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Research and Development in the Philippine Fisheries Sector

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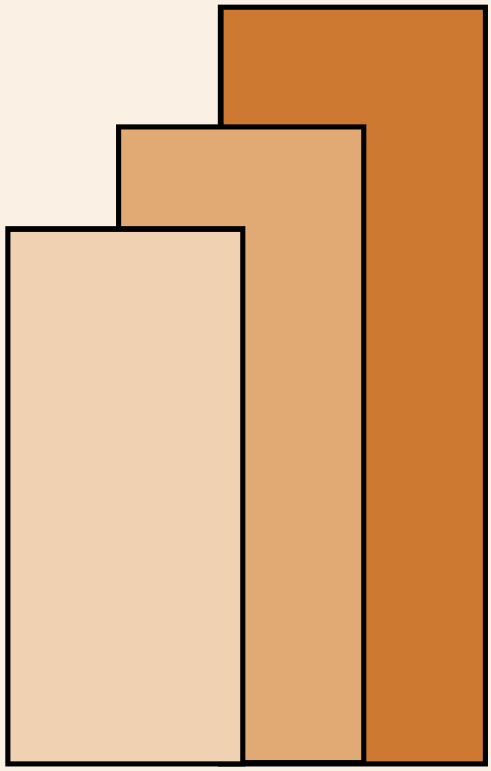

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PHILIPPINE INSTITUTE FOR DEVELOPMENT STUDIES
AND THE
DEPARTMENT OF BUDGET AND MANAGEMENT

RESEARCH AND DEVELOPMENT IN THE PHILIPPINE FISHERIES SECTOR (FINAL REPORT)

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Research and Development in the Philippine Fisheries Sector[1]

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I. Introduction

Performance of the Fisheries Sector

The Philippine fisheries sector has been performing poorly in recent years. In general, for the 1992-1996 period, total output increased but at declining rates (Tables 1 and 2). Of the three subsectors, commercial fisheries registered a growth trend similar to the whole sector while municipal fisheries consistently declined. Aquaculture rose at relatively higher rates, but its growth trend was decreasing also.

The relative shares of the fisheries subsectors to total output changed over time due to their varying performance. Historically, municipal fisheries has been the largest contributor. By 1996, however, it was only second to aquaculture in value of production although it remained the top producer in volume (Figure 1).

The anemic performance of the fisheries sector is partially reflected in foreign trade figures as well. For most of the 1992-1996 period, fish imports grew faster and exceeded fish exports in quantity although the latter was greater than the former in value throughout the period (Table 3 and 4).

The poor performance of the fisheries sector is striking when compared to those of the whole economy and crop agriculture. Over the 1992-1996 period, both the gross national product (GNP) and crop agriculture production

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grew at much higher rates than did fisheries production (Tables 5 and 6). As a result, the ratios of fisheries output to the national and crop agriculture production progressively decreased over time.

While the fisheries sector has slowed down, the domestic demand for fish has been fast increasing. Driven by a continuously growing population, the national fish requirement has expanded more than the supply, resulting in growing deficits over time (Table 7). Fish importation has increased to meet the growing domestic demand but, even with it, the per capita availability of fish remains way below the per capita requirement.

There is little question that despite its weak performance, the fisheries sector remains an important component of the economy. Traditionally, it has been a major source of employment for the population. The country has about a million fishermen and fish-farmers (Table 8). In addition, an estimated 12 percent of the general population derive their livelihood from fisheries-related activities. Fish is also critical to national health and nutrition, being the source of about 75 percent of the total animal protein requirement of the country, more than poultry and livestock combined.

Development Problems in the Fisheries Sector

It is generally recognized that the weak performance of the fisheries sector has been the result of several interrelated problems which were left unattended over a long time (Guerrero 1997, PCAMRD 1996b, and BAR 1991). In summary, these problems are as follows:

a) resource depletion in coastal waters due to the overfishing and destructive fishing, as manifested by the deterioration of important fish stocks and species and the degradation of ecosystems;

b) large-scale environmental damage, as evidenced by the destruction of coral reefs and mangroves in marine areas and the pollution of major rivers and lakes;

c) proliferation of industrial, agricultural, commercial and domestic activities which discharge pollutants into marine waters, contributing to the deterioration of ecosystems and rendering marine food potentially harmful for consumption;

d) prevalence of poverty among municipal fishermen, which leads to the vicious cycle of continuing dependence on and overexploitation of dwindling marine resources and deepening poverty;

e) low productivity in aquaculture due to the scarcity of fry in milkfish culture, high cost of production inputs and diseases in prawn culture, ride tide problem in mussel and oyster culture, and other reasons;

f) underutilization of the off-shore and Exclusive Economic Zone (EEZ) by commercial fishermen which is made worse by the uncontrolled poaching by foreign fishermen; and

g. high postharvest losses, at about 30 percent of total output, that is exacerbated by the limited number of ways through which fish are processed for both local and foreign markets.

Of the above problems, resource depletion in coastal waters and poverty among municipal fishermen are considered the most severe and urgent (ADB 1997). Thus, notwithstanding the need to produce more to reduce deficits, the main development issue in fisheries today is not simply how to raise output. Beyond this immediate challenge are the pressing concerns of sustainable resource use and poverty alleviation in the coastal areas. The latter, in particular, has gained special prominence with the ascendancy of a new national administration which declares uplifting the plight of the poor as utmost priority.

Role of R&D in Fisheries Development

Research and Experimental Development (R&D) is defined as any systematic and creative work undertaken in the physical, natural, mathematical and applied sciences by using scientific methods in order to increase the stock of knowledge and the use of this knowledge in these fields to devise new applications. R&D certainly plays a key role if the fisheries sector is to be revived. Primarily, this is because it will generate the new information and technologies that can increase output above current low levels. Beyond this impact, R&D has additional relevance given the environmental and social state in fisheries. It can develop effective policies and management approaches for the rehabilitation, protection, enhancement and long-term sustainable exploitation of resources and the alleviation of poverty in the coastal areas.

Recently, two important laws, the 1997 Agriculture and Fisheries Modernization Act or AFMA (R.A. 8435) and the Philippine Fisheries Code of 1998 (R.A. 8550), were passed to modernize the agriculture and fisheries sectors. These laws recognized the importance of R&D and allotted sections for the reorganization and consolidation of research and development activities in the concerned sectors. Fittingly, their stated objectives institutionalized sustainable resource use and poverty alleviation as major goals of fisheries development along with increased production (Congress of the Philippines 1998 and 1997a).

Objectives of the Paper

Given the important development role it plays, this paper aims to review the current state of R&D in the fisheries sector with the end purpose of identifying problems and then formulating recommendations for addressing them. The specific objectives of the paper are to: a) review the status of fisheries R&D, including its institutions, manpower and budget; b) assess its performance; c) identify its important constraints; and d) recommend measures for improvement. It is hoped that this paper will contribute to the

effort of improving the fisheries R&D system that is expected to follow with the passing of the two aforementioned laws which cover the sector.

The paper uses secondary data and information from fisheries agencies and previous works on fisheries R&D. In addition, it also utilizes primary data and information gathered through a recent survey of selected fisheries institutions done by the Philippine Institute for Development Studies (PIDS) and interviews with key informants.

II. Status of Fisheries R&D

Organization

The responsibility of managing and coordinating fisheries R&D in the Philippines has been the task of the Philippine Council for Aquatic and Marine Research and Development (PCAMRD). The Council, which is under the Department of Science and Technology (DOST), is specifically mandated to plan, monitor and evaluate fisheries R&D by virtue of Executive Order 128 of 1987.

The organizational structure and linkages in fisheries R&D is illustrated in Figure 2. Horizontally, the PCAMRD has established the National Aquatic Resources Research and Development System (NARRDS) made up of national centers, zonal centers and over 30 public and private fisheries R & D member institutions (Table 9). The main function of this network is to serve as the implementing arm of fisheries R&D by conducting basic and applied research and technology transfer activities. In the conduct of specific projects, individual members coordinate with the Council and receive from it grants for research and manpower development.

Other than the individual institutions, the PCAMRD links up with international institutions involved in fisheries research such as the International Center for Living Aquatic Resources Management (ICLARM) and the Southeast Asian Fisheries Development Center – Aquaculture

Department (SEAFDEC AQD). Furthermore, the Council and the NARRDS cooperate with the local government units (LGUs), non-governmental organizations (NGOs), private organizations (POs), and government organizations (GOs) in technology dissemination and adoption. This cooperation is pursued directly through the joint conduct and sponsorship of technology transfer and commercialization activities, such as the pilot testing of new technologies and related activities.

Vertically, the PCAMRD interacts with two government agencies whose R&D scope covers the fisheries sector. These are the Bureau of Agricultural Research (BAR) of the Department of Agriculture (DA) and the Ecosystem Research and Development Bureau (ERDB) of the Department of Environment and Natural Resources (DENR). These agencies are mandated to coordinate all research of the regional offices and line agencies within their respective departments. The BAR covers fisheries research because fisheries is administratively classified under the agriculture sector. The ERDB does so since aquatic resources form part of the natural resource base and, therefore, falls under the coverage of the DENR.

The interactions between the PCAMRD, BAR and ERDB are centered in three specific areas. First, in terms of delineation of coordination and monitoring functions, the Council sets overall direction and policy guidelines and the direct supervision of R&D activities of the NARRDS while the other two institutions are responsible for the R&D activities conducted by their regional offices and line agencies. Second, in terms of R&D budget preparation, BAR and ERDB are responsible for preparing the annual consolidated list of DA/DENR research proposals in fisheries with their corresponding budgets which they then submitted to PCAMRD for monitoring purposes. The Council exercises the function to review and recommend to the Department of Budget and Management (DBM) research budgets, including those coming from the DA, DENR and other agencies. Third, in terms of organization, the three agencies are tasked to discuss matters of mutual concern and interest through a joint technical working committee which meets every quarter.

The PCAMRD and the other two government agencies also in ways other than the above. They consult each other in the development of research thrusts and priorities, improvement of methodologies and identification of gaps in the fisheries sector R&D. They assist each other in activities related to the adaptation, verification and dissemination of new technologies and in the joint review and approval of some research projects. Furthermore, they share personnel expertise and information and jointly conduct personnel development activities.

Expenditures

Estimates of the yearly R&D expenditures for fisheries and agriculture and natural resources show that for the period 1982-1995, annual expenditures at current prices for fisheries R & D averaged P45.82 million (Table 10). This constituted .004 percent of the average annual GNP, .019 percent of average annual agriculture/forestry/fisheries gross value added (GVA), and .102 percent of average annual fisheries GVA. As percentage of government expenditures, the fisheries allocation comprised only .03 percent of the average national government expenditure. Over time, expenditures have been growing at an average of 23.67 percent annually (Table 11).

By program, marine fisheries benefited the largest share of expenditures, at around 60.59 percent of the total, on average, while inland fisheries/aquaculture and socioeconomics shared 34.07 percent and 5.34 percent, respectively (Table 12). By commodity, species classified under basic domestic needs had the largest share of expenditures, at around 51.90 percent, on average, while species classified under export winners and other priority areas (OPAs) shared 28.70 percent and 19.40 percent, respectively (Table 13).

