SHELLFISH FARMING IN IRELAND:

AN EXAMINATION OF THE CRITERIA AND OBJECTIVES FOR DEVELOPMENT

ABSTRACT

Shellfish Farming In Ireland: An Examination Of The Criteria And Objectives For Development

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The main reason for establishing the shellfish farming industry in Ireland was to create economic activity and employment in peripheral coastal regions. Whether or not this indigenous marine-based industry is capable of achieving these objectives is central to this doctoral dissertation.

The research investigates the location, business creation and development of these enterprises. It identifies critical factors influencing the performance of these farms and assesses whether peripheral enterprises suffer from constraints on their growth because of their location and their social and economic environment. These findings also provide an essential context for assessing the appropriateness of current Government and EU policy in relation to peripheral enterprise development.

A longitudinal study of the shellfish industry was conducted over a period of four years and was directed at the shellfish farmer and farm enterprises. The main findings of the research show that successful development of shellfish farming depends on its response to a wide range of competitive threats and opportunities. The research approach adopted a competitive business framework which enabled these factors and shellfish farm business responses to be identified and analysed.

The findings also show that in its present form, the industry is essentially a part-time activity engaged in shellfish cultivation, and, as such, will be incapable of meeting the broad objectives set for the industry. With the introduction of Government and EU Directives and Regulations, the industry will become a potentially more complex and diverse activity, and will necessitate the employment of a wide range of different farm management skills, practices and technologies. For the industry to succeed, however, the research suggests the establishment of a limited number of large-scale farms in core regions, where the necessary skills could be developed and where economies of scale could be achieved.

ACKNOWLEDGEMENTS

There are many people I wish to thank for their support, encouragement and co-operation in compiling this research dissertation. The support came from Professor Joyce O'Connor and from Fr. John Brady of the National College of Ireland and from my supervisor, Brendan Devine. The encouragement from my colleagues in Bord Iascaigh Mhara and from the staff of the many marine development agencies. Co-operation I received in abundance from the shellfish farmers themselves.

I also appreciate the help of Jim McMahon in compiling the statistics used in this dissertation and for the dedication of Mary Carroll in computing the material.

I can only repay them with my gratitude by producing a dissertation that hopefully does justice to their involvement.

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INTRODUCTION

The aims of this research dissertation are to investigate, analyse, and define the peripheral coastal region shellfish farming industry in Ireland. The result of the findings will be used to explore the traditional notion that shellfish farm activity will help stimulate economic and social activity in the peripheral coastal regions and to create employment.

It is intended that the findings of this research will help identify barriers impeding the expansion of the industry, explore opportunities for exploiting this natural resource, and quantify operational practices and procedures needed to manage and develop this indigenous resource.

The findings of this research should be of benefit to the Government and Government support agencies, as well as to policy makers involved in the promotion of the shellfish industry who may find the results of interest in providing a useful document in the planning and assessment of future programmes for the development of shellfish farming in peripheral coastal regions. Practising shellfish farmers, intending shellfish farmers and students of enterprise development may also find the research useful.

The research will examine the shellