

AQUACULTURE ECONOMICS RESEARCH FOR SOUTHEAST ASIA:
NEEDS, STATUS, DEVELOPMENT, PRIORITIES AND IMPLEMENTATION *

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INTRODUCTION

By definition, this paper is ambitious. No individual is experienced or knowledgeable enough to make specific conclusions or even strong recommendations over such a broad set of issues relevant to aquaculture economics. The purpose of this paper is to suggest a general framework and program in which specific AFSSRN activities on aquaculture economics research can be defined, implemented and perhaps even evaluated. Given that the AFSSRN is itself a relatively small program with a wide fisheries economics mandate, I feel it is important that the network make early decisions on its aquaculture economics research philosophy and overall strategy for the next three years. The remainder of this paper is an attempt to assist in those two decisions.

THE NEED FOR AQUACULTURE ECONOMICS RESEARCH

I assume that the economists in the AFSSRN accept aquaculture as an additional means of technical and economic efficient production of fish. The specific advantages aquaculture can offer as a food production system need not be re-stated here. In 1983, 9 million tonnes of fish were reared in aquaculture systems around the world. Asia accounted for 6.5 million tonnes (72%), with China alone producing 5 million tonnes (56% of world total and 77% of Asia's).¹ This represents approximately 10 percent of the total world fish catch. For China, aquaculture represents 25 percent of its total seafood production.² Historically, finfish makes up approximately two-thirds of the total aquacultural production.³ In 1981 in Asia (excluding China), aquaculture represented 632,500 ha. under culture, and had an estimated gross value of 1.27 billion US dollars.⁴ This average

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value of US\$2,000/ha hides significant differences between countries, i.e. for brackishwater culture the figure was US\$5,500/ha in Taiwan and US\$800/ha in Indonesia. Presently, fish farming is the fastest growing part of the world fishing industry, farmed catch increasing by over 5% annually.⁵ It has been estimated for Asia that the potential area for aquaculture production is about eight times the area now farmed.⁶ This limited data alone indicates that aquaculture is an important source of income and food in Asia, it consumes considerable physical resources, its technological base is diversified and it is very probable that the industry is in a dynamic state of expansion and has the resource potential to expand. In my opinion, each of these reasons justify relevant economic research on aquaculture so that aquaculture can contribute to the development goals of Asia.

STATUS OF AQUACULTURE ECONOMICS RESEARCH

Until recently, fisheries economics research could usually be equated with marine fisheries economics research. To an extent, this can be logically explained by the fact that marine fisheries has been and remains the dominant type of fishery. A second reason, one with less logic in my opinion, is that the traditional research methods used in agricultural economics and farm management could be adopted readily and quickly for aquaculture. The most important question here though is not to define aquaculture economics vis-a-vis other branches of resource economics, but to decide if aquaculture economics research has and is being developed relevant to biological and technological advances (and the commercialization of those advances) in the national aquaculture industry. My feeling is that it is not, and particularly with regards to aquaculture in Asia. It is the latter on which I will concentrate.

Biological and technological research and training for tropical aquaculture in Asia is itself a fairly recent phenomena. However, it is increasing steadily. Reliable data on the research resource allocations are not available, but the establishment of institutions and programmes

such as: SEAFDEC AQD (Southeast Asian Fisheries Development Center's Aquaculture Department), ICLARM (International Center for Living Aquatic Resources Management), Research Institute for Coastal Aquaculture in Indonesia, National Inland Fisheries Institute in Thailand, Freshwater Fisheries Research Station program at Malacca in Malaysia, and the NACA (Network of Aquaculture Centers in Asia) MSc Degree training program, are indicative of substantial support for aquaculture. The International Rice Research Institute (IRRI), in cooperation with various Asian Farming Systems Research (AFSR) national programmes, will consider incorporating rice-fish culture as part of their experimental design for component technology evaluation. This work has presently started in Thailand. National governments, bilateral donor agencies i.e. IDRC, and the Asian Development Bank (ADB) are major financial contributors to those research activities.

The results of this aquaculture research, as shown in numerous scientific journal articles and workshop papers, demonstrate that economic data and economic analysis of existing and new production technology, lags far behind that in biology and engineering. This was stated by C J Shepard in the mid-seventies⁷, it was the conclusion of participants at the IDRC and ICLARM sponsored workshop on Aquaculture Economics Research in Asia in 1981⁸, and I believe it is still true for Asian aquaculture research today. ICLARM, through the publication of its various 'Technical Reports', offers one of the few consistent sources of literature on Asian aquaculture economics research. To date, aquaculture economics and aquaculture economists do not play important roles in national and regional aquaculture research. As yet, they do not have a strong institutional base from which to do this. I will return to this point later on in the paper.

DEVELOPMENT OF RELEVANT AQUACULTURE ECONOMIC RESEARCH METHODOLOGIES

As I mentioned earlier, aquaculture as a food production system, does not mean that traditional agricultural economics analysis is automatically

appropriate to make aquaculture resource allocation decisions. In subsequent papers, Dr Kee-Chai Chong and Dr Sarun Wattanuthcariya will discuss very specific methodological problems and approaches to aquaculture economics. There are some general characteristics of aquaculture which I feel distinguish it from agriculture in terms of economic analysis. These are:

- i) The relative economic values for specific genetic traits of most species have not yet been determined. For example, what relative value do producers place on disease resistance compared to growth or size distribution compared to total biomass? In local markets, what are relative values for specific fish characteristics i.e. size, flesh colour, taste? What level of confidence can economists place on their assumed values of these traits in their analysis?
- ii) For many cultured species, the "quality" of seed is unknown. Many aquaculture production systems rely on seed obtained from the wild. This presents the producer with a high degree of uncertainty with regard to how the fish will respond to specific management practices.
- iii) Relative to land in farming, the "quality" of water in aquaculture is subject to potentially greater variation both between and within a particular production season. This presents the producer with uncertainties regarding his choice of "optimal" management practices of stocking densities and feeding.
- iv) Much of the future expansion of aquaculture production will come from producers who presently have little or no experience in aquaculture. This likely means that future investment, particularly by the small private producer, will have very high values of risk associated with it, probably much higher than that for a change in technology in an existing farming system. For the economist, risk analysis will be an important part of his or her research.
- v) As there generally is in agriculture, in aquaculture there is not a well defined historical legal system of property rights. This particularly affects coastal aquaculture; its successful development may ultimately depend not on technical and financial viability, but

"legal" viability. This means economists will have to devote considerable time to defining and evaluating the criteria, coastal communities place on access and use of water which has potential for aquaculture production.

Doubtless, there are other important characteristics of aquaculture which demand attention in the development of appropriate economic analysis.

SUGGESTIONS FOR PRIORITIES IN AQUACULTURE ECONOMICS RESEARCH

The following research topics are based on my limited involvement with both technical fisheries scientists and economists. It is by no means complete and they have not been placed in order of priority. I feel it is the purpose of this workshop and the responsibility of the AFSSRN as a group to set the actual priorities for its own research program.

1. What are the relative economic values of specific genetic traits of the major cultured species, from both the aquacultural producer and fish consumer perspectives?
2. By species, what are the comparative costs and returns in production in various systems of culture (i.e. pond, cage, mono-culture, poly-culture)? How does this data compare between countries?
3. What is the comparative net benefit from culturing finfish versus prawns versus bivalves?
4. What are the comparative income distribution, employment and resource efficiency effects for different systems of culture? Are these related to the cost structure and investment requirements of the specific culture systems? To what extent can labour substitute for capital?
5. What is the economic impact of feed supplementation for different species? Under what conditions is feeding relevant?

6. What is the economic impact of employing methods of disease control (other than breeding to select for disease resistance)?
7. What are existing and potential markets i.e. demand, price elasticity of demand, price cross-elasticity of demand and income elasticity of demand, for different species?
8. What are the comparative economics of different methods of seed supply i.e. source from the wild, specialized hatchery, combined hatchery and grow-out single farm operation?
9. What are the economies of scale for different culture systems?
10. Under what conditions can aquaculture be successfully integrated into agriculture systems, and under what conditions can aquaculture be a part-time complementary enterprise for coastal fishermen?

CONSTRAINTS IN THE DEVELOPMENT OF AQUACULTURE ECONOMICS

Later in this workshop, Dr Edward McCoy and Mr Michael Vakiley will be discussing how economists and biologists can work together in aquaculture research. I am sure that Dr Kee-Chai Chong will also be touching upon this issue in his discussion of Farming Systems Research (FSR) approaches for aquaculture.

Aquaculture economics research, particularly that research with a focus on - evaluation of existing production methods, evaluation of resources for aquaculture, evaluation of experiments to develop technology, and evaluation of new technology with aquaculture producers MUST integrate biological/technical and economic criteria. Every aquaculture producer (like every farmer) selects his technology and management practices based on biological/technical and economic considerations. Therefore, the research that develops and recommends new technology and management must also do likewise.

There are a variety of reasons why economists have not played a major role in aquaculture research and why it will be difficult to integrate the disciplines.⁹ Some of these are:

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- (a) Traditional university training, both curriculum and research, does not encourage a multi-disciplinary approach.
- (b) The disciplines have different assumptions on existing environments and have different criteria for evaluating technical change.
- (c) Economists tend to conduct research based on extensive surveys rather than on relatively short-term experiments.
- (d) The use of advanced econometric analysis techniques on applied experimental data results in economists' decisions being "out of phase" (i.e. too late) with subsequent experimental design.
- (e) Biological research institutions responsible for aquaculture research and research resource allocations, are usually directed and staffed by biological scientists.

I believe that the AFSSRN aquaculture economic research program has the potential to address issues (b), (c) and (d). Point (b) is not a problem in the sense that I think (c) and (d) are. Multi-disciplinary aquaculture economics research has to be cost-effective and be credible.¹⁰ It cannot achieve this if its methodology is unnecessarily lengthy and complex. I encourage the AFSSRN to develop and implement economic research on aquaculture which is based on biological and economic problem identification and selection, and biological and economic experimental design and evaluation.

FOOTNOTES

1. The Economist, June 23, 1984, page 70.
2. "The Significance of Aquaculture" Chapter 1 page 9 in Aquaculture: An Opportunity for Canadians, Science Council of Canada, March 1985.
3. Table 1.1 page 7 in Aquaculture Economics: Basic Concepts and Methods of Analysis, by Yang C Shang, 1981.
4. Fishery Statistical Bulletin for South China Sea Area (1981), SEAFDEC, Thailand, November 1983.
5. The Economist, June 23, 1984, page 70.
6. Rabanal, H.R., 1977 "Aquaculture in Southeast Asia", a paper presented at the Tenth Annual World Mariculture Society Convention, January 22-27, 1979, Honolulu, Hawaii.
7. Shepard, C. J., 1974. The Economics of Aquaculture - A review. Oceanogr. Mar. Biol. Ann. Rev. 13 pages 413-420.
8. "Aquaculture Economics Research in Asia", Proceedings of a Workshop held in Singapore 2-5 June 1981, IDRC 193e.
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10. Ibid

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13. The Economist. June 23, 1984.
14. Technical Reports, ICLARM (various).