Breakdowns of R&D expenditures by selected institutions for 1992-1996 are presented in Tables 14 and 15. Among the national institutions, the share of appropriations coming from their own funds averaged 34.74 percent

while that generated from external sources averaged 65.26 percent. When SEAFDEC AQD is included, the share from own appropriations rose to 41.34 percent while that from external grants declined to 58.66 percent. By source of external grants, local sources provided an average of 61.92 percent of the total grants received by the NARRDS members while foreign donors allocated 38.8 percent. With SEAFDEC AQD included, the share of local sources declined to 54.39 percent while the percentage contribution of foreign funds rose to 45.61 percent.

Manpower

Data on the number and distribution of manpower resources show that as of 1996, a total of 754 researchers were involved in fisheries R & D (Table 16). Of these number, 8.89 percent have doctoral degrees, 34.35 percent have masteral degrees and the rest were bachelor degree holders and associates. Most of the doctorate degree holders were working in Luzon and the Visayas and only a few were situated in Mindanao. Although reliable data cannot be presented, it has been reported that more R&D personnel work in aquaculture and inland fisheries than in the marine fisheries (PCAMRD 1996a).

Fisheries R&D manpower has certain characteristics other than the above. In 1998, the average number of manpower for all categories in selected NARRDS institutions is a small percentage of the number of people working in SEAFDEC AQD (Table 17). Furthermore, the average graduate to undergraduate staff ratio, technical to non-technical staff ratio, and age of staff for the former are lower than for the latter (Table 18). Gender wise, however, both NARRDS institutions and SEAFDEC AQD are about equal, with a little more female than male staff in their rosters.

III. Performance of Fisheries R&D

National Performance

At the aggregate level, there is a dearth of secondary data and information useful for measuring the actual performance and development impacts o fisheries R&D. At the level of institutions, programs and projects, the same thing is also true. In general, production technologies generated by institutions have not been intensively analyzed in term of actual development impacts. Likewise, the institutions as well as the programs and projects they run generally have not undergone similar evaluations. This lack of assessment at both the macro and micro levels renders an assessment of overall fisheries R&D difficult.

Despite the lack of past evaluations, the poor performance of the fisheries sector in the areas of production, sustainable resource use and poverty alleviation in recent years already speaks a lot about the limitations of R&D as a development tool in the sector. It is either that R&D has not been producing the results expected from it or its results have not been effectively extended to and utilized by practitioners in the private sector and government. This particular failure on fisheries R&D in the Philippines and in other Southeast Asian countries has been noted by the World Bank (1991).

Publication Performance

In the absence of past evaluation, an option which can be done here is to look into other parameters which can provide some indication of fisheries R&D performance. One such parameter is the output of fisheries in term of refereed publications. This measure will provide a partial indication of R&D productivity, and, therefore, performance.

For R&D in general, the output in terms of publications in international refereed journals has been disappointing (Lacanilao 1997, 1996a, 1996b, and 1995). Not only is the country lagging behind other countries in the number of

journal publications, less than half of the few publications which have been produced so far were authored by Filipinos. Also, most of the publications were done only by a very select group of performing national institutions and locally-based international institutions (Tables 19 and 20).

In the case of fisheries and agriculture, in particular, figures indicate that the R&D in the former sector may have been performing a little better than the latter sector in terms of publications with Filipino authors (Table 21). However, as in overall R&D, the fisheries publications have been few and most of these come only from selected institutions (see Table 20). This dearth in publications in fisheries is further evidenced by the low number of refereed journal articles which were authored by local researchers (Table 22).

Fisheries Sector Program (FSP)

At the micro level, R&D performance can be partially assessed by looking into one activity, the FSP, which was evaluated ex-post. Although this program cannot represent the whole sector, the exercise is worth doing because it was one of the biggest budgeted fisheries endeavors in recent years.

The FSP was implemented by the DA from 1990 to 1995. After its termination, its performance was intensively analyzed by PRIMEX and ANZDEC (1996). The evaluation indicated that its research component may not have lived up to its billing. The component had a low approval rate of about 20 percent for the research projects proposed for funding (Table 23). Furthermore, one year after the termination of the FSP, the completion rate of research projects remained low, at 52 percent. The low approval rate may have reflected the poor quality of the research proposals and some degree of incompetence among the researchers, especially since only a portion of the total funds allocated for research was eventually used . Likewise, the low completion rate may imply a certain degree of inefficiency in the way R&D activities were conducted.

In addition to the above, the evaluation of the research component of FSP generated other negative comments. Overall, the evaluation concluded that the research activities under FSP may not have addressed many of the important objectives in fisheries. Among the reasons cited were that research projects conducted were actually “pet” projects of institutions which were neither specifically aimed at addressing FSP concerns nor relevant to the geographical areas covered by the program; the distribution of research projects was highly skewed in favor of aquaculture and within this subsector, research allocation for addressing priority problem areas was inappropriately low; and research conducted on the environment, coastal resources management and the optimum utilization of aquatic products which were previously identified as important concerns were limited.

Summary

In brief, an intensive analysis of the performance of fisheries R&D cannot be done due to the lack past studies and available data and information. However, the available evidence show that fisheries R&D did not perform well in term of publication in international refereed journals. The evaluation of the research component of the FSP also indicated low approval and completion rates for projects and other problems. While the evidence are scanty, they are consistent in implying that R&D still has a long way to go as an engine of fisheries development.

IV. Problems in Fisheries R&D

This section discusses the problems constraining fisheries R&D in the Philippines. The problems are identified through a review of the relevant literature and discussions with key informants coming from both the private sector and government.

Institutional Issues

Poor collaboration

As explained earlier, the PCAMRD is the agency tasked to manage and coordinate overall fisheries R&D while the BAR and the ERDB coordinate fisheries research of the regional offices and line agencies of their respective departments. Because of the similarity in functions and constituency, potential overlapping existed between the three agencies. To address this problem, they delineated their functions through existing Memoranda of Agreements (MOAs). Implementation of these agreements, however, has been hampered by poor collaboration. In particular, in violation of the MOAs, the agencies do not actually jointly review all research proposals submitted for funding (PCAMRD 1995). Furthermore, collaboration is weak or does not exist in several activities and strong only in one aspect (Table 24).

Potential duplication

The Fisheries Code may have created a duplication problem between the PCAMRD and the Bureau of Fisheries and Aquatic Resources (BFAR). The law reconstituted the BFAR from a staff to a line bureau under the DA and assigned it the function of formulating and implementing a Comprehensive Fishery Research and Development Program. To effect this program, the law created a new agency within BFAR, the National Fisheries Research and Development Institute (NFRDI), which will become its main research arm. Among the functions of this agency is the establishment of a national infrastructure which will facilitate, monitor and implement various research needs and activities of the fisheries sector and the establishment, strengthening and expansion of a network of fisheries-related communities through effective communication linkages nationwide. These functions of the BFAR and the NFRDI may duplicate those of the PCAMRD. For one, the responsibilities of formulating and implementing an overall plan for fisheries R & D and coordinating its implementation are mandates of the Council. Likewise, the Council has already established a network of research institutions, the NARRDS, to serve as implementing arm for fisheries R&D. At a larger scale, the duplication of functions in the R&D programs of the

fisheries and agriculture sectors has been noted by the Agricultural Commission (Congress of the Philippines 1997b).

Streamlining problem

Under which agency and department should the task of managing, coordinating and implementing R&D fall is a long running issue that has a life of its own in fisheries circles. At present, this question is far from settled. The Agricultural Commission (Congress of the Philippines 1997b) argued that R&D in fisheries and agriculture in its totality should be the mandate of the DA. However, the Philippine Fisheries Code is vague on this as it merely that while the NFRDI is the national R&D arm in fisheries, it will form part of the National Research and Development Network of the DOST.

It must be mentioned that contrary to the position of the Agricultural Commission and other proponents, there are many actors in the fisheries sector who strongly believe that the present Council system operated by the DOST is the rational approach to running R&D. This said, this streamlining issue must now be considered, especially in light of the large current fiscal deficits faced by the government brought about by the economic crisis.

Capability Issues

Low public investment

Perhaps the most glaring resource-related problem in R&D is the historically low government funding that agriculture as a whole receives, a case which was already shown here (Tables 10 and 11). In developed countries, average public spending on investment in agriculture R&D is about two percent of their agricultural GVA. In contrast, only about .019 percent of GVA is allocated locally. Regionally, the Philippines has the lowest R&D allocation for agriculture in Asia (Congress of the Philippines 1997b).

For fisheries, in particular, allocation averaged only about .102 percent of fisheries value added which is close to what agriculture is getting. However, the fisheries R&D budget is only about 3.6 percent of the total

expenditure for agriculture and natural resources R&D combined. Thus, compared to agriculture and natural resources, fisheries is getting the worse end of the deal in the sharing of government funds.

A look at disaggregate data indicates that not only is government funding for fisheries R&D low, it is also unevenly divided between institutions. In 1996, among the NARRDS members, the budget in total magnitude and as ratios to number of researchers and projects differ widely (Tables 25 and 26). It can be seen also that the ratios of budget to number of researchers and projects were low for many institutions, including some zonal centers.

To address the problem of low budget for agriculture and fisheries R & D, the AFMA stipulated that allocations be increased to least one percent of GVA by year 2001. For its part, the Fisheries Code legislated the creation of a special fund for fisheries R&D of the initial amount of P100 million. The AFMA is mute regarding the sharing of funds between agriculture and fisheries. Assuming that allocation will be proportionate to output contribution, then the budget for fisheries should jump substantially from its current levels. There is already doubt that the planned increases in allocations will fully materialize soon given the mounting fiscal deficits.

Low private investment

Data on private investment in fisheries R&D are scarce. This is understandable given the natural aversion of the private sector to divulge information. This notwithstanding, it is known that private entities have been involved in one way or another in R&D, especially in applied research and technology verification activities where the likelihood of generating new technologies for immediate commercial application is high.

A lot of the private sector involvement in fisheries R&D is in aquaculture. During the rapid development of this industry in the last twenty years, private firms have been collaborating with national institutions and locally based international research agencies in the conduct of applied

research covering many commodities, including prawn, tilapia, milkfish, crab and other commercially profitable species.

In the commercial fisheries, private sector participation in R&D is limited since research in capture technologies usually require larger investments and results are difficult to patent. Also, a lot of the research activities, such as stock and resource assessments, have social externalities which go beyond the private interests of private operators and, thus, are better left to government and international research agencies to conduct. The common practice in the commercial fisheries has been to use imported technologies outright or modify to some extent said technologies to suit local requirements and needs.

In the municipal fisheries, private investment in money terms is low because the poor economic position of the municipal fishermen practically prevents them from doing such investment. However, manpower involvement in R&D is substantial among fishermen and their families by way of participation in the conduct of numerous coastal resource management and similar projects undertaken by government and international agencies.

Available data show that overall, the share of private investment in fisheries R&D is low (Table 27). To promote this type of investment, the AFMA encourages government research agencies to go into co-financing agreements with the private sector provided that the terms and conditions of the agreements are beneficial to the country. For reasons already cited, the possibility of these agreements actually happening will be higher in aquaculture that in the commercial and fisheries subsectors.

Low foreign investment

Figures show that the contribution of foreign funding for fisheries R&D was more than half of total funding (Table 27). In recent years, however, this share has gone down (Tables 15 and 16). By 1996, only 7 percent of the total funds of NARRDS institutions come from foreign sources (Table 28).

Furthermore, funding was concentrated only in a few concerns, mostly the environment and OPAs.

Foreign funding is important because it is essentially a signalling mechanism. Low outside investment for domestic R&D could mean that local research institutions and their programs are not internationally competitive and vice versa. Furthermore, in this time of economic crisis, foreign money may be the only viable way of increasing allocations. The AFMA and Fisheries Code did not address the issue of international funding for R&D.

Untimely release of funds

Aside from the low allocations, a commonly cited fund-related problem in fisheries R&D is the untimely release of government funds to institutions, programs and projects. In fact, this constraint is true not only for R&D but also for other activities depending on government support. In fisheries, it is acute because of the importance that time and season play in the conduct of activities. Although there are no data which can be used to validate this, research activities are reported to be cancelled or haphazardly conducted because of the delay in the release of funds.

The review of the FSP pointed out other problems related to the management of government funds (PRIMEX and ANZDEC 1996). These include the excessive control by the Department of Budget and Management (DBM) over a large proportion of program funds, the diversion of some funds to other activities not necessarily directly related to the program, the lack of coordination between the DBM and program administrators regarding fund utilization, and the lack of a financial monitoring system for the funds.

Shortage of manpower

Earlier figures show that the NARRDS institutions relatively have limited R&D manpower at all levels. (Table 16). They also indicate that personnel capability varies greatly between regions and programs and that senior personnel, especially those with doctorate degrees, are concentrated only in a few institutions (Table 17). The limited number of doctorate degree

holders has been compensated for in some cases by masteral degree holders. While this is so, it cannot be denied that more doctorate degree holders are required in NARRDS institutions to provide the organizational and research leadership.

A comparison of selected NARRDS and NARRDN institutions suggests that the manpower in fisheries R&D is no more than 10 percent of that in agriculture although the percentage of Ph.Ds is a bit higher (Table 29). This proportion is highly uneven and not reflective of the higher ratio of fisheries output to total agricultural production (see Table 10). The graduate to undergraduate ratio of fisheries R&D staff appears to be significantly lower compared to that of agriculture also.

The problem of limited manpower in fisheries R&D, especially in institutions located in the provinces, deserves attention because of the rural nature of many fisheries activities. Researchers working in the countryside are more exposed to the actual problems in fisheries and are in a better position to correctly identify priority research areas for implementation. More of them should be recruited then to enhance the capability of the sector to conduct hands-on and meaningful, instead of “ivory tower”, research.

The Fisheries Code did not address the problem of limited R&D manpower in fisheries. The AFMA, on the other hand, stipulated the creation of a science fund to sustain career development. Since, the manpower problem is directly related to funding. the planned increases in the total R&D allotment, should they materialize, will go a long way towards addressing it.

Low level and poor maintenance of capital assets

While the data presented here concentrate only on funding and personnel resources, capital resources such as buildings, facilities and equipment, also help determine the success or failure of R&D. In fisheries, the capital resources for R&D have been wanting, more so in provincial institutions which receive smaller shares of the research budget. The problem of inadequate capital assets is worsened further by poor maintenance. There

have been reports that proper maintenance is sometimes sacrificed by institutions to meet more immediate expenses, such as salaries and wages. In sites close to the sea, the faster deterioration of capital assets brought about by salt makes the problem of poor maintenance very serious.

Like the manpower problem, the inadequate and poor maintenance of capital assets are functions of funding. If the NARRDS institutions get a raise in their allocations, they could purchase enough of the capital assets and spare money for maintenance. Again, the solution rests a lot on the materialization of the increased allocations promised by the AFMA and Fisheries Code.

Management Issues

Top down and reactive approach

The management approach in fisheries R&D at present has been described as predominantly emanating from the top and generally reactive to the pronouncements of sectoral and commodity-based policy objectives (PCAMRD 1997). Projects and programs are usually evaluated, recommended and approved on the basis of set priorities determined mostly at the top, such as the Science and Technology Agenda for National Development (STAND). The top down approach reduces the participation of local communities and constituents in R&D and potentially excludes their interests in the setting up of priorities and activities. Furthermore, the commodity oriented nature of research may have concentrated mainly on production and sacrificed the other important goals of sustainable resource use and poverty alleviation.

Wrong research practices

Another management issue in fisheries R & D is the prevalence of wrong practices in the conduct of research, in particular, the propensity of researchers to publish research results not in international refereed journals, as already cited earlier, but in the form of gray literature, or written information produced without adequate peer review or pre-publication evaluation, such as

research papers in institutional reports and conference proceedings. Lacanilao (1997, 1996a, 1996b, and 1995) explained that this mistake has led to the non-validation of research results by competent experts and the misplaced packaging and dissemination of technologies based mostly on unverified information.

The poor publication record of R&D can be traced back to other inappropriate practices in the educational and research systems, including the non-requirement of the publication of the thesis research of graduate students, incorrect granting of research incentives based only on progress reports, and the granting of recognition and awards not based on quality research outputs.

Unattractive incentive system

An important factor affecting publication performance is the inadequate incentive system prevailing in government funded R&D. In most cases, minimal financial incentives are granted researchers conducting research using the funds of their own agencies. Remuneration from projects funded by other government sources have been low also (Lacanilao 1997). This inadequate incentive system encourages many researchers to do odd jobs not related to research or consulting work for the private sector and international organizations.

The Magna Carta for the Government Science and Technology Personnel (R.A. 8439) was recently passed to address the problem of low incentives in government R&D. This law allows the provision of honoraria, share of royalties, hazard allowance and other benefits to science and technology workers. It remains to be seen if the total benefits from the law would be comparable to the returns from consulting and other income generating activities of research personnel.

Lack of evaluation of performance and development impacts

There is a dearth in studies which extensively assess the performance and development impact of fisheries R&D as earlier cited. This is certainly

disappointing given the already long history of fisheries research and the fact that ex-post assessment of completed research activities should be a major basis for future funding support.

The limited expertise within institutions and the emphasis of research on pure technology generation are among the reasons why performance evaluation and impact assessment have been left out in R & D activities. Another is that, in general, the use of actual development impacts as a yardstick of performance is not yet a norm in R&D. Still is that the function to evaluate are not clear mandates of the institutions tasked to manage fisheries R&D. For instance, the stated responsibilities of the PCAMRD, and for that matter the new NFRDI, do not include R&D ex-post evaluation and impact assessment as part of their duties (PCAMRD 1995 and Congress of the Philippines 1998).

No system of accountability for institutions

Lack of system of accountability

Because of the lack of ex post evaluation and impact assessment, an effective system that holds institutions accountable of the results and value of their research is not yet in place in fisheries R & D. In general, institutions continue to get their funding from government or elsewhere irrespective of how they did in the past. Consequently, under-performing research institutions, the so called “white elephants”, may remain in business to the detriment of government service.

Low Emphasis on Socioeconomics and Policy Research

There is bias against socioeconomics and policy research in fisheries R & D. Available figures show that, over the years, this type of research comprise only a small proportion of the non-technical studies conducted in fisheries (Table 30). In addition, other important areas of study, for instance the role of fisheries in nutrition and health, have been left out. Earlier, data also indicate than the manpower and financial resources for socio-economic

and policy research have been low relative to other research concerns (Table 27).

The low emphasis on socioeconomics and policy research is directly related to the inability of institutions to conduct performance evaluation and analysis of development effects of research activities. It also limits their ability to develop and implement activities that will pursue the non-production-oriented goals of the sector.

Uneven allocation of resources between commodities and sectors

There is an uneven allocation of resources in the conduct of commodity-based research in fisheries, as reflected by the mismatch in the allocation of funds by commodities and their contribution to output. For instance, data on the funding allocation of PCAMRD monitored research projects for 1996 show this (Tables 31 and 32). Of the export commodities, crab which had the highest export value was only next to seaweed, which had the third highest export value, in fund allotment. Of the commodities for domestic needs, small pelagics which had the highest production value only had the second highest funding, behind tilapia which contributed the least output. Even in terms of budget to project ratio, there are significant differences in the allocations between commodities (Table 33). The uneven allocation of research funds across commodities in the agriculture sector as a whole was also cited by the Agricultural Commission (Congress of the Philippines 1997b).

At the level of sectors, the sharing of funding is likewise skewed. For instance, about 50 percent of the total number of researchers are into aquaculture which contributed much less than this percentage to output (PCAMRD 1996a). Interestingly, many NARRDS institutions continue to fund aquaculture activities significantly even when the government is already allocating so much on the sector through SEAFDEC AQD.

Low level of cooperation and networking between institutions

Although figures cannot be presented to support this claim, cooperation and networking among locally based fisheries R&D institutions is generally low (PCMRD 1997a). To promote cooperation and networking in the regions, fisheries research consortia exist but these organizations are beset with problems (PCAMRD 1995). Similarly, interactions between local institutions and locally based international counterparts have been generally minimal. As a case in point, joint projects between SEAFDEC AQD and UPV, which are physically closely located, have been few. Except for some sporadic engagements, the same is true for ICLARM and NARRDS institutions.

A couple of years ago, the PCAMRD established R&D zones and designated zonal centers to promote regional cooperation and networking between institutions. Despite this, it can be assumed that the problem remains especially among institutions which consider themselves as fierce competitors instead of close allies in fisheries R&D.

Weak link between research and extension

Other than funding, poor extension is probably the most often accused fall guy in fisheries R&D. Yet, this problem is very real (e.g. PCAMRD 1997). While strictly speaking, extension does not fall within the domain of R&D, the former has a dominant significance to the latter as a development instrument. Without effective extension, the technologies and information generated by R&D would not reach their intended users therefore negating the rationale for conducting research in the first place.

Poor extension worsened in the early part of this decade when the extension function in fisheries was devolved from the BFAR to the LGUs. As most of the latter did not have the manpower and financial capabilities to perform it effectively, extension suffered. With the reconstitution of the BFAR back as line agency, it will conduct extension again. The success of the agency in this effort depends much on its ability to put back its regional offices and assemble the corresponding manpower and resources for the purpose.

V. Conclusions and Recommendations

In summary, the three most important concerns in fisheries today are decreasing growth in output, unsustainable resource use, and poverty among municipal fishermen. Fisheries R&D may have been generally ineffective in helping address these problems. Over time, it has accumulated problems of its own which need correction for it to become a potent engine of fisheries development. Below are some recommendations on how to address the problems in fisheries R&D.

Institutional Issues

The institutional problems identified here are actually interrelated in the sense that if effective streamlining is implemented, improved coordination and reduced duplication will likely follow, other things the same. Hence, streamlining, or the lack of it, is the main institutional problem to tackle.

This paper strongly recommends that streamlining must be given top priority by the national government and leaders in the fisheries sector. A study should be immediately conducted that will look into the best approach for streamlining. The group to conduct the study should be composed of representatives from the different R&D institutions, other related public agencies and the private sector.

There are some streamlining approaches which can be considered even now. One is to directly eliminate the duplicating structures in fisheries R & D by putting only under one roof the task of fisheries R&D management. This means the merging of the PCAMRD and NFRDI into one agency which will also exercise the fisheries R&D functions of the BAR and ERDB. The potential benefits from this approach is a reduced bureaucracy and increased efficiency over the long term. The losses are adjustment and dislocation costs in the short run. If a merger is implemented, the question of which department fisheries R & D should fall will be decided. Legally, the DA has

the upper hand because the Fisheries Code, being a law, takes precedence over previous executive orders that may run counter to it.

Another structural approach that may be followed is maintaining mostly the structural status quo but strictly dividing the areas of responsibility among the different agencies. For example, PCAMRD may be limited to managing R& D among the SCUs and similar institutions, the NFRDI will absorb the fisheries function of BAR and exercise management responsibility among the DA field offices and agencies, and the ERDB will continue its function among DENR field offices agencies. If funds and personnel are adjusted proportional to the reduced areas of responsibility of the institutions, this approach will also improve efficiency over the long run and at the same time relatively limit the adjustment costs in the short term.

Still another approach that deserves consideration is functional in nature, which is to again maintain the structural status quo but strictly define the functions of the different agencies. For instance, the PCAMRD may be tasked to manage basic and upstream research while the NFRDI would be responsible for applied and downstream research. This alternative could also lead to improved efficiency and reduce adjustment costs if proportional reductions in the resources of each agency are done.

Deciding which of the numerous potential streamlining approaches should be eventually implemented will require a detailed evaluation that will investigate all aspects, including financial, institutional, legal, social and even political feasibility. If there is strong will on the part of the national government, there will be little doubt that streamlining can be effected. If no streamlining can be done in the end, the least the existing agencies could do is improve collaboration by strictly complying to existing MOAs. In addition, a new MOA between PCMRD and the NFRDI must be drafted and religiously followed by the two agencies.

Capability Issues

It seems futile to discuss research funding at this point when the government is forced to cut down expenses due to the public deficits brought about by the economic crisis. Yet, if precious additional money can be squeezed and then used wisely, it will certainly help improve the capabilities of institutions to conduct good research. Presently, strong leadership is what is most needed in the competition for scarce funds. Hopefully, the newly appointed Undersecretary for Fisheries, the soon to be appointed head of the NFRDI and the Executive Director of the PCAMRD will band together and take the lead to ensure that at least a substantial portion of the funds promised by the AFMA and Fisheries Code will be forthcoming to the sector.

On the issue of low private investment, stimulating an increase is tricky because business may only get into research activities that have direct relevance to profitability. In addition, business is retrenching and very cautious in their investment commitments in light of the economic crisis. Thus, proper selection and prioritization of applied researches which can be co-financed by the private sector are necessary. Once identified, these potential areas of cooperation must be vigorously promoted.

To promote private investment in R&D, an attractive incentive package will be needed in most cases. Potential attractants are the grant to private financiers of the right of first access to information and technologies generated by a research activity and ready technical assistance from the beneficiary research agency to the private financiers. To promote participation further, the option of providing certain tax-based incentives to private entities may be explored.

Overall, to determine the level of private involvement in R&D on a continuous basis, it is recommended that the agencies concerned should implement a system for monitoring business investment in research, including those conducted without government participation. Data gathered will help

provide a more complete picture of the total resources available for fisheries research.

The problem of low foreign funding in fisheries R&D may be approached in a similar way as private investment. Institutions must identify areas which are attractive to international donors and come up with an effective approach to generate foreign investment. As in the case of private funding, incentives may have to be provided. Potential attractants are the provision of local counterpart funding, joint authorship, and subsidized expatriate personnel and office space.

To effectively generate both private and foreign funds, it is also recommended that the function be made part of the job description and performance evaluation of R&D administrators and researchers. Incentives should be awarded to management and research personnel on the basis of their ability to generate external funds from any source.

The problem of untimely release of public R & D funds and other issues related to fund management have their roots in the large bureaucracy and the chaotic system with which the public purse is being disbursed. Because the problems are pervasive across sectors, hope is high that the new officials of the DBM will place efficient fund management as a priority objective. Little more can be beyond this but the expectation that this time, the problems will be corrected.

The shortage of manpower in fisheries R & D in general can be addressed not just by increasing public funding for it but also by promoting external study grants and other forms of support for staff development. Foreign grants for studies at the graduate level, especially for doctorate degrees, should be actively sought by R&D institutions at all level by establishing strong linkages with fisheries-oriented educational institutions abroad. Likewise, institutions must allocate a regular sum from its annual budget for staff development, funds which are earmarked solely for the purpose and cannot be diverted to other uses.

Because of the lag in manpower, fisheries institutions must spend relatively more on staff development than their agriculture counterparts. To address locational and institutional bias, the managers of nationally granted scholarships must see to it that grants are rationally distributed across institutions and regions. This way, rural and smaller institutions will not be left out in the staff development process. To effect these and the other changes, a study that will inventory the existing manpower in fisheries R&D, identify gaps and limitations, and develop the most effective and equitable staff development program to address the gaps is in order.

The problem of limited capital resources is analogous to that for limited manpower. Hence, a study must also be done which accounts the capital asset resources of fisheries R&D, identify gaps and limitations, and search for effective solutions. At the risk of being redundant, public funding must be subsequently generated to immediately address areas of high priority. In addition, efforts must be done to generate private and foreign donations for high priority projects, such as the improvement of the libraries of local research institutions which can only be described as grossly inadequate at present.

Lastly, to promote proper maintenance, institutions should allocate money solely for the purpose, a fund which cannot be juggled to other activities. Furthermore, since maintenance is a function not only of funding but also of individual care, institutions should develop and effective accountability system which will punish careless users of equipment, and reward the careful ones.

Management Issues

The current management system in fisheries R&D should be transformed into one which a) gives appropriate consideration to each of the objectives of increased production, sustainable resource use and poverty alleviation, and b) promotes greater participation from its final constituents, which are the private practitioners and public decision-makers. To attain this

transformation, it is recommended that a study be conducted that will develop the methodology for correctly weighing the sectoral objectives and the innovative schemes that will promote more participation from both the higher and lower rungs in fisheries R&D.

Even without a study, it is clear that the allocation of R & D resources in fisheries leaves much to be desired, objective wise. In particular, there is a preponderance of production-related activities at the expense of other objectives, especially poverty alleviation. This paper recommends that poverty alleviation be upgraded as a goal of fisheries R&D, by way of injecting more investment into activities that address them. Increased funding should be afforded non-technical research, such as those on health and nutrition, socioeconomics and policy, and other issues which are relevant to the alleviation of poverty. Furthermore, despite the increasing number of foreign funded projects in the subsector, additional investment should be allocated to municipal fisheries research not only because it is the central arena for addressing environmental and social concerns in fisheries but also since we need a local and unbiased perspective of the problems there.

Between sub-sectors and species, it was shown earlier that the current allocation of R&D resources is not consistent to measurable indicators, such as contribution to output. Along this line, the importance given aquaculture and some cultured species deserves a second look. Perhaps, local institutions should spend less money on aquaculture research and certain other cultured species since government investment in SEAFDEC AQD is already substantial. It is also suggested that concerned institutions should meet periodically to streamline their activities and minimize duplication in aquaculture R & D.

There is no doubt that the problem of poor publication and wrong research practices should be addressed if R&D is to progress. The proposals of Lacanilao (1997; 1996a; 1996b; 1995) be seriously considered by fisheries R&D managers. Among the most important ones are the undertaking reforms in the local educational and research systems and the granting of

incentives for researchers to published. The implementation of these measures to correct wrong research practices should raise the production of reliable and verified technologies and information from fisheries R&D in the future.

It is recommended that fisheries R&D institutions take evaluation and impact analysis of R&D activities as part of their regular functions. Results of these studies should be used to measure performance of institutions and researchers and serve as basis for future funding support. Furthermore, a system that holds researchers and institutions accountable for their performance should be put in place to reduce the incidence of underperforming institutions and individuals.

As mentioned, the problem of networking is only partly addressed by the creation of zonal centers for fisheries R&D. Much remains to be done to improve networking among local institutions and between them and locally based international institutions. Aside from the structures already in place, R&D managers should look into the possibility of establishing professional associations at the zonal or lower levels to support the networking role of zonal centers.

Finally, the goal of effective extension will be served if all agencies and institutions doing it will pull their acts together. Since BFAR is now the undisputed leader in extension, so to speak, it should take the lead in the coordination of extension. It is suggested that BFAR give the highest priority to the rebuilding of its extension infrastructure which lost when it was turned into a staff agency years ago. In addition, it should extend its hand of friendship and cooperation to the other local and international institutions doing training and extension in the country.

References

Asian Development Bank (1997). Report and recommendation of the President to the Board of Directors on proposed loans to the Republic of the Philippines for the Fisheries Resource Management Project.

Bureau of Agricultural Research (1991). National Fisheries Research Program 1990-1994. Department of Agriculture, Elliptical Road, Diliman, Quezon City.

Bureau of Agricultural Statistics (1997a). Fisheries Statistics of the Philippines 1992-1996. Department of Agriculture, Quezon City.

Bureau of Agricultural Statistics (1997b). 1996 Philippine Fisheries Profile. Department of Agriculture, Quezon City.

Congress of the Philippines (1998). The Philippine Fisheries Code of 1998. Metro Manila.

_____ (1997a). The Agriculture and Fisheries Modernization Act of 1997. Metro Manila.

_____ (1997b Report and recommendations of the Congressional Commission on Agricultural Modernization.

De Jesus, C. C., L. G. Bondoc and A.G. Maghirang (1997). Policy research in the fisheries sector: Status, Direction and Priorities. Philippine Council for Aquatic and Marine Research and Development, Los Baños, Laguna.

Guerrero, R. D., III (1997). The sustainable development of Philippine fisheries resources. Philippine Council for Aquatic and Marine Research and Development, Los Baños, Laguna.

Lacanilao, F. (1997). How to improve R & D capability. Paper presented at the 1997 UP Faculty Conference, Subic, 18-21 May 1997. Marine Science Institute, University of the Philippines, Diliman, Quezon City.

_____ (1996a). We Should Do R & D the Right Way. In *Policy Update*, Vol. 4 No. 4: pp. 1-8.

_____ (1996b). Understanding research and development. In *The CODHEND Teacher*, Vol. 7 No. 1. Pp. 1-8.

Lacanilao, F. (1995). Research and development problems of fisheries. Lecture presented at the Scientific Symposium “Sustainable Development of Fisheries Resources”, National Research Council of the Philippines, University of the Philippines, Quezon City.

National Statistical Coordination Board (1997). Philippine Statistical Yearbook.

Philippine Council for Aquatic and Marine Research and Development (1997a). An identification of a rational approach to the development of the fisheries sector. Los Baños, Laguna.

_____ (1997b). PCAMRD Annual Report 1996.

_____ (1996a). An analysis of the R and D investment in the fisheries sector. Los Baños, Laguna.

_____ (1996b). National Marine Science Research and Development Program.

_____ (1995). Towards improving R & D management in the fisheries sector. Los Baños, Laguna.

Pacific Rim Innovation and Management Exponents, Inc. and ANZDEC Ltd. (1996). Fisheries Sector Development Project, Phase I Report, Vol. II: Fisheries Sector Program Review. 86 p.

