BIO-ECONOMIC ANALYSIS OF SHELLFISH-CULTURE ACTIVITY IN FRANCE

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ABSTRACT

Bio-economic models are not in common use in the field of shellfish culture and may prove to be an important analysis and evaluation tool. This paper will deal only with the potential contribution of these models to furthering knowledge of the dynamics of production and marketing systems. Such models should enable us to determine interactions between the strategies used by the various participants in this field, as well as between the shellfish industry and other areas of economic activity, whether it be at the level of the individual operation, the shellfish basin or the industry. In particular, it can be shown that external factors have an influence on the shellfish industry (for example by determining the relationship between tank load and quantity and value of production), and an evaluation may be made of the economic repercussions of various space allocation and environmental utilization scenarios.

key words: shellfish industry, bio-economic models, external factors, operating strategy, economic analysis

RESUME. Les modèles bio-économiques sont encore peu développés en matière de conchyliculture et peuvent constituer un outil d'analyse et d'évaluation important. Seul l'apport potentiel de tels modèles dans la connaissance de la dynamique des systèmes de production et de commercialisation est discuté ici. Ils permettent en principe d'appréhender les interactions, d'une part, entre les stratégies des différents agents du secteur et, d'autre part, entre le secteur conchylicole et les autres activités économiques, dans les entreprises, des bassins conchylicoles et la branche d'activité. Il est possible, en particulier, de montrer les externalités affectant la conchyliculture (par exemple en dégageant les relations entre la charge d'un bassin et la production en quantité et en valeur) et d'évaluer les répercussions économiques de scenarios alternatifs d'allocation de l'espace ou d'utilisation du milieu.

mots-clés : conchyliculture, modèles bio-économiques, externalités, stratégie d'exploitation, analyse économique.

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INTRODUCTION

Culture of shellfish in France is basically being done in small-scale facilities, often as family operations. There are a number of similarities between shellfish-culture and certain forms of agriculture: work is mainly performed by family members, supplemented where necessary by a small number of permanent employees and a larger number of seasonal employees, and the future of the operation is normally dependent on the manager of the facility. Above all, shellfish-culture activities, like agriculture, require the permanent use of a given space, and production levels are partially dependent on the area under culture.

Shellfish-culture activities nevertheless differ from agriculture in several ways, and we shall discuss two of these:

- production levels in a shellfish-culture operation do not only depend on the surface farmed and the means of production used. They are also dependent both on total basin load and on water quality, that is, in both cases, on decisions made by other operators or users of the space. These interdependencies, which affect the production of each operator, make up what economists call "external factors".

  These external factors in the shellfish-producing industry are related to those that exist in the fishing industry: the production of a fishing vessel depends in part on the total fishing effort applied to

List of abbreviations used:

CCM	Commissions des Cultures Marines (marine culture commissions)
CIAT	Comité Interministériel d'Aménagement du Territoire (interministerial committee on national development)
COREP	Commissaire de la République
DASS	Direction Actions Sanitaires and Sociales (sanitary and social action branch)
DDE	Direction Départementale de l'Equipment (departmental equipment branch)
ENIM	Etablissement National des Invalides de la Marine (national association of naval veterans)
MSA	Mutualité Sociale Agricole (agricultural social benefit association)
POS	Plans d'Occupation des Sols (land use plans)
SAUM	Schéma d'Aménagement et d'Utilisation de la Mer (program for development and use of the sea)
SDAU	Schéma Directeur d'Aménagement and d'Urbanisme (master plan for urbanism and development)
SMVM	Schéma de Mise en Valeur de la Mer (maritime development plan)
SNDCA	Schéma National Directeur de la Conchyliculture et de l'Aquaculture (réservation des sites) (national master plan for the shellfish and aquaculture industry - site reservations)

a fish stock. They differ by the fact that, in the fishing industry, some operators may increase their fishing capacity and make a profit, to the detriment of other operators, while in the shellfish industry, all operators in a given basin share the consequences of pollution or epizootic disease: there are only losers.

- allocation of operating space is not done, in France, on the basis of acquisitions or the location of private property.[1] These areas are part of state-owned maritime lands. They are not allocated by a free market process; rather, allocation is governed by regulations.[2] Granting of concessions on state-owned maritime lands is the responsibility of a state official, the Commissaire de la République, for the region involved, acting on recommendations from a "Commission des Cultures Marines" (CCM) including representatives from the administration, parliament and professional groups. Development of activities that will interact with the shellfish industry or compete with it for use of space and the environment, may be furthered or hindered by other decision-making centres such as municipalities, general and regional counsels and various administrative bodies.

1. ECONOMIC ANALYSIS

Economic analysis may play a three-fold role:

(i) contribute to better knowledge of the structure and dynamics of production and marketing systems, since economic analysis is aimed at producing explanatory outlines that are meant to represent causal interdependencies,

(ii) clarify future actions, that is, to forecast the economic consequences of some decision that is currently being envisaged,

(iii) contribute to defining the process of allocating resources in fields where the free market does not come into play.

Only the potential contribution of bio-economic models to knowledge of the dynamics of production and marketing systems will be discussed here.

The causal interdependencies to be studied in analysing the shellfish industry have to do with:

(i) the shellfish industry itself, actions by individuals and enterprises (individual strategies), relations between production zones and within a given basin (collective strategies),

(ii) relations between this sector and other competitive or complementary economic activities.

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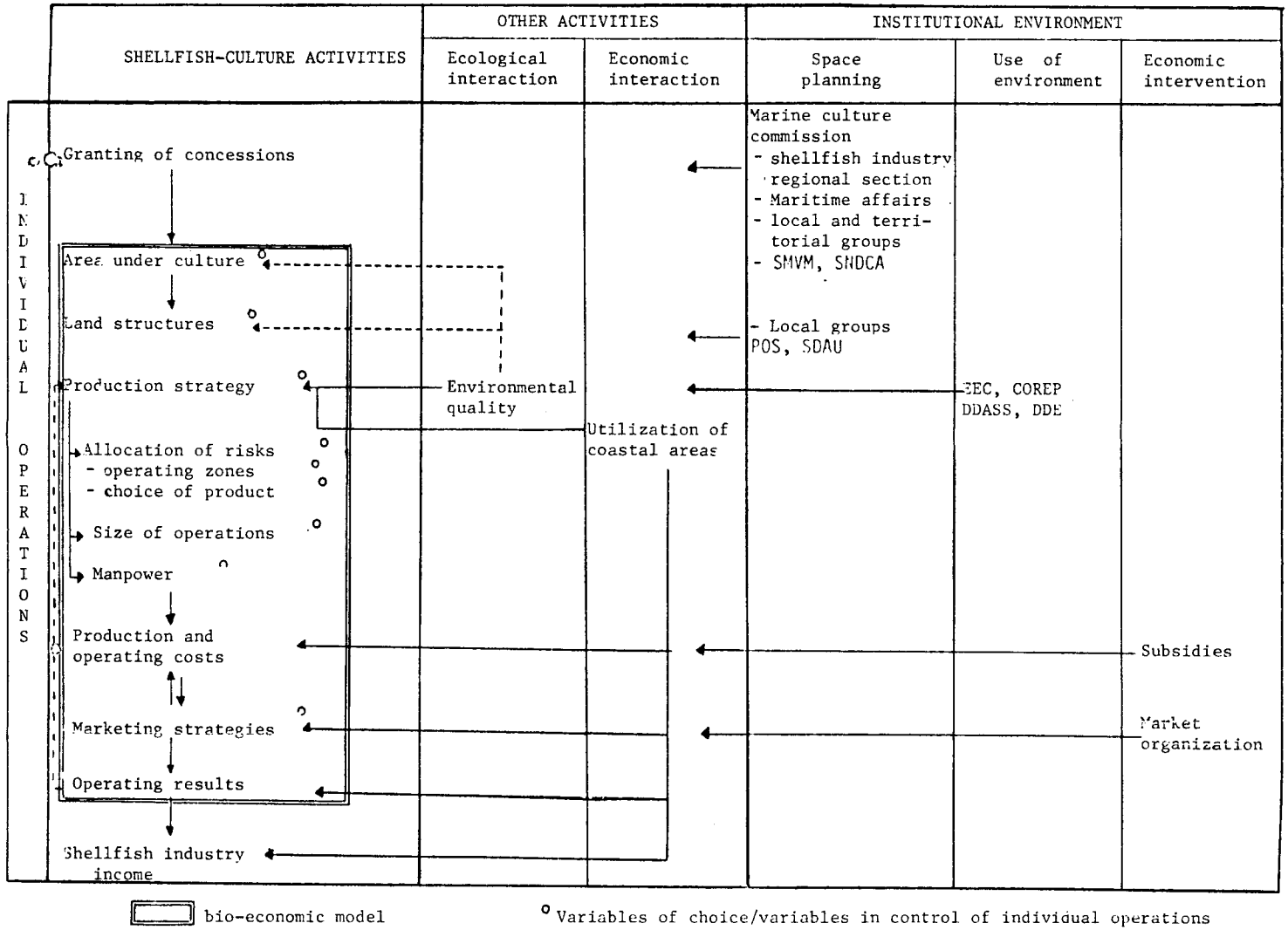
[1] With the exception of land installations, which may be privately owned.

[2] Décret No. 83-228, 22 March 1983, laying down the regulations governing authorization of marine culture operations.

TABLE 1: INTERACTIONS AND ENVIRONMENT: INDIVIDUAL OPERATIONS



It is possible to break these interactions down into three aggregate levels: individual operations (individuals or enterprises), shellfish-culture basins, and the sector as a whole. At each of these levels, inter-dependencies cannot be understood outside the social and institutional context in which they occur (Table 1).

1.1 Individual operations

The results of a shellfish-culture operation depend on its choice of operating strategy. These choices will have an effect on its income and on the make-up of its production and/or operating costs, for example:

- choice of product, collection of spat and/or nursery culture and/or maturation,
- allocation of risk, distribution of concessions over several producing basins. This distribution may lead to specialization of production, which is a function of costs,
- choice of marketing strategy: among oyster-farmers, for example, there are both producers and shippers,
- choice of size of operation: use of family labour alone or hiring of permanent or seasonal employees.

Each shellfish-culture operation develops its own strategy on the basis of the limited information it has in order to attain its own objectives. Each producer does not necessarily react on the basis of all the inter-dependencies listed above, since most of the time the information he has deals only with prices and working time.

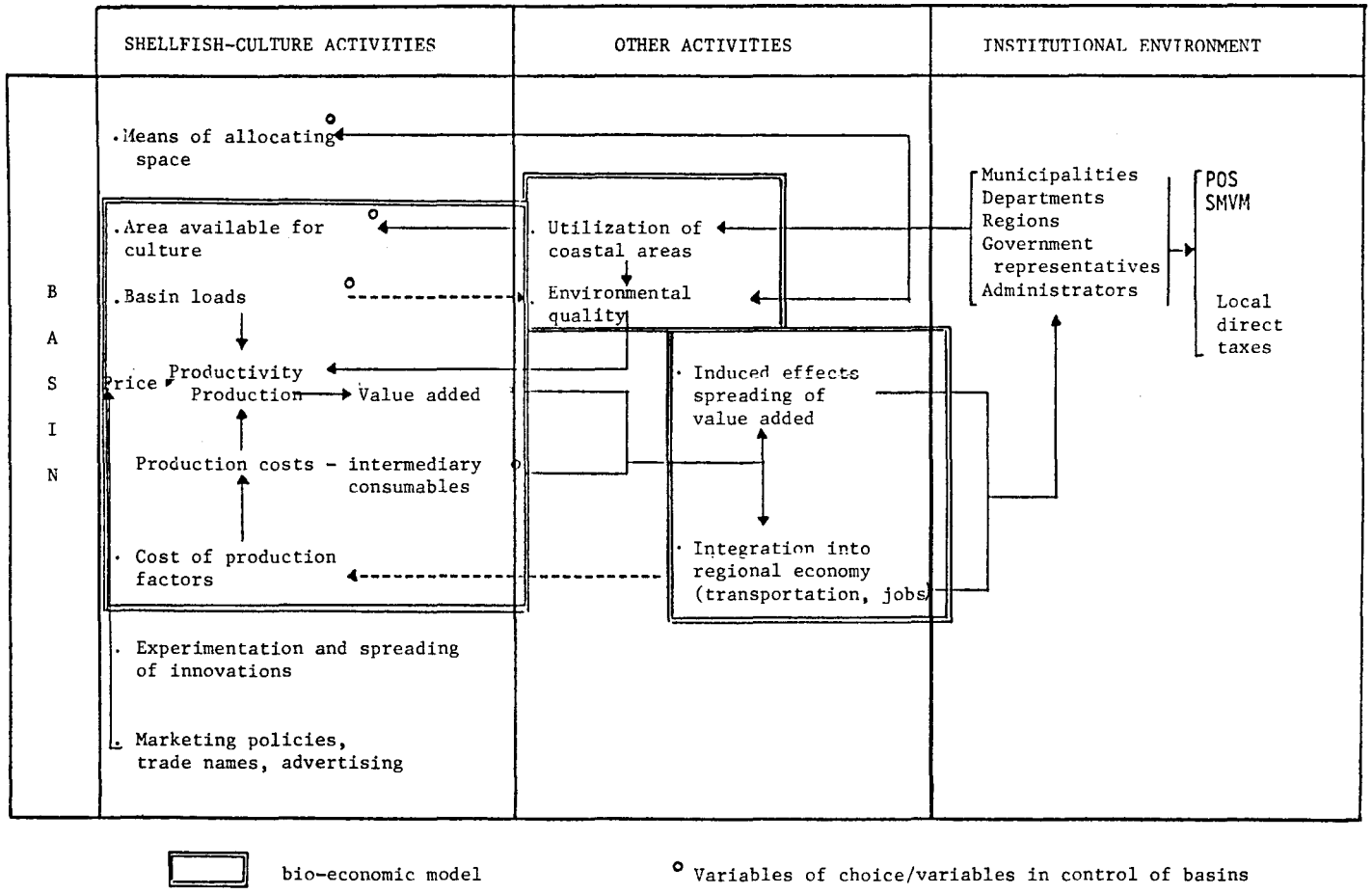
Entering the field (and leaving it), as well as individual development strategies, involves land-tenure problems. The way in which shellfish concessions are managed reduces the degree of freedom enterprises have in developing their own strategies: marine culture commissions often feel it is best to take back a concession that is not used at at least 50% of its capacity. In the same way, the lack of systematic renewal of expiring concessions may be a disruptive factor.[1]

