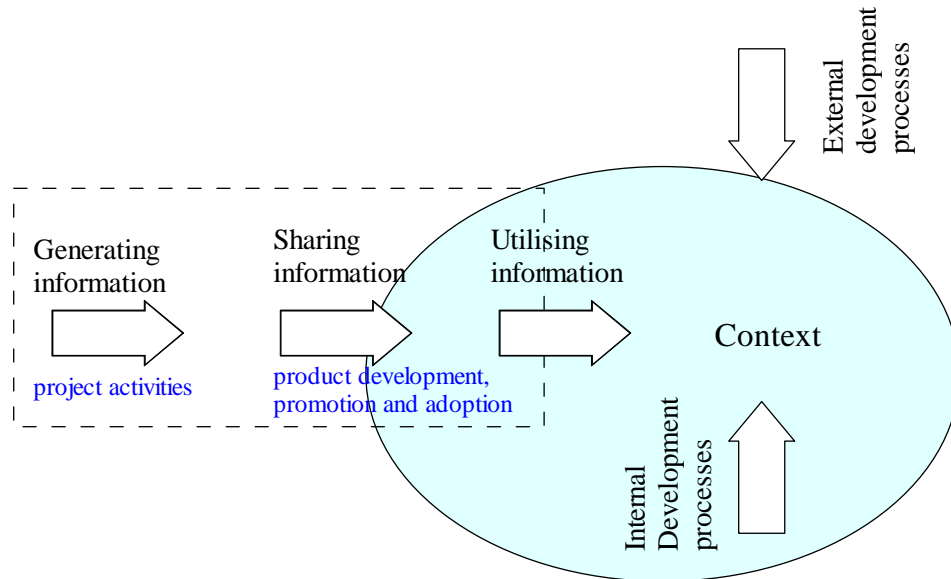


Figure 1. Factors contributing to changes in developmental context (adapted from Herweg and Steiner, 2002).

Presented like this the concept of measuring impact appears straightforward, however this is in fact often not the case. As Figure 1 suggests, the context is not affected only by the particular research project or cluster but instead responds dynamically to a number of other processes both internal (e.g. changing user objectives) and external (e.g. macroeconomic conditions), many of which are believe may be unquantifiable, but which may be more significant than the project intervention [3]. These processes create their own particular opportunities and constraints to contextual change and with which the project or cluster must interact. For example, where fisher incomes have increased in the years after project intervention, it can be difficult to separate the contribution of research from those of extension efforts, changes in demand for fish or changes in employment opportunities. Indeed some of these other influences may hinder the uptake of research outputs. Together these contribute to what has been termed the ‘attribution gap’ [3,4,5]. As time goes on it becomes increasingly difficult to establish the links between the observed changes and the project.

While a considerable literature on the value of agricultural research, rural development and of measuring the impact such projects exists [e.g. 3,5,6,7] there is much less literature concerning the impact of fisheries research and in particular fisheries management research. For example, in an assessment of the returns to research, it was found that only 16 (5.4%) of the 294 case studies examined related to research on natural resources and, of these, the majority concerned forestry research [6]. The paucity of literature on the subject may stem from the difficulty of measuring fisheries management research impact.

Fisheries management research is often aimed at an **enabling^b** level because of the scale at which management decision-making is so often required and the common pool nature of the resource systems. Given these attributes, which distinguish fisheries management from either agriculture or aquaculture, developing the capacity of intermediary beneficiaries, such as government and/or community-based agencies and institutions to manage their resources is typically the most effective means of delivering benefits to the target beneficiaries (the poor). The effect on the livelihoods of the poor is therefore less direct than for focussed research where the outputs are delivered directly to the target beneficiaries, for example the promotion of new seed varieties. A further difference between fisheries and these other production systems is that the research products often have a key aim of preventing overexploitation or

rebuilding stocks rather than increasing production. Therefore the effect of better management may not be increased incomes or yields but, instead, a more resilient socio-ecological system.