World Bank (1991). Fisheries and aquaculture research capabilities and needs in Asia. World Bank Technical Paper Number 147, Fisheries Series.

Yap, Wilfredo (1997). Can the Philippines produce enough fish for the multitude? In *Aquaculture Asia*, Vol. II No. 3. pp. 32-38.

Table 1. Philippine fish production, by subsector, 1992 -1996						
		1992	1993	1994	1995	1996
	Quantity (Metric Tons)					
	All sectors	2,625,607	2,631,945	2,720,989	2,784,316	2,769,239
	Commercial	804,866	824,356	859,328	893,232	879,073
	Municipal	1,084,360	1,013,969	992,578	972,043	909,248
	Aquaculture	736,381	793,620	869,083	919,041	980,918
	Value (Thousand Pesos)					
	All sectors	65,443,532	70,212,299	80,212,118	83,056,620	83,140,854
	Commercial	16,800,653	18,021,205	20,714,470	25,065,358	24,555,340
	Municipal	22,656,385	22,031,352	24,474,929	26,463,833	25,373,175
	Aquaculture	25,986,494	30,159,742	35,022,719	33,527,429	33,212,339
Source: BAS (1997a).						

Table 2. Annual growth rates of Philippine fish production, by sector, 1992 - 1996

	1993	1994	1995	1996	Average
Quantity (%)					
All sectors	0.24	3.38	2.33	-0.54	1.35
Commercial	2.42	4.24	3.95	-1.59	2.26
Municipal	-6.49	-2.11	-2.07	-6.46	-4.28
Aquaculture	7.77	9.51	5.75	6.73	7.44
Value (%)					
All sectors	7.29	14.24	3.55	0.10	6.29
Commercial	7.26	14.94	21.00	-2.03	10.29
Municipal	-2.76	11.09	8.13	-4.12	3.08
Aquaculture	16.06	16.12	-4.27	-0.94	6.74

Source: Table 1

Table 3. Philippine exports and imports of fishery products, 1992 –1996						
		1992	1993	1994	1995	1996
	Quantity (Metric Tons MP)					
	Exports	131,915	163,745	172,080	169,746	164,673
	Imports	221,545	208,895	241,194	270,213	262,587
	Net Exports	-89,630	-45,150	-69,114	-100,467	-97,914
	Value (Thousand Pesos)					
	Exports	11,090,306	14,074,021	15,027,333	15,656,803	15,110,548
	Imports	2,496,379	2,249,188	2,505,466	2,923,590	3,178,130
	Net Exports	8,593,927	11,824,833	12,521,867	12,733,213	11,932,418
Source: BAS (1997a).						

Table 4. Annual growth rates of Philippine exports and imports of fishery products, 1992 - 1996					
	1993	1994	1995	1996	Average
Quantity (%)					
Exports	24.13	5.09	-1.36	-2.99	6.22
Imports	-5.71	15.46	12.03	-2.82	4.74
Net Exports	49.63	-53.08	-45.36	2.54	-11.57
Value (%)					
Exports	26.90	6.77	4.19	-3.49	6.30
Imports	-9.90	11.39	16.69	8.71	6.72
Net Exports	-37.60	-5.89	-1.69	6.29	-9.72
Source: Table 5					

Table 5. Gross national product, crop agriculture production and fisheries production in the Phiilippines, 1992-1996

		1992	1993	1994	1995	1996
	Value (Million Pesos)					
	GNP	1,374,838	1,500,287	1,736,382	1,958,932	2,282,958
	Crop Agriculture	172,710	177,699	209,018	234,494	275,232
	Fisheries	65,444	70,212	80,212	83,057	83,141
	Ratios (%)					
	Fisheries / GNP Ratio	5	5	5	4	4
	Fisheries / Crop Agriculture Ratio	38	40	38	35	30
Source: NSCB (1997) and Table 1						

Table 6. Annual growth rate of gross national product, crop agriculture and fisheries production in the Philippines, 1992 - 1996

	1993	1994	1995	1996	Average
Value (%)					
GNP	9.12	15.74	12.82	16.54	13.37
Crop Agriculture	2.89	17.62	12.19	17.37	12.52
Fisheries	7.29	14.24	3.55	0.10	6.30

Source: Table 3

Table 7. Philippine fish requirement based on 36 kg per capita assumption, net supply, and shortfall, 1985 -1994

Year	Requirement ('000 mt)	Supply ('000 mt)	Deficit ('000 mt)	Imports ('000 mt)	Per capita supply (kg)	
					W/out imports	With imports
1985	1,979	1,676	303	6	31	31
1986	2,019	1,755	263	33	31	32
1987	2,059	1,775	284	68	31	32
1988	2,100	1,790	310	117	31	33
1989	2,142	1,873	269	141	32	34
1990	2,185	1,937	248	131	32	34
1991	2,263	2,037	226	145	32	35
1992	2,313	2,013	300	145	31	34
1993	2,363	1,983	380	119	30	32
1994	2,413	1,966	447	124	29	31

Source: Yap (1997).

Table 8. Estimated employment in fisheries, 1996

Sector	Number of persons	%
Aquaculture	258,480	26.09
Municipal	675,677	68.19
Commercial	56,715	5.72
TOTAL	990,872	100.00

Source: BAS (1997b).

Table 9. Membership of the National Aquatic Resources Research and Development Systems (NARRDS), 1998

Member Institutions	Address	Classification
Zone 1. Northern Luzon Aquatic Resources R & D Zonal Center: Don Mariano Marcos Memorial State University		
Don Mariano Marcos Memorial State University (DMMMSU)	Bacnotan, La Union	
Mariano Marcos State University (MMSU)	Curimao, Ilocos Norte	
Benguet State University (BSU)	La Trinidad, Benguet	
Pangasinan State University (PSU)	Lingayen, Pangasinan	
Cagayan State University (CSU)	Tuguegarao, Cagayan	
Nueva Viscaya State Institute of Technology (NVSIT)	Bayombong, Nueva Viscaya	
Central Luzon State University (CLSU)	Muñoz, Nueva Ecija	NC
Department of Agriculture Regional Field Unit I (DA RFU I)	San Fernando, La Union	
Department of Science and Technology Cordillera Administrative Region (DOST CAR)	La Trinidad, Benguet	
Department of Agriculture Regional Field Unit II (DA RFU II)	Tuguegarao, Cagayan	
Department of Science and Technology Region III (DOST-Reg.III)	Capitol Ground, San Fernando, Pampanga	
Department of Environment and Natural Resources Region I (DENR-I)	Florentino Bldg., San Fernando, La Union	
Department of Agriculture Regional Field Unit III (DA RFU III)	San Fernando, Pampanga	
Department of Science and Technology Region I (DOST-Reg.I)	DMMMSU, CET Campus, San Fernando, La Union	
Department of Science and Technology Region II (DOST-Reg.II)	Nursery Cmpd., Tuguegarao, Cagayan	
Department of Environment and Natural Resources Region II (DENR-Reg.II)	Nursery Cmpd., Tuguegarao, Cagayan	
Department of Environment and Natural Resources Region III (DENR-Reg.III)	San Fernando, Pampanga	
University of Northern Philippines (UNP)	Vigan, Ilocos Sur	
Department of Agriculture Cordillera Administrative Region (DA CAR)	La Trinidad, Benguet	
University of the Philippines Marine Science Institute	Bolinao	NC
Zone 2. Southern Luzon Aquatic Resources R & D Zonal Center University of the Philippines Los Banos		

University of the Philippines Los Banos (UPLB)	College, Los Banos, Laguna	NC
University of the Philippines - Marine Science Institute (UP-MSI)	Diliman, Quezon City	NC
University of the Philippines Institute of Biology (UP-IBS)	Diliman, Quezon City	
Palawan State University (PSU)	Aborlan, Palawan	
Catanduanes State College CSC)	Virac, Catanduanes	
National Mapping and Resources Information Agency (NAMRIA)	Fort Bonifacio, Makati City	
Ecosystem Research and Development Bureau (ERDB)	College, Los Banos, Laguna	
Environmental Management Bureau (EMB)	Kamias Road, Quezon City	
Bureau of Fisheries and Aquatic Resources (BFAR)	Arcadia Bldg., Quezon Ave., Quezon City	
Department of Agriculture Regional Field Unit V (DA RFU V)	San Agustin, Pili, Camarines Sur	
Bicol University College of Fisheries (BUCF)	Tabaco, Albay	
Department of Agriculture Regional Field Unit IV (DA RFU IV)	ATI Bldg., Diliman, Quezon City	
Department of Environment and Natural Resources Region IV (DENR-Reg.IV)	1515 L & S Bldg., Roxas Blvd., Manila	
Department of Science and Technology Region IV (DOST-Reg.IV)	Jamboree, Los Baños, Laguna	
Department of Sscience and Technology Region V (DOST-Reg.V)	Rawis, Legaspi City	
Department of Environment and Natural Resources Region V (DENR-Reg.V)	Patio Napal Bldg., Legaspi City	
Protected Areas and Wildlife Bureau (PAWB)	Balara, Quezon City	

Zone 3. Visayas Aquatic Resources R & D Zonal Center
University of the Philippines in the Visayas

University of the Philippines in the Visayas (UPV)	Miag-ao, Iloilo	NC
Iloilo State College of Fisheries (ISCOF)	Barotac Nuevo, Iloilo	
University of San Carlos (USC)	Talamban, Cebu City	
Northern Iloilo Polytechnic State College (NIPSC)	Estancia, Iloilo	
Panay State Polytechnic College (PSPC)	Mambusao, Capiz	
SUML	Dumaguete City	
Eastern Samar State College (ESSC)	Borongan, Eastern Samar	
University of Eastern Philippines (UEP)	Catarman, Northern Samar	
CCST-RIFT	Carmen, Cebu	
Department of Agriculture Regional Field Unit VI (DA RFU VI)	Fort San Pedro, Iloilo City	
Department of Science and Technology Region VIII (DOST-Reg.VIII)	Tacloban City	
Cebu State College of Science and Technology	Carmen, Cebu	

Department of Science and Technology Region VI (DOST-Reg.VI)	Magsaysay village, La Paz, Iloilo City
Department of Science and Technology Region VII (DOST-Reg.VII)	Governor Manuel Cuenco Ave., Banilad, Cebu City
Department of Environment and Natural Resources Region VI (DENR-Reg.VI)	Iloilo City
Department of Environment and Natural Resources Region VII (DENR-Reg.VII)	Cebu City
Department of Environment and Natural Resources Region VIII (DENR-Reg.VIII)	Sto. Nino Ext., Tacloban City
Department of Agriculture Regional Field Unit VII (DA RFU VII)	Cebu City
Department of Agriculture Regional Field Unit VIII (DA RFU VIII)	Tacloban City
Siliman University (SU)	Dumaguete City
Visayas State College of Agriculture (ViSCA)	Baybay, Leyte, 6521-A
Samar State Polytechnic College (SSPC)	Catbalogan, Western Samar

Zone 4. Northern Mindanao Aquatic Resources R & D Zonal Center
Mindanao State University - Naawan