The influence of other economic activities being carried on in the same area as the shellfish operation may be felt in various ways:

- existence of activities that complement shellfish-culture, such as agriculture, fishing or tourism, may make it possible:
  1) for the operator to exercise another activity, and thus to have other sources of income (fisherman/shellfish-farmer, for example)
  2) to have seasonal labour available to the shellfish industry.
- on the other hand, the existence of permanent activities that are less demanding or more profitable may deprive shellfish farmers of the manpower reserves they require.

[1] Payeur, F. (1984).

TABLE 2: INTERACTIONS AND ENVIRONMENT: SHELLFISH BASINS



Economic analysis of shellfish-farming operations is a new field, and while bio-economic models have been developed in some countries (in particular in the U.S.A.), they are non-existent in France. Bio-economic models, at this level of aggregation, are built without explaining external factors; variations in the various parameters are considered to be exogenous, no matter what their origin. The purpose of these models is to establish relations between the various inputs and their costs and the value of production. The bio-economic models thus constructed have two main functions:

(i) pedagogical function, by showing the parameters and variables that enter into the composition of an individual result: what interactions there are between areas farmed, choice of product, size of enterprises, production costs, cost of intermediate consumables, etc. and the results obtained by shellfish-culture operations,

(ii) these models may also be used to evaluate the sensitivity of results to variations in the relative importance of various parameters, making it possible to *guide* decision-making in such areas as:

- choice of individual strategies (influence, *ceteris paribus*, of a variation in spat price, collected vs hatchery vs imported spat),

- orientation of certain aspects of research (influence of a variation in shellfish growth rates on operating results).