It is widely recognised that the utilisation of the outputs of research and resulting change in the context (intended and unintended) take time to develop [3,5,7,8]. For enabling research in particular this time lag may be significant because of the indirect way in which contextual change is achieved. The effect of multiple factors affecting the context can be compounded by this time-lag between fisheries research product utilisation and the resulting change in context [9]. Thus, even if the chain of events described in Figure 1 do occur successfully, it may be difficult to demonstrate contextual change as plausibly attributable to the research. Overall, assessing the impact of fisheries research is therefore fraught with challenges and in some cases may be prohibitively expensive.

METHODOLOGY

Previous fisheries management research impact assessments undertaken by DFID examined either contextual changes for a small selection of individual FMSP projects [9] or the effectiveness of the FMSP management team and commissioned projects in making available new information from good quality science [10]. The latter study examined management arrangements and employed independent specialists to assess the quality of the science undertaken.

In an attempt to address the challenges described above, this study attempted to consider the four stages along the impact pathway illustrated in Figure 1 from project activities that generated new information through the sharing of this knowledge, its utilisation, and finally the changes in context that were believed to have subsequently arisen:

1. Information generation: The effectiveness of the research in generating high quality and relevant new information.
2. Information sharing: The extent to which the methods and communications channels lead to access to the research products by the key communications stakeholders.
3. Information utilisation: The extent to which the research products were adopted and affected policies, institutions and organisations and whether these resulted in improved livelihoods of poor.
4. Resulting contextual change: Where it is possible to measure, the extent to which the capacity to access and manage, livelihoods assets (e.g. natural resources and physical assets) increased due to the project activities and whether this resulted in sustainable positive livelihood streams.

This approach was intended to provide an overall picture that not only determined efficacy at each stage but also assisted in establishing the plausibility of attribution. It was also intended to identify potential constraints to impact and what opportunities had been created.

Data for the assessment was assembled from a variety of sources including project reports and annual questionnaires completed by project leaders. Questionnaires and semi-structured interviews were used to obtain more information on the perception of researchers and research users regarding the quality of FMSP commissioned research as well as the extent to which decision-makers had access to or were using the results from the research. Views were also sought on the extent to which respondents felt that the communications channels used might contribute to further uptake and potential impact (see [11] for further details). In terms of scientific rigour and credibility of research messages, the peer-review process provides a measure of quality assurance and so data on publication in peer reviewed journals and citations were collated.

A representative selection of researchers^c who had been involved in the FMSP as project leaders were interviewed to obtain their perspective primarily on the generation and sharing of information, but also on how the FMSP had managed this process. To identify the researchers, projects were first grouped according to the five FMSP research themes. Where possible, two project leaders from each theme were then selected for interview so that the overall selection as far as possible included balanced representation from both social and natural scientists from both universities and private organisations within each theme (Table I).

Table I. Summary of the key researchers selected for interview.

FMSP Research Theme	Researcher	Number of FMSP projects as project leader	Agency/ University	Discipline
1. Information to inform management-research and influence policy	1	2	University	Social Science
	2	1	Agency	Natural Science
2. Information requirements for including poor fishers in the assessment and management of their fisheries	3	4	Agency	Natural Science
3. Fisheries assessment methods to inform management	4	4	University	Natural Science
	5	3	Agency	Natural Science
4. Pro-poor <u>capture</u> fisheries management strategies	6	2	Agency	Natural Science
	7	2	Agency	Social Science
5. Pro-poor <u>enhancement</u> fisheries management strategies.	8	4	University	Natural Science
	9	2	University	Social Science

As well as the views of individual researchers, an institutional perspective of the FMSP was also sought from a number of agencies with national, regional and international remits. These agencies had either collaborated with FMSP projects and/or were targets of project outputs and were therefore able to provide a more objective perspective on the utility of the FMSP and the chain of events leading to potential contextual change. Agencies were grouped by project cluster and geographic region. The two most important agencies within each region, judged in terms of the total number of projects they had collaborated with, or had been targets of, were then selected for interview (Table II). This process provided a total of three international, eight regional and nine national agencies. Senior members of each agency, or individuals with knowledge of the project(s) were then contacted for their views and opinions.

Table II. Agencies contacted to provide information for the impact assessment.

Location	Geographic Focus	Agency	Means of response
	International	FAO, Rome, Italy	Verbal
	International	WorldFish Center	Verbal
	International	STREAM, Bangkok, Thailand	Verbal
South Asia	Regional	WorldFish Center, Bangladesh	Written
	National	Bangladesh Centre for Advanced Studies	Verbal
South-East Asia	Regional	MRC, Vientiane, Lao PDR	Verbal
	Regional	WorldFish Center, Malaysia	Verbal
	National	RDC, Lao PDR	Verbal
	National	Department of Livestock and Fisheries, Lao PDR	Verbal
Africa	Regional	SFLP, West Africa	Verbal
	National	Institute of Marine Studies, Tanzania	Verbal
	National	DoF, Zanzibar, Tanzania	Verbal
	National	DoF, Dar es Salaam, Tanzania	Verbal
	Regional	WWF, Dar es Salaam, Tanzania	Verbal
	National	Ministry of Fisheries and Marine Resources, Namibia	Written
Indian Ocean	National	Seychelles Fishing Authority	Written
Caribbean	Regional	Caribbean Regional Fisheries Management	Verbal
South Pacific	Regional	SPC	Written
	Regional	Forum Fisheries Agency	Verbal

To obtain more in-depth information on the utilisation of research products and contextual change, the study focussed on three representative clusters of projects from within themes 3, 4 and 5 (see Table I) in the FMSP portfolio^d. Information was sought concerning how the beneficiaries (intermediary and target) had been, or would be affected by the research. This included their perceptions of changes in biological, social and economic conditions as well as in management capacity that could be attributed to the project. The opinions of beneficiaries were regarded as an important indication of the perceived relevance of the research as well as highlighting unexpected or unintended contextual changes. This information was collected primarily through interviews with key informants within each beneficiary group and analysis of catch data (for more details see [12]).

RESULTS

The results will be described in relation to the stages leading to impact, as shown in Figure 1. The first stage is the **generation of credible and relevant information** through the application of rigorous scientific methods. Researchers reported that the FMSP had produced “some of the most useful, rigorous and innovative research in tropical fisheries management” [11]. In this respect, it was felt by a number of respondents, both university and agency, that the positioning of the FMSP at the development/science interface has been productive in terms of both developmental impact and the advancement of science. This was attributed to the fact that the FMSP had enabled researchers to focus on undertaking scientific research that directly addresses important development issues. As such, it was felt that the FMSP had been different to many other funding sources that tend to address either scientific research without reference to development issues or development issues with little or no provision for rigorous research. At the same time it had, for example through demand assessments and by providing continuity through project clusters, allowed researchers to better understand the existing context and enabled management agencies in developing countries to help define the researchable constraints, thus ensuring their relevance.

The recent independent review of the FMSP concluded that several FMSP scientists are at the forefront of research in their fields, undertaking innovative, cutting-edge science in both natural sciences and within interdisciplinary field, producing high-quality peer-reviewed publications [10]. The FMSP publishing and citation record in peer-reviewed journals (Figure 2) provides an indicator of the success in generating high quality information. To date a total of 136 peer-reviewed articles have been produced that have been considered by independent assessors to be of “high calibre” [10]. Moreover, the potential impact of FMSP journal articles^e are amongst the highest of any of the ten DFID funded natural resource science Programmes. FMSP research is also considered to be generally well renowned within the scientific community [10].