Mindanao State University - Naawan (MSU-Naawan)	Naawan, Misamis Oriental
Mindanao State University Iligan Institute of Technology (MSU-IIT)	Iligan City
Central Mindanao University (CMU)	Musuan, Bukidnon
Department of Environment and Natural Resources Region X (DENR-Reg.X)	Puntod, Cagayan de Oro City
Xavier University	Cagayan de Oro City
Department of Science and Technology Region X (DOST-Reg.X)	J.R. Borja Memorial Hospital Cmpd., Carmen
Department of Science and Technology Region XIII (DOST-Reg.XIII)	Butuan City
Mindanao State University Marawi (MSU-Marawi)	Marawi City
Ateneo de Davao	Davao City
D-RIFT	Panabo, Davao del Norte
Department of Agriculture	General Santos City
Department of Agriculture	La-la Lanao del Norte

Zone 5. Southern Mindano Aquatic Resources R & D Zonal Center
Zamboanga State College of Marine Science and Technology

Zamboanga State College of Marine Science and Technology (ZSCMST)	Fort Pilar, Zamboanga City
University of Southern Mindanao (USM)	Kabacan, North Cotabato
Cotabato City State Polytechnic College (CCSPC)	Cotabato City

Mindanao State University - Tawi-tawi (MSU-Tawi-tawi)	Bongao, Tawi-tawi
Mindanao State University Maguindanao (MSU-Maguindanao)	Datu Odin Sinsuat, Maguindanao
Sultan Kudarat Polytechnic State College (SKPSC)	Takurong, Sultan Kudarat
Davao Oriental State College of Science and Technology (DOSCST)	Mati, Davao Oriental
Southern Philippines Agri-Business and Marine Aquatic School of Technology (SPAMAST)	Malita, Davao del Sur
Davao del Norte State College (DNSC)	Panabo, Davao del Norte
Department of Agriculture Regional Field Unit IX (DA RFU IX)	Gen. V. Alvarez St., Zamboanga City
Department of Agriculture Regional Field Unit XI (DA RFU XI)	Davao City
Department of Agriculture Regional Field Unit XII (DA RFU XII)	Cotabato City
Department of Environment and Natural Resources Region IX (DENR-Reg.IX)	Pasonanca Park, Zamboanga City
Department of Environment and Natural Resources Region XI (DENR-Reg.XI)	Lanang, Davao City
Department of Environment and Natural Resources Region XII (DENR-Reg.XII)	Bonifacio St., Cotabato City
Department of Science and Technology Region IX (DOST-Reg.IX)	Zamboanga City
Department of Science and Technology Region XI (DOST-Reg.XI)	Davao City
Department of Science and Technology Region XII (DOST-Reg.XII)	Cotabato City
Department of Science and Technology Autonomous Region of Muslim Mindanao (DOST ARMM)	Cotabato City
Department of Agriculture Autonomous Region of Muslim Mindanao (DA-ARMM)	Cotabato City
Department of Environment and Natural Resources Autonomous Region of Muslim Mindanao (DENR-ARMM)	Cotabato City

Note: NC means National Center
Source: PCAMRD Files

Table 10. R&D expenditures for fisheries, GNP and GVA of the Philippines for 1982-1995 (In million pesos)

		Gross Value Added (GVA)			R & D as % of		
		Gross	Agriculture/		Gross	Gross Gross Value Added	
	R&D	National	Forestry/	Fisheries	National	(GVA)	
	Expenditure	Product	Fisheries		Product	Agri./ For./	Fisheries
Year	in Fishery	(GNP)			(GNP)	Fisheries	
1982	14.52	313,544	74,055	14,084	0.005	0.020	0.103
1983	14.67	363,268	82,545	17,580	0.004	0.018	0.083
1984	10.14	508,485	129,824	22,666	0.002	0.008	0.045
1985	15.82	556,074	140,554	27,058	0.003	0.011	0.058
1986	22.02	596,276	145,807	32,019	0.004	0.015	0.069
1987	18.07	673,130	163,927	31,256	0.003	0.011	0.058
1988	33.40	792,012	183,515	34,708	0.004	0.018	0.096
1989	37.03	912,027	210,009	36,460	0.004	0.018	0.102
1990	76.33	1,082,557	235,956	40,833	0.007	0.032	0.187
1991	67.74	1,266,070	261,868	47,276	0.005	0.026	0.143
1992	109.98	1,385,562	294,922	51,633	0.008	0.037	0.213
1993	119.49	1,500,287	318,546	57,533	0.008	0.038	0.208
1994	38.34	1,737,315	372,853	65,860	0.002	0.010	0.058
1995	63.89	1,970,519	412,965	70,206	0.003	0.015	0.091
Average	45.82	975,509	216,239	39,227	0.004	0.019	0.102

Source of Table: PCAMRD (1996a).

Table 11. Total national government expenditures, government expenditure in ANR R&D, and R&D expenditures in the fisheries sector of the Philippines for 1982-1995 (In million pesos)

Year	Total National Government Expenditure	Government Expenditure R&D for ANR	Government Expenditure R&D for Fisheries	% of Total National Government Expenditure R&D for ANR	% of Total National Government Expenditure R&D for Fisheries
1982	57,029	905.11	14.52	1.59	0.030
1983	61,838	852.36	14.67	1.38	0.024
1984	53,450	780.73	10.14	1.46	0.019
1985	58,329	888.91	15.82	1.52	0.027
1986	67,409	1,035.49	22.02	1.54	0.033
1987	79,321	318.47	18.07	0.40	0.023
1988	85,539	1,099.54	33.40	1.29	0.039
1989	117,012	1,033.93	37.03	0.88	0.032
1990	156,668	1,070.27	76.33	0.68	0.049
1991	166,158	1,180.18	67.74	0.71	0.041
1992	194,778	1,276.83	109.98	0.66	0.056
1993	309,437	2,404.52	119.49	0.78	0.039
1994	322,695	2,463.25	38.34	0.76	0.012
1995	387,398	2,649.59	63.89	0.68	0.016
Average	151,223	1,283.00	45.82	1.02	0.03
Ave. Growth Rate	17.09	23.57	23.67	0.07	0.05

Source of Table: PCAMRD (1996a).

Table12. R&D expenditures in the fisheries by sector, 1988-1996 (In million pesos)

Year	Total R&D in Fishery	Marine Fisheries	%	Inland Fisheries Aquaculture	%	Socio-Economics	%
1988	33.40	22.55	67.53	9.50	28.43	1.35	4.03
1989	37.03	13.93	37.63	22.49	60.74	0.61	1.64
1990	76.33	59.24	77.61	15.34	20.09	1.76	2.30
1991	67.74	28.75	42.44	19.66	29.03	19.32	28.53
1992	109.98	76.06	69.16	33.07	30.06	0.85	0.78
1993	119.49	80.46	67.34	39.03	32.66	0.00	0.00
1994	38.34	16.31	42.54	20.90	54.51	1.13	2.95
1995	63.89	36.90	57.76	23.32	36.50	3.67	5.74
1996	115.34	66.62	57.76	42.10	36.50	6.62	5.74
Total	661.54	400.83		225.40		35.31	
Average	73.50	44.54	60.59	25.04	34.07	3.92	5.34

Source: PCAMRD (1996a).

Table 13. R&D expenditures in the fisheries sector, 1993-1996 (In thousand pesos)

Commodity	1993	1994	1995	1996	Average	%
EXPORT WINNERS						
Shrimp	4,168	2,819	340	23,668	7,749	10.12
Seaweeds	7,913	2,753	3,556	7,295	5,379	7.10
Crabs	1,473	1,852	1,916	4,911	2,538	3.30
Tuna	1,345	1,168	1,222	447	1,046	1.40
Milkfish	10,398	3,714	533	6,090	5,184	6.80
Subtotal	25,297	12,306	7,567	42,411	21,895	28.7
BASIC DOMESTIC NEEDS						
A. Food						
Tilapia	2,291	3,445	1,471	3,912	2,780	3.6
Small Pelagics	1,281	1,132	2,006	5,212	2,408	3.1
B. Environment	69,445	8,768	14,093	44,953	34,315	44.8
Inland Waters	-	788	-	-		0.3
Subtotal	73,017	14,133	17,570	54,077	39,699	51.9
OTHER PRIORITY AREAS	21,174	11,898	7,553	18,858	14,871	19.4
Total R&D Expenditures	119,488	38,337	33,020	115,346	76,548	100

Source of Table: PCAMRD (1996a).

Table 14. R&D expenditures for fisheries of selected NARRDS institutions, by source of funds, 1992-1996 (In thousand pesos)

INSTITUTION	Funds	1992	1993	1994	1995	1996	Average	%
DA-BFAR	Own Appropriations	5,801	5,031	7,364	8,680	1,639	5,703	95.22
	External Grants	0	0	200	144	1,087	286	4.78
	Sub-total	5,801	5,031	7,564	8,824	2,726	5,989	100.00
DOST-PCAMRD	Own Appropriations	9,600	11,010	10,960	9,090	18,610	11,854	30.47
	External Grants	40,370	14,900	29,440	22,730	27,810	27,050	69.53
	Sub-total	49,970	25,910	40,400	31,820	46,420	38,904	100.00
UPV	Own Appropriations	184	100	239	50	830	281	2.35
	External Grants	15,553	2,409	30,887	5,677	3,709	11,647	97.65
	Sub-total	15,737	2,509	31,126	5,727	4,539	11,928	100.00
MSU-Naawan	Own Appropriations	2,578	2,466	2,581	3,077	5,384	3,217	78.79
	External Grants	-	522	643	679	982	707	17.30
	Sub-total	-	2,988	3,224	3,756	6,366	4,084	100.00
Total without SEAFDEC AQD	Own Appropriations	18,163	18,607	21,144	20,897	26,463	21,055	34.74
	External Grants	55,923	17,831	61,170	29,230	33,588	39,548	65.26
	Total	74,086	36,438	82,314	50,127	60,051	60,603	100.00
SEAFDEC AQD	Own Appropriations	8,330	8,530	10,840	12,530	12,890	10,624	66.30
	External Grants	3,150	3,550	3,770	8,490	8,040	5,400	33.70
	Sub-total	11,480	12,080	14,610	21,020	20,930	16,024	100.00
Total with SEAFDEC AQD	Own Appropriations	26,493	27,137	31,984	33,427	39,353	31,679	41.34
	External Grants	59,073	21,381	64,940	37,720	41,628	44,948	58.66
	Total	85,566	48,518	96,924	71,147	80,981	76,627	100.00

Note: - means no data

Source: PIDS survey, 1998.