The role of the models is not to determine optimum production conditions for an enterprise representative of the sector and to compare the results of each operation to the model. It is more to the point to attempt to establish a typology of shellfish-farming operations, not only based on traditional criteria (area, tonnage produced), but also on the strategies adopted (production scales, allocation of risks, manpower, growth). This typology could be based on two types of criteria:

- total or partial completion of a culture cycle. This may result from a natural constraint (e.g. impossibility of collection north of the Loire) or from a deliberate choice pinpointing the existence of markets at various stages in the culture process. Based on strategical choices such as spat producer and/or culturer and/or finisher-shipper, Dumont (1) was able to distinguish 19 categories of operations.

- production structures. These are many and varied: capital invested, manpower employed, number of activities exercised by operator, etc., and at the present time are difficult to quantify.

The models thus developed would make it possible to test, for each type of operation, their sensitivity to the results of variations in parameters and then to compare these sensitivities for the various types of operations in a given environment.

1.2 Basin

Total production and value added in a shellfish basin, as well as operator income, are related to the area under culture and production per unit of area.

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[1] Dumont, P. (1983)

The *area available for shellfish culture*, as well as the possibilities for land installations are the result of decisions taken at the institutional level[1] with respect to use of coastal areas. To a great extent, these decisions are an exogenous variable for shellfish operators. They may influence the decision-making process through pressure from their professional association and the economic arguments this organization may present. The stakes are quite large: development of the shellfish industry is partly through the creation of concessions outside areas already being used, and the development of other, competitive activities, in terms of space or use of the environment, may be nearly irreversible. For municipalities, the shellfish industry is often poorly situated in comparison with other activities due to the absence of tax income, since there are exemptions both from business taxes and property taxes on developed properties.[2]

The strategies of various shellfish-industry groups may act directly through *the criteria chosen for the use of available space*. Shellfish-industry organizations may propose a local policy for operating structures.[3] Officials (Commissaires de la Rēpublique) will thus be led to adopt regulations, after consultation with marine culture commissions, on the minimum and maximum dimensions of new concessions granted. The means for applying for vacant concessions and allocation of these concessions play an important role, due to the possibility for encouraging or preventing certain types of activity. For example, proposals put forward recently by professional groups for defining the minimum area for installations in a basin might favourize applicants over 35 years of age, to the detriment of younger applicants.[4]

Biological production models make it possible to take into consideration external factors due to the effect of basin loading on carrying capacity or the impact of other ecological variables in the environemnt. Bio-economic models may enable the results obtained by biological shellfish production models to be translated into terms of costs and income. These bio-economic models may be confined to interactions between the production factors used, basin loading and production, with unit costs and prices being considered exogenous. They may be integrated into larger models that trace the integration of the shellfish industry into the regional economy as well as induced effects through spreading of value added through the economy.[5] These models make it possible to consider the following aspects:

- potential for seasonal employment or supplementary income; costs, such as transportation, which depend on the regional economic climate,

- an overall increase in shellfish-culture activity would bring with it an increase in consumption of intermediate goods and in purchases of equipment; suppliers of goods and services would see an increase in their activities, which would lead to a rise in their purchases.

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[1] Land-use plan (P.O.S.), developed at the municipal level. Maritime development program (S.M.V.M.) prepared by the State and assigning authority to the various municipalities and regions and to the State.

[2] Prat, J.L. (1983)

[3] Décret No. 83-228, 22 March 1983, laying down regulations governing authorization of marine culture operations (Art. 4).

[4] Payeur, F. (1984)

[5] Harris, C.C. and Norton, V.J. (1979)

- an increase in value added in the shellfish industry causes a rise in total wages and salaries to employees and operations; the effects of this increase may cause a chain reaction through expenditures by employees and operations in other sectors of activity.