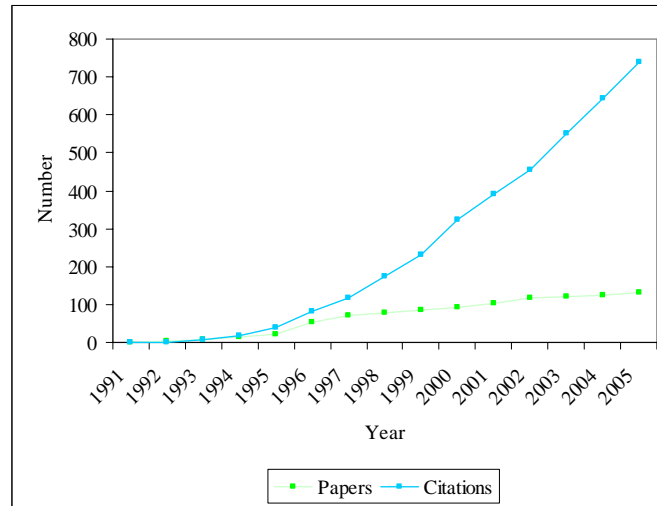


Figure 2. Cumulative number of peer reviewed papers produced and citations

Involvement by Southern partners in the process of generating information has also proved beneficial, and in this respect, the FMSP has been highly valued by a number of those involved. These agencies have also been actively involved in innovative research and this has contributed to the development of their own research capacity^f.

Information needs to be available and accessible to those best placed to use it in management decision-making in order to achieve positive contextual change. Thus effective **sharing of information** is vital both to research and to the management process. While peer-reviewed papers can provide quality assurance and are an effective media for communication within the scientific and academic community, they are less so for other discourse communities, for example policy-makers, resource managers and the, often illiterate, resource users. This has been recognised by the FMSP and projects were commissioned to look specifically at data collection and management and information sharing. Over time, the Programme increasingly emphasised uptake promotion and the translation of research messages into more targeted and accessible formats at the commissioning phase [2]. Researchers have responded, making use of a wide variety of methods from songs, t-shirts and theatre through policy briefs, presentations, workshops and displays to webpages, guidelines and manuals and developing some particularly innovative approaches, to make their messages available and accessible to a range of stakeholder groups. Feedback from a range of intermediary and target beneficiaries during the study suggests that these efforts appear to have been successful in raising awareness and increasing availability of outputs [11]. However, the responses have also indicated that collaborative research activities with an emphasis on communication and a high level of interaction, remain the most effective way to transfer knowledge and simultaneously develop capacity.

The process of sharing information has had an additional benefit in helping to establish links between organisations and individuals, building extensive networks of researchers and practitioners. In some cases, links between researchers, management agencies and fishers have been strengthened, particularly where participatory research processes, such as adaptive learning, have helped to forge these links [12]. As an information supplier, the FMSP has, in the view of international and regional fisheries agencies including FAO and WorldFish Center, demonstrated an awareness of parallel research and development initiatives, ensuring the FMSP activities have been complementary rather than competitive or repetitive [11].

Examples of **utilising information** generated by FMSP have occurred at all levels from local, village, to international level. All of the national, regional and international organisations contacted during the impact assessment indicated that they had adopted or planned to adopt outputs from the FMSP. How the information was used ranged from informing research and/or policy through developing training materials to direct use and application in management planning [11].

In terms of informing research this has not been limited to the many researchers who have cited peer-reviewed papers originating from FMSP funded research. Outputs from FMSP research were also reported to have been highly beneficial in strategic planning by international organisations such as WorldFish Center for planning future research programmes [11]. In the Pacific region, FMSP research generated guidelines for the design and deployment of fish aggregating devices (FADs). This helped inform research on FADs by the Secretariat of the Pacific Community (SPC). The SPC have, in turn, recently assisted Nauru, a country where food security has become a major issue, to deploy two FADs specifically to assist local small-scale fishers [11].

Research outputs have informed course material for universities and training colleges around the world including Plymouth University, Asian Institute of Technology and Bangladesh National University. Stock assessment software developed by the Programme has also been incorporated into training courses run by The Centre for Marine Fisheries Research of India [12].