Table 15. R&D expenditures for fisheries of selected NARRDS institutions, by source of external grants, 1992-1996 (In thousand pesos)

INSTITUTION	Funds	1992	1993	1994	1995	1996	Average	%
DA-BFAR	Local	0	0	200	144	1,087	286	100.00
	Foreign	0	0	0	0	0	0	0.00
	Sub-total	0	0	200	144	1,087	286	100.00
DOST-PCAMRD	Local	12,310	8,140	18,780	19,060	23,200	16,298	60.25
	Foreign	28,060	6,760	10,660	3,670	4,610	10,752	39.75
	Sub-total	40,370	14,900	29,440	22,730	27,810	27,050	100.00
UPV	Local	15,553	2,409	13,531	2,804	3,472	7,554	64.86
	Foreign	0	0	17,356	2,873	237	4,093	35.14
	Sub-total	15,553	2,409	30,887	5,677	3,709	11,647	100.00
Total without	Local	27,863	10,549	32,511	22,008	27,759	24,138	61.92
SEAFDEC AQD	Foreign	28,060	6,760	28,016	6,543	4,847	14,845	38.08
	Total	55,923	17,309	60,527	28,551	32,606	38,983	100.00
SEAFDEC AQD	Local	0	0	0	0	0	0	0.00
	Foreign	3,150	3,550	3,770	8,490	8,040	5,400	100.00
	Sub-total	130,009	54,269	143,484	79,357	93,639	5,400	100.00
Total with	Local	27,863	10,549	32,511	22,008	27,759	24,138	54.39
SEAFDEC AQD	Foreign	31,210	10,310	31,786	15,033	12,887	20,245	45.61
	Total	185,932	71,578	204,011	107,908	126,245	44,383	100.00

Note: MSU-Naawan has no breakdown for sources of external grants

Source: PIDS survey, 1998.

Table 16. Distribution of manpower for fisheries R&D, by zonal areas (1996)

Agency	PhD	MS	BS	ASSOC	Total	%
Zonal Area for Northern Luzon (Region I, II. III. And CAR)	11	57	25	-	93	12.33
Zonal Area for Southern Luzon (Region NCR, IV and V)	20	45	131	12	208	27.59
Zonal Area for Visayas (Regions VI, VII and VIII)	31	117	166	6	320	42.44
Zonal Area for Northern Mindanao (Region X,XI,and Caraga)	2	19	53	-	74	9.81
Zonal Area for Southern Mindanao (Regions IX and XII)	3	21	35	-	59	7.82
TOTAL	67	259	410	18	754	100
%	8.89	34.35	54.38	2.39	100.00	

Note: Figures include SEAFDEC AQD
Source: PCAMRD (1996a).

Table 17. Manpower for Fisheries R&D of selected NARRDS institutions, 1998

INSTITUTION	PhD	MS	BS	NI	Total
DA-BFAR	2	21	42	1	66
DOST-PCAMRD	4	11	10	0	25
DMMMSU	1	6	15	0	22
UPLB	1	1	0	0	2
UPV	0	12	13	1	26
MSU-Naawan	4	19	13	0	36
MSU-Marawi	1	15	10	1	27
CLSU	1	7	2	0	10
UPMSI	3	2	20	0	25
BU	4	9	2	0	15
MMSU	1	2	4	0	7
PSU	0	3	1	0	4
Average without SEAFDEC AQD	2	10	13	0	25
SEAFDEC	21	43	1	0	65
Average with SEAFDEC AQD	1	7	7	0	15

Note: NI means not indicated

Source: PIDS Survey, 1998.

Table 18. Ratios of manpower for Fisheries R&D of selected NARRDS institutions, 1998

INSTITUTION	Graduate: Undergraduate	Male : Female	Technical: Non-technical	Average age
DA-BFAR	2.50	0.50	12.20	-
DOST-PCAMRD	5.10	0.56	1.08	41
DMMMSU	1.40	0.69	10.00	51
UPLB	0.00	0.00	0.00	34
UPV	0.92	0.37	7.67	38
MSU-Naawan	5.46	0.80	2.27	43
MSU-Marawi	2.50	0.80	26.00	44
CLSU	4.50	1.00	9.00	42
UPMSI	3.10	0.32	11.50	28
BU	8.50	0.88	2.75	40
MMSU	1.50	0.75	0.00	40
PSU	3.00	0.00	0.00	40
Average without SEAFDEC AQD	3.21	0.56	6.87	40
SEAFDEC	64	0.51	20.67	42
Average with SEAFDEC AQD	7.88	0.55	7.93	40.25

Note: - means no data
Source: PIDS survey, 1998.

Table 19. Science and technology performance as indicated by the number of publications in refereed or ISI journals (yearly average)

Country	Publications in 1981-1992	Publications in 1994-1995	Percent increase
Taiwan	1,728	5,221	202
South Korea	1,047	4,255	301
Hongkong	785	1,703	117
Singapore	524	1,270	142
Thailand	419	574	37
Malaysia	314	463	47
Indonesia	157	243	55
Philippines	209	224	7

Note: ISI stands for Institute for Scientific Information

Sources: Lacanilao (1997,1996b,1995).

Table 20. Number of Philippine publications in international refereed journals in 1994

INSTITUTION	Total	With Filipino as first author
UP Diliman (MSI)	28(11)	17
SEAFDEC	21	16
UP Los Baños	13	8
International Rice Research Institute	77	7
Department of Health	17	6
University of Santo Tomas	6	4
Central Luzon State University	4	3
Visayas State College of Agriculture	4	3
UP Manila	9	2
Department of Agriculture	5	2
De La Salle University	4	2
San Miguel Corporation	2	2
West Visayas State University	2	2
UP Visayas	2	1
ICLARM	5	0
Others (14 institutions)	16	10
TOTAL	215[a]	85

[a] Five publications are each shared (counted twice) by two institutions

Note: Figure in parenthesis is for UP-MSI. Fisheries institutions are underlined.
Source: Lacanilao (1995).

Table 21. Philippine peer-reviewed publications in journals covered by *Science Citation Index*, by major field, 1994

Major Field	Number of institutions	Total publications	Number with Filipino authors[a]
Aquatic sciences	11	45	29
Agriculture	7	100	25
Medicine	9	35	14
Physical sciences	7	19	9
Others	11	11	8
Total	45	210	87

[a]As first or sole authors

Source: Lacanilao (1995)

Table 22. Scarcity of Refereed or ISI journal publications by Filipinos as listed in Philippine bibliographies & review publications

Bibliography or review publication	Total no. of articles listed	ISI journal articles by Filipinos	%
Marine invertebrates	1,032	68	6.6
Seaweeds	780	62	7.9
Coral reefs, magroves and seagrasses	194	20	10.3
Milkfish biology	298	55	18.5
Capture fisheries	129	0	0
Total	2,433	205	8.4

Source: Lacanilao (1995).

Table 23. Number of fisheries research proposals submitted, evaluated, and approved under the National Fisheries Research Program of FSP

Problem Area	Submitted	Reviewed	Approved	Funded	Completed	Budgeted (In million pesos)
I. Management of the 12 Priority Bays	67	37	24	24	19	129.668
II. Coastal Resources Management and Rehabilitation	63	43	14	14	9	6.562
III. Optimal Exploitation of EEZ and Offshore Fishing Resources	30	20	5	5	1	43.352
IV. Aquaculture	506	402	82	66	24	23.888
V. Optimum Utilization of Aquatic Products	78	67	4	2	2	0.403
VI. Special Projects	106	77	15	9	7	3.432
Total	850	646	144	120	62	207.305

Source: PRIMEX and ANZDEC (1996).

Table 24. Strength of PCAMRD/BAR/ERDB in areas of collaboration			
Area of Collaboration	Weak	Strong	Not at all
1. Research coordination and monitoring	*		
2. Research priorities and thrusts	*		
3. Review and evaluation of research projects	*		
4. Research budget review/dialogue	*		
5. Sharing of experts			*
6. Sharing of research information	*		
7. Collaboration on critical research concern, policy and special studies or projects			*
8. Research utilization			*
9. Conduct of agency in-house review and regional R and D symposia		*	
10. Scholarship, training, workshops and conferences			*
11. Organizations			*
Source: PCAMRD (1995).			

Table 25. Agency-funded fisheries R&D projects of NARRDS institutions, by number of researchers and budget, 1996

INSTITUTION	No. of Researchers	Budget (P)	Budget: Researcher Ratio
DA-BFAR	61	3,754,000	61,541
DMMMSU	13	1,072,903	82,531
UPLB	9	3,373,580	374,842
UPV	44	2,193,075	49,843
MSU-Naawan	25	1,257,125	50,285
ZSCMST	15	790,000	52,667
DA-CAR	-	230,100	-
DA-Region1	2	1,007,000	503,500
DA-Region 2	10	889,000	88,900
DA-Region 4	-	4,572,000	-
DA-Region 5	-	2,180,046	-
DA-Region 6	-	785,000	-
DA-Region 8	-	415,000	-
DA-Region 11	-	902,044	-
DA-Region 13	-	310,000	-
DA-ARMM	-	87,000	-
DENR-Region 10	-	4,165,000	-
BU	-	543,000	-
CMU	2	11,000	5,500
CSC	-	341,000	-
CSU	18	548,040	30,447
CCSPC	-	1,461,033	-
CVPC	-	244,000	-
DOSCST	-	972,500	-
ISCOF	19	2,425,000	127,632
MMSU	17	100,000	5,882
MSU-SULU	-	590,488	-
MSU-TCTO	21	1,330,000	63,333
NIPSC	3	5,450,248	1,816,749
NMP	-	64,564	-
NVSIT	5	136,000	27,200
PALSU	-	1,110,000	-
PIT	-	308,000	-
PSPC	12	25,000	2,083
PSU	8	321,000	40,125
TONC	-	60,000	-
UEP	-	496,370	-
UPMSI	25	3,579,400	143,176
Average	17	1,265,777	195,902

- means no data

Source: PCAMRD (1996a) and PCAMRD Files.

Table 26. Agency-funded fisheries R&D projects of NARRDS Institutions, by number of projects and budget, 1996			
INSTITUTION	No. of Projects	Budget (P)	Budget: Project Ratio
DA-BFAR	11	3,754,000	341,272.73
DMMMSU	30	1,072,903	35,763.43
UPLB	9	3,373,580	374,842.22
UPV	8	2,193,075	274,134.38
MSU-Naawan	7	1,257,125	179,589.29
ZSCMST	7	790,000	112,857.14
DA-CAR	4	230,100	57,525.00
DA-Region1	10	1,007,000	100,700.00
DA-Region 2	8	889,000	111,125.00
DA-Region 3	41	4,572,000	111,512.20
DA-Region 4	12	2,180,046	181,670.50
DA-Region 5	12	785,000	65,416.67
DA-Region 6	8	415,000	51,875.00
DA-Region 8	8	902,044	112,755.50
DA-Region 11	10	310,000	31,000.00
DA-Region 13	3	87,000	29,000.00
DA-ARMM	1	4,165,000	4,165,000.00
BU	3	543,000	181,000.00
CMU	1	11,000	11,000.00
CSC	4	341,000	85,250.00
CSU	6	548,040	91,340.00
CCSPC	4	1,461,033	365,258.25
CVPC	2	244,000	122,000.00
DOSCST	3	972,500	324,166.67
ISCOF	9	2,425,000	269,444.44
MMSU	12	100,000	8,333.33
MSU-SULU	1	590,488	590,488.00
MSU-TCTO	8	1,330,000	166,250.00
NIPSC	13	5,450,248	419,249.85
NMP	3	64,564	21,521.33
NVSIT	2	136,000	68,000.00
PALSU	4	1,110,000	277,500.00
PIT	3	308,000	102,666.67
PSPC	1	25,000	25,000.00
PSU	6	321,000	53,500.00
TONC	1	60,000	60,000.00
UEP	3	496,370	165,456.67
UPMSI	31	3,579,400	115,464.52
Total	309	48,099,516	155,661.86
- means no data			
Source: PCAMRD (1996a).			