These studies of the effects of variations in final demand on regional economies have been used, for example, to calculate the economic consequences of pollution caused by the grounding of the Amoco Cadiz.[1]

1.3 The shellfish sector

Interrelations between the various shellfish operations may occur on a national level, through the existence of a professional organization and training structure, and through processes for determining prices (markets) and costs.

(i) Professional organization: Based on a system close to that of fisheries,[2] the shellfish industry is characterized by the weakness of its union representation and the absence of a local structure, like that of the local maritime fisheries committees, in individual basins. There are six regional sections, which together form an interprofessional shellfish industry committee, which is in term represented in the CCPM.

(ii) Training is provided by maritime trades schools and by specialized vocational high schools.

(iii) Overall influence of the national (and international) economic climate on the shellfish industry as a whole depends on several factors (Table 3).

- Production costs: The cost of a number of consumables is beyond the control of producers, e.g. cost of hatchery or imported spat, cost of equipment such as sorters which partly depend on the existence of industries using similar techniques, manpower costs (ENIM - MSA).

- Investment: Financing mechanisms (subsidies, banking system, interest rates, etc) are crucial factors in investment decisions.

- Industry turnover: the industry has very poor control over demand factors. Producers can only act on consumption through collective advertising and cooperative financing by the State (FIOM) and producers. Other parameters that are just as important are not controlled: available income, foreign trade, constitution of reserves, etc.

There are very few global economic models in France today. For the time being, there is no model of supply (make-up of costs)[3], and very few models of market functioning. One example that might be mentioned is that prepared by P. Dumont (1983) for the cupped oyster. This study shows, first, that there is great variability in the demand for cupped oysters compared to retail prices (1:11) and disposable income (1:01). Second, these considerations and the low value of consumer price elasticity compared to operating costs show that marketing and distribution structures in France do not always coincide with domestic supply.

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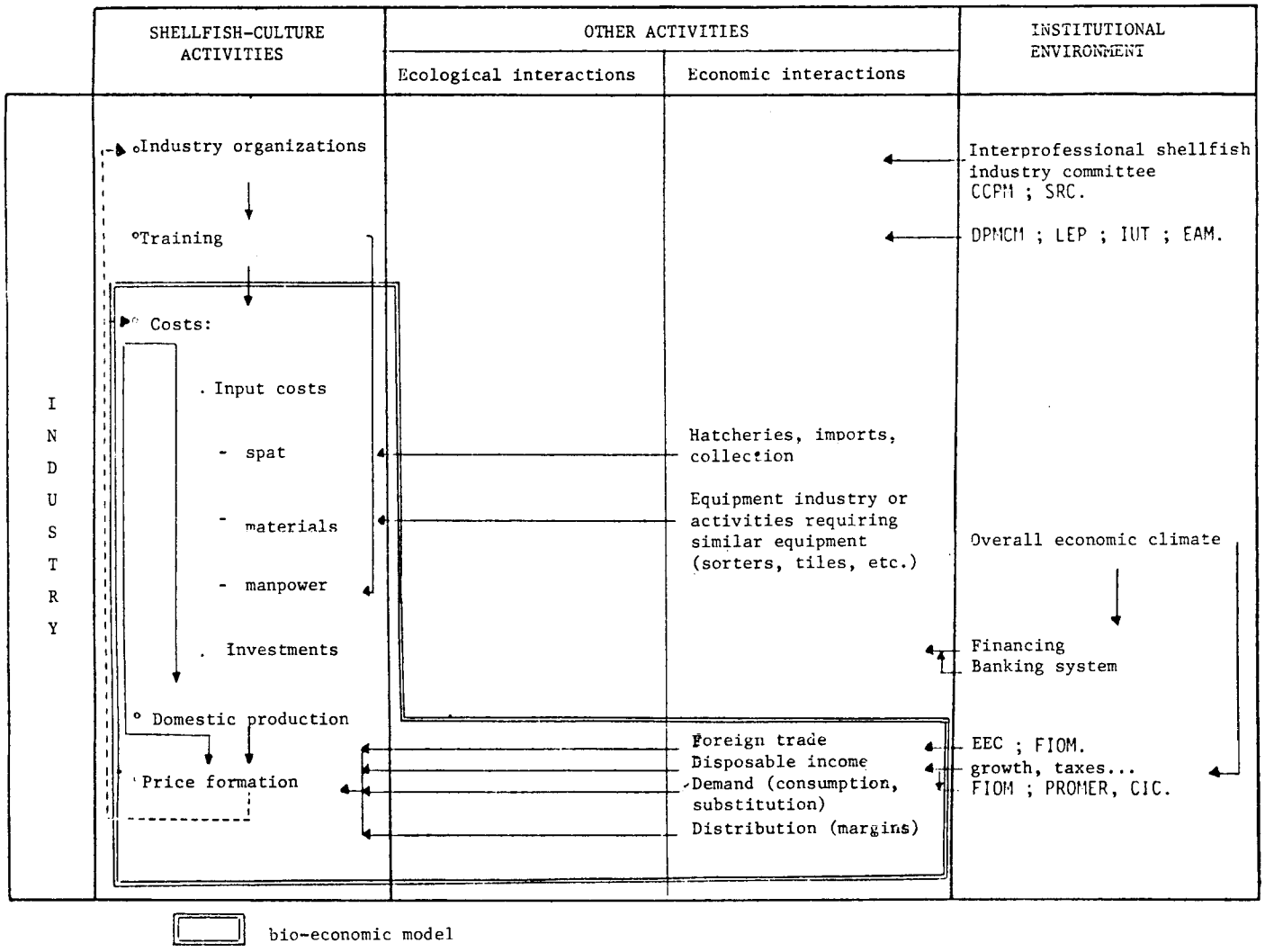
[1] Bonnieux et al. (1980