Examples of the application of FMSP-funded outputs in management are widespread and varied. Following a comprehensive training programme, the West Bengal Department of Fisheries, India, now routinely employ FMSP stock assessment tools to support their management evaluation activities. The FAO's Inland Fisheries Department (FIRI) has also expressed interest in using various outputs to improve resource assessment and management for Lake Victoria, as well as for future co-management projects in Brazil [11].

At the enabling level, FMSP projects have developed a novel and innovative method for evaluating the benefits from licensing foreign fishing, guiding the decision-making process. Application has led to substantial increases to coastal state revenues from fisheries, increased arrests and convictions of illegal foreign vessels, increased employment and increased local processing capacity due to increased use of port services and increased landings [9].

At the local level, primarily in countries in Asia and Africa, decision-makers have been able to access and make use of information to change and improve the way in which they manage their fisheries. This has resulted in impacts on the biophysical, technical, social, economic and institutional aspects of the context that have delivered a range of benefits to the poor who are dependent upon these resources. This has been particularly evident in the more focussed research where there has been a more direct link between the research outputs and those dependent upon the resources.

In Lao PDR, experiments undertaken in collaboration with 38 villages to determine appropriate multi-species stocking strategies under different environmental conditions, suggested that yields could be increased significantly if recommendations resulting from the research were adopted. An evaluation two years later, conducted as part of the impact assessment reported here (see [12]), found that many of the recommendations had subsequently been widely adopted resulting in significant increases in both yield and village income, providing an important source of funds for village development projects.

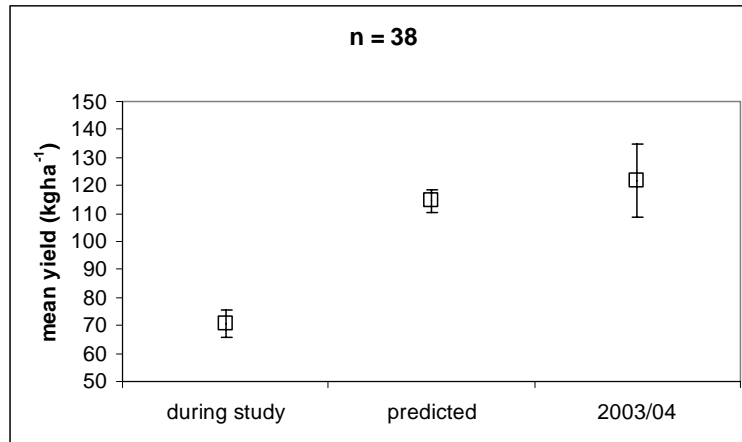


Figure 3. Mean yield recorded across 38 village-managed fisheries in southern Lao PDR during stocking experiments (during study), predicted yield if the information generated were to be applied (predicted) and actual mean annual yield two years later (2003/04).

Research in Bangladesh on the effect of timing irrigation system sluice gate opening upon fish stocks led to recommendations on sluice gate control that could protect fish stocks while providing water for rice field irrigation [13,14]. These recommendations have been applied at sites in Bangladesh by CNRS with funding from DFID's Natural Resources Systems Programme, resulting in reported increases to fish yield and biodiversity. As a final example, in Zanzibar, fishers were able to successfully develop new fishing techniques that enabled them to fish in locations that they would never have gone to otherwise.

DISCUSSION

In practice, the model illustrated in Figure 1 proved useful for guiding enquiry into the process by which research generates developmental impact and the changes that can result. By separating the process into distinct stages, each one could be considered from a range of perspectives. This enquiry has indicated that the Fisheries Management Science Programme has generated significant amounts of new and useful information and products. There is widespread belief amongst international research agencies that the research has been scientifically rigorous and successful in producing new knowledge and in applying and testing existing knowledge and methodologies in new ways. While the costs and benefits of FMSP research has been difficult to quantify (often because of the enabling nature of the research), the limited studies that have been done indicate that the research represented very good value for money with low costs per beneficiary and per unit output [9,15].

