ECONOMIC INDICATORS OF SUSTAINABLE DEVELOPMENT IN FISH CULTURE

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Summary
This chapter presents a number of micro and institutional economic indicators for fish farming that arguably satisfy the basic criteria for measuring sustainable development as a human-centred and development-oriented concept. The indicators are suggested as supplements to the Total Factor Productivity (TFP) and the Relative Labour Productivity (RLP) methods, which can evaluate aquaculture from a macro, sectoral and firm perspective, to measure the economic dimension of sustainability of the fish culture industry.

1. Introduction
As part of the agreement ensuing from the Earth Summit 1992, the selection of indicators for sustainable development, often-abbreviated to sustainability in the literature, has become a major academic and policy endeavour of countries (Authors’ Note 1). The FAO’s policy towards sustainability follows faithfully the intent and spirit of the Earth Summit and has led to the development of sustainability indicators for capture fisheries, as exemplified by various papers in a special issue of the Marine Freshwater Research in 2000 (notably Dahl 2000; Garcia 2000a; Garcia 2000b; Hundloe 2000).
With a view to promote research and partake in the multi-disciplinary discussion in the development of sustainability indicators for aquaculture (Authors’ Note 2), this short chapter seeks to develop simple economic indicators that are essential for two purposes. They are (a) the comparative measurement of the sustainability of a spatial entity (say a country, a region or a village) over time and/or (b) the ranking of sustainability of a spatial entity relative to other entities in the same period. These purposes meet the requirements of scientists who may use indicators as a method to describe and monitor changes without any policy agenda. They may also help satisfy the needs of policymakers who would like to use indicators as methods of control and as the basis for establishing goals to promote public efforts in achieving certain objectives.

In the next section, the requisite characteristics of the indicators are specified in order to show that the major issue in developing indicators lies in the theoretical understanding of sustainable development. Then two convenient approaches to index sustainability partially, namely the Total Factor Productivity (TFP) and Relative Labour Productivity (RLP), are presented. Finally, as supplements to either the TFP or RLP approaches that can be of macro, sectoral and firm-level application, the possible micro and institutional economic indicators for measuring sustainability of fish farming are discussed. Such indicators are considered applicable to Hong Kong as a small open laissez faire economy. As Hong Kong’s economic policies are well known as non-interventionist, the indicators should be of interest also to polities that are liberalising their economies.

Bibliography

Alberti M. (2000). Urban form and ecosystem dynamics: empirical evidence and practical implications. *Achieving Sustainable Urban Form* (eds. K. Williams, E. Burton, and M. Jenks), pp.84-96. London: E & FN SPON. [This paper discusses the relationship between urban forms and urban ecosystem. Tables 1 and 2, at pp. 87 to 91, are particularly handy references to the relevant literature.]

Alchian A.A. (1965). Some economics of property rights. *IL Politics* Vol.30 No.4, pp.127-149. [This is a classic paper that defines various property rights regimes, namely common, communal and private. Alchian explains the view that property rights are rules used to tackle the problems of competition, which is unrestrained in a state of “common property”. As such, property rights are an example of an institution, the institution that regulates competition.]


Anderson T.L. (1982). The new resource economics: old ideas and new applications. American Journal of Agricultural Economics Vol.64 No.5, pp.928-934. [This paper discusses the fundamental concepts of property rights with particular reference to open access fisheries.]


Angello R.J. and Donnelley L.J. (1976a). Externalities and property rights in the fisheries. Land Economics Vol.52 No.4, pp.519-529. [This paper is about the potency of the price mechanism in terms of measuring externalities.]

Angello R.J. and Donnelley L.J. (1976b). Prices and property rights in the fisheries. Southern Economic Journal Vol.42 No.2, pp.253-262. [This paper evaluates the price mechanism in terms of alternative property rights regimes for fishery resources.]

Brown, L.R. (2000). Fish farming may soon overtake cattle ranching as a food source. Worldwatch Issue Alert, Earth Policy Institute, 3 October.


Buchanan J.M. (1993). Property as a Guarantor of Liberty, 64 pp. Aldershot: Edward Elgar. [This short monograph of Buchanan, Nobel Prize winner in economic science, argues that private property is a means of self-production, a means to secure liberty and freedom from the chaos of the market. Buchanan has the idea that property provides a basis of self-sufficiency. At pages 49 to 50, it extracts parts of an encyclical letter of Pope Leo XIII that addresses, among other things, private property.]


Cheung S.N.S. (1970). The structure of contract and the theory of a non-exclusive resource. Journal of Law and Economics Vol.13 No.1, pp.49-70. [This paper gives a theoretical exposition about resource allocation under different property rights regimes, notably private and non-exclusive (i.e. open access) regimes. Cheung gives an even more general theory which he calls “a theory of price control” later in the same journal.]

Coase R.H. (1959). The federal communications commission. Journal of Law and Economics Vol.2 No.1, pp.1-40. [This paper shows an interesting example of externalities, crowding, in which no specific party may be said to be blameworthy. Crowding of radio frequencies is explained as an outcome of property rights delimitation. In this paper, the famous statement that ‘property rights is the prelude to market transactions’ is made.]


Fish Marketing Organisation, Hong Kong (1970). Sea Life around Hong Kong (Vols. 1 to 14), Hong Kong, FMO.


Hardin G. (1968). The tragedy of the commons. *Science* Vol.162 No.3859, pp.1243-1248. [This is the paper that gives rise to the now popular notion of the tragedy of the commons.]