[2] 1945 Ordinance; Décret of 17.02.1958, amended in 1968.

[3] cf. Dumont, P. in preparation.

TABLE 3: INTERACTIONS AND ENVIRONMENT: SHELLFISH INDUSTRY



CONCLUSION

Bio-economic models may form an important analysis and evaluation tool. In principle, they make it possible to determine external factors affecting shellfish-culture activities, for example, by showing the relationship between basin loads and quantity and value of production. They may also be used to evaluate the economic repercussions of alternatives for space allocation or use of the environment.

The potential for developing accurate models and using them as an aid to decision-making is nevertheless uncertain in France:

- Practical difficulties involved in obtaining reliable information on shellfish operations may jeopardize the possibility of developing bio-economic models in the very near future, especially since:
  - biological models of shellfish production have not yet been developed,
  - very few economic studies exist on the shellfish industry, and little is known about the strategies followed by shellfish farmers in areas such as access to space or investment, financing structures, the impact of taxation and other important aspects.
- The potential scope of bio-economic models is related to the manner in which the results of this research are used; however:
  - At the basin level, the results obtained from models may emphasize the interest of a group strategy (for example limiting basin loads). This strategy is nonetheless difficult to reconcile with that currently being followed by some operators, whose profits are related to better production estimates and pricing prospects than those of their competitors. As well, under-estimating production means that some income is concealed from the taxation authorities.
  - Development of coastal areas and of conditions of environmental use is carried out through a consultative process in which pressures inevitably come into play; for example, choice criteria resulting from a cost-benefit type of economic analysis may not be taken into consideration. The situation in France is, from this point of view, different from that encountered in countries such as the United States, where evaluating the economic impact of various decisions on the use of natural resources is a necessary preliminary to decision-making.[1]

It is essential to involve disciplines such as sociology or political science in the study of the crucial elements affecting the dynamics of the shellfish sector of the economy, e.g.:

- knowledge of the choices and strategies available to operators, either as individuals or groups,
- decision-making processes leading to arbitration of conflicts on use of space and the environment, the role and conditons of using scientific information in these decision-making processes.

[1] Cf. for example the case of the Water Resources Council: "Establishment of Principles and Standards for Planning", Federal Register, Vol. 38, No. 174, September 10, 1973.

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