Detecting contextual change and plausibly attributing impact was found to be a challenge. It takes time to achieve impact but paradoxically time also diminishes the likelihood of being able to attribute impact to the Programme. This is particularly true for enabling research where the effects on the livelihoods of the target beneficiaries are indirect. Even if it is possible to monitor impact beyond the lifespan of the research, it should be acknowledged that the assessment may overlook impacts beyond the initial focus area or long after the research activities. Our experiences in conducting this assessment have also shown

that assessing and predicting impact beyond the lifespan of research activities is made difficult by the changing needs and priorities of intermediary and target beneficiaries. These can influence decisions concerning uptake and adoption and make it difficult to reliably predict future impacts.

The process of generating, sharing and using information was found to have contributed in many cases to augmented management capacity, which, in turn, has led to improved management performance with accompanying benefits to those dependent on the fisheries, including the poor. Within projects, it was found that when the process of sharing information has required or included participatory methods with an emphasis on 'learning by doing', there have been additional benefits, including improved institutional and individual capacity to formulate and evaluate management plans and activities. The assessment of the Programme has also highlighted a number of lessons that can inform future research activities and Programmes as follows.

Uptake and positive impacts are more likely when the supply of information meets local demand. Demand assessments, raising awareness of issues and available information amongst stakeholder groups, and demonstrating the potential benefits from adoption, are all important in achieving adoption, use and contextual change. Experiences with participatory research within the FMSP have suggested that this can best be achieved if Southern partners (including resource users or their legitimate representatives) are involved in the conceptualisation of the research as well as its implementation. Experiences have indicated this should be **active** involvement and that where such involvement fell short the perception of the research outputs could be affected. In addition, Programme continuity and momentum are important to maximise impact. The Programme was funded for eleven years and in this time has achieved continuity and momentum by allowing research, and research partnerships, to develop via a number of related projects, clusters and themes (see [2] this volume, for details). Continuity and momentum were however sometimes compromised by changes in the geographical focus that were required as a result of DFID's changing priorities.

Uptake promotion became more important in the latter years of the FMSP with increased attention paid to communication. Experiences showed that for uptake promotion, peer reviewed journal articles and relatively passive methods such as guidelines or websites are not enough to achieve uptake and impact without supporting active promotional initiatives. Organising these initiatives around a Programme communications framework appears effective. Such a framework helps to ensure coherence across the products and messages being communicated and that the products and messages are both appropriate and accessible to the potential users.

In conclusion, the FMSP has managed to achieve rigorous and relevant science that has resulted in positive developmental impact primarily because it has managed to effectively fund research for development rather than conducting academic research with development funds. Maintaining this 'purpose vision' has been important in achieving continued developmental impact. However it is important for any development orientated research activities or programme to acknowledge that a potential conflict exists between the desire of researchers to produce peer-reviewed academic journal type outputs and the need for research messages to be available in accessible formats to a wider range of audiences. The creation of appropriate incentive structures or well defined roles for researchers should be considered.

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ENDNOTES

- a) Herweg and Steiner (2002) consider the context to comprise the biophysical, socio-cultural, economic and political environment in which the project operates

- b) DFID refer to enabling, inclusive and focused activities: Enabling actions are those that address the wider policy and institutional environment, and include measures in support of the policies and context for poverty reduction. Inclusive actions are broad-based, and aim to improve opportunities and services, and also address issues of equity and barriers to participation of the poor. Focused actions directly address the rights, interests and needs of poor people.
- c) The selected researchers were either the leaders or co-leaders on 41% of all FMSP projects.
- d) FMSP identified eleven series of projects (clusters) within the five themes shown in Table 1. The three clusters selected for more in depth study represent 25.09% of total FMSP expenditure.
- e) Based upon the journal impact factor scoring system.
- f) While capacity development was not within the remit of the FMSP for much of the eleven years, projects did manage to find ways to undertake capacity development activities.

This paper was funded by the UK Department for International Development (DFID) under the Fisheries Management Science Programme (FMSP), managed by MRAG Ltd. The views expressed are not necessarily those of DFID. Further information about the FMSP may be found at www.fmsp.org.uk