Herdt R.W. and Lynam J.K. (1989). Sustainable development and the changing needs for impact assessment of international agricultural research. *Paper presented at a workshop, Assessment of International Agricultural Research Impact, Cornell International Institute for Food, Agriculture and Development*, Ithaca, NY, USA. [This paper modified the original concept of using total factor productivity as a measure of economic sustainability to include explicitly the externalities associated with both inputs and outputs.]


John Paul II (1991). *Centesimus Annus*, Vatican City: Libreria Editrice Vaticana. [This is an encyclical letter addressed by His Holy Father Pope John Paul II to the Catholic Church. It reviews the Encyclical of Pope Leo XIII which addresses the problems and issues of modernism that emerged in the nineteenth century and, as far as modern economics is concerned, gives guidance to believers in respect of private property and the environment.]


Lai L.W.C. (1993). Marine fish culture and pollution. *Asian Economic Journal* Vol.7 No.3, pp.333-351. [This paper shows Hong Kong empirical evidence that fisheries output in privatised portion of the ocean zoned for marine fish culture is greater than that in the public portion of the same ocean notwithstanding growing marine pollution in both portions, verifying basic property rights propositions.]

Lai L.W.C. and Lo E.C.W. (1986). A location quotient approach for open space investment decision in metropolitan Hong Kong. *Planning & Development* Vol.2 No.2, pp.42-46. [This is an example of the application of the approach used to define the relative productivity indicators used here.]

Lai L.W.C. and Yu B.T. (1995). The ‘Hong Kong’ solution to the overfishing problem: a study of the cultured fish industry in Hong Kong. *Managerial and Decision Economics* Vol.16 No.5, pp.525-535. [This paper discusses how the conversion of common access fisheries resources into private property by mariculture can lead to experimentation in resource and marketing enhancements.]

Lai, L.W.C. and Yu B.T. (2002). The Hong Kong Fish Marketing Organisation: a case study of the nature of the financial problem of a legal monopoly. *Pacific Economic Review* Vol.7 No.1, pp.85-96. [This paper explains the emergence of structural deficits of the Fish Marketing Organisation of Hong Kong, a legally created organisation that monopolises iced marine fish marketing. Introduced during Japanese occupation of Hong Kong, this form of forced marketing led to various means used by fishermen to bypass regulations, including resorting to marine fish culture.]


Lynam J.K. and Herdt R.W. (1989). Senses and sustainability: sustainability as an objective in international agricultural research. *Agricultural Economics* Vol.3, pp.381-398. [The authors of this paper proposed the use of total factor productivity as a possible measure of economic sustainability.]


Nabli M.K. and Nugent J. B. (1989). The new institutional economics and its applicability to development. *World Development* Vol.7 No.9, pp.1333-1347. [This paper discusses the applicability of institutional economics to development economics.]


Yu B.T., Shaw D., Fu T.T. and Lai L.W.C. (2000). Property rights and contractual approach to sustainable development, *Environmental Economics and Policy Studies* Vol.3, No.3, pp.291-309. [This is the paper in which the Yu’s interpretation, using conventional neoclassical techniques, is first discussed. The techniques help distinguish the “soft” from “hard” sustainability. Examples of the application of this interpretation to promote sustainable development from Hong Kong and Taiwan are demonstrated.]

Authors’ Notes

1. In this short paper, unless otherwise specified, sustainable development is used as a synonym of sustainability. For a general discussion of sustainability in agricultural economics, see Norgaard (1991, 1992); and Yu *et al* (2000).

2. Aquaculture as defined by FAO is “the farming of aquatic organisms including fish, mollusks, crustaceans, and aquatic plants under some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc.” In this paper, the terms aquaculture, fish culture, and fish farming are used interchangeably.

3. The Index of Biotic Integrity (IBI), initially developed for fish (Karr 1981), has been suggested for application to urban planning. See Alberti (2000).

4. For competing approaches, see Fullenbaum *et al.* (1972); Smith and Berkes (1991)

5. The ornamental fish culture industry is an engine of such an evolution. The story of the goldfish is a good example to show how a natural species evolves into a rich variety. (Man 1982)

6. For other methods, see Squires (1992).

7. The approach is versatile and can be used for “weighing” various ratios, such as casualty rates in battles (Lai 2001).

8. This section is largely taken from Leung (1996).

9. As mentioned earlier, a similar relative index can be developed using the TFP concept to provide an analysis of all factors of production instead of just labour input as follows: \( \text{RTFP} = \frac{\text{TFP}_f}{\text{TFP}_y} \), where TFP, and TFP, are the total factor productivity of the fish culture industry and the entire economy,
respectively. Obviously, to implement such an index would require information on all factors of production in addition to labour, which is frequently not available.

10. Examples of studies on sustainability of fish culture in Hong Kong include Wilson (1997); Lam (1999).

11. Though the regulation of the fisheries industry by the Hong Kong’s Fish Marketing Organisation (Food and Agriculture Organisation of the United Nations 1955); Szczepanik, E.F. 1960) may not breach WTO’s policies, it has been criticised by Lai and Yu for preventing vertical integration (Lai and Yu 2002).

12. His Supreme Pontiff (John Paul II: Chapter IV) refers to this concept of the Second Vatican Ecumenical Council in addressing the issue of private property discussed in various passages in *Rerum Novarum* of Leo XIII, which have been quoted by Buchanan (1993, p. 50) as an apology for the institution of private property.

**Biographical Sketches**

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