Table 27. R&D expenditures for fisheries by sector and source of funds, 1988-1994 (In million pesos)

Sector	Foreign	%	Government	%	Private Sector	%	Grand Total
Marine Fisheries	218.45	73.48	75.78	25.49	3.08	1.04	297.31
Inland Aquatic Resources	60.73	37.96	98.08	61.31	1.17	0.73	159.98
Socioeconomics	4.67	18.65	20.35	81.35	-	-	25.02
Total	283.85	58.85	194.21	40.37	4.25	0.88	482.31

Source: PCAMRD (1996a).

Table 28. Distribution of the NARRDS R&D Program budget by source of funds, 1996

COMMODITY	Source of Funds		Total
	Local (P)	Foreign (P)	Budget
Export Winners			
Seaweed	7,236,997	0	7,236,997
Crab	2,613,727	842,677	3,456,404
Tuna	225,000	0	225,000
Shrimp	1,605,739	0	1,605,739
Basic Domestic Needs			
Tilapia	2,664,975	0	2,664,975
Milkfish	80,903	0	80,903
Small Pelagics	2,257,428	0	2,257,428
Environment	29,000,173	2,262,513	31,262,686
Other Proirity Areas	14,837,104	1,500,000	16,337,104
Total	60,522,046	4,605,190	65,127,236

Source: PCAMRD (1997b).

Table 29. Comparison of the number of R & D personnel in selected NARRDS and NARRDN institutions, 1995-1996

INSTITUTION	PhD	MS	BS	Total	Graduate:Undergraduate
NARRDS					
UPLB	4	3	2	9	3.50
DMMMSU	1	9	3	13	3.33
UPV	15	13	16	44	1.75
MSU-NAAWAN	2	14	9	25	1.78
CLSU	1	10	0	11	0.00
UPMSI	15	6	4	25	5.25
ZSCMST	3	7	5	15	2.00
Average	5	9	6	18	2.52
NARRDN					
UPLB	53	206	225	484	1.15
USM	37	72	8	117	13.63
ViSCA	39	69	24	132	4.50
BSU	15	36	36	87	1.42
CMU	43	135	139	317	1.28
ISU	17	61	13	91	6.00
CSSAC	19	40	30	89	1.97
Average	32	88	68	188	4.28

Note: NARRDN stands for National Agriculture and Natural Resources Research and Development

Network, the counterpart of NARRDS. NARRDS data are for 1996 while NARRDN data are

for 1995. NARRDS data are specifically for fisheries R&D manpower only.

Sources: PCAMRD (1996a) and RMC,CEM-UPLB (1997).

Table 30. Number of studies by type/discipline, by year, Philippines

Type of study	Period of Study						
	1974 and below	1975 to 1980	1981 to 1986	1987 to 1992	1993 to date	Total	%
Socioeconomics (General)	2	52	40	53	25	172	13.64
Production Economics/ Management	8	39	90	46	19	202	16.02
Resource Economics/ Management	0	7	13	41	25	86	6.82
Sociological/ Sociocultural	3	4	7	25	19	58	4.60
Marketing/ Trade and Prices	11	63	78	46	20	218	17.29
Policy Studies	4	27	62	89	50	232	18.40
Industry Studies	0	9	17	7	5	38	3.01
Institutional							
a. Credit	0	2	9	3	2	16	1.27
b. Cooperatives	0	1	1	10	6	18	1.43
c. Legal	0	2	0	1	1	4	0.32
d. Agencies/NGO/Community	0	0	0	5	3	8	0.63
e. Education/Manpower S & D	0	0	4	1	2	7	0.56
f. Extension/Training/Technology Adoption	0	3	5	2	2	12	0.95
g. Tenurial/Territorial use rights	0	2	4	9	1	16	1.27
Bio-economics	0	0	0	2	1	3	0.24
Consumption/Demand	2	1	2	0	0	5	0.40
Others							
a. Feasibility/Investment Studies	8	27	37	26	17	115	9.12
b. Impact/Effect Studies	1	2	1	3	0	7	0.56
c. Processing	4	8	9	5	0	26	2.06
d. Gender (Role of Women)	0	0	2	3	4	9	0.71
e. Others (e.g. livelihood opportunities)	0	1	0	1	7	9	0.71
Total	43	250	381	378	209	1261	100.00
Average	3.41	19.83	30.21	29.98	16.57	100	

Source: de Jesus, et al. (1997).

Table 31. Distribution of Total NARRDS R&D Program budget, by commodity and export value, 1996

COMMODITY (Export winners)	Total Budget (P)	%	Exports Value (Million P)	%
Seaweed	7,236,997	57.78	2,442	22.36
Crab	3,456,404	27.60	252	38.82
Tuna	225,000	1.80	4,534	2.31
Shrimps/Prawn	1,605,739	12.82	3,901	36.51
Total	12,524,140	100.00	11,129	100.00

Source: BAS(1997a;1997b) and PCAMRD Files.

Table 32. Distribution of Total NARRRDS R&D Program budget, by commodity and production value, 1996

COMMODITY (Basic Domestic Needs)	Total Budget (P)	%	Production Value (Million P)	%
Tilapia	2,664,975	53.26	4,461	12.95
Milkfish	80,903	1.62	8,949	25.97
Small Pelagics	2,257,428	45.12	21,045	61.08
Total	5,003,306	100.00	34,455	100.00

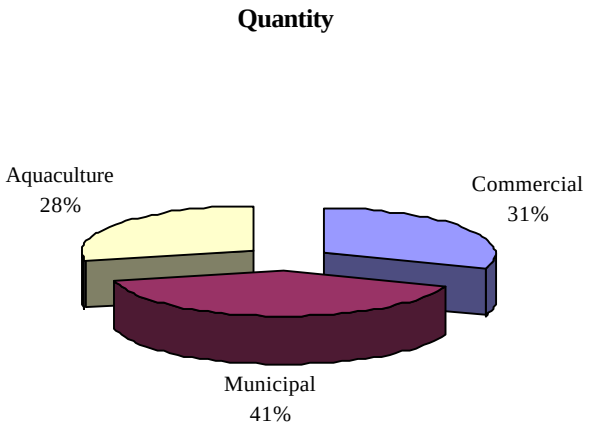
Source: BAS (1997a;1997b) and PCAMRD Files.

Table 33. Agency-funded fisheries R&D projects of NARRDS institutions, by commodity, number of projects and budget, 1996

COMMODITY	No. of Projects	Budget (P)	Budget: Project ratio
Seaweed	25	2,029,574	81,182.96
Crab	17	4,349,424	255,848.47
Tuna	6	397,000	66,166.67
Shrimp/Prawns	12	1,585,739	132,144.92
Tilapia	33	2,550,581	77,290.33
Milkfish	27	2,464,428	91,275.11
Small Pelagics	5	2,800,903	560,180.60
Environment	59	15,382,840	260,726.10
Other Proirity Areas	125	16,539,027	132,312.22
Average	34	5,344,391	184,125.26

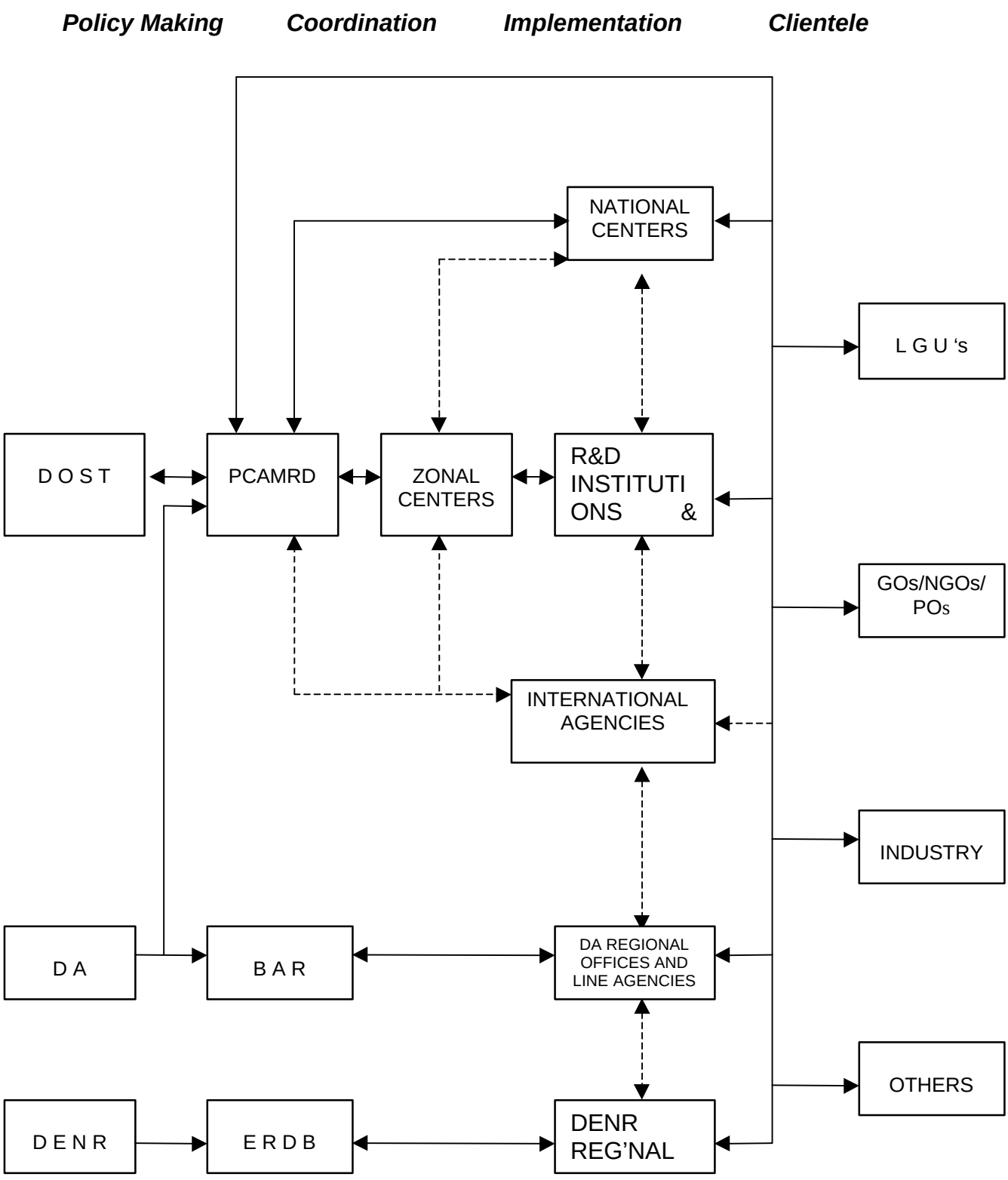
Source: PCAMRD Files.

Figure 1. Philippine Fish Production, by share of subsectors, 1996



Source: Table 1

Figure 2. Organizational structure and linkages in the management of R&D in the fisheries sector.



Source: PCAMRD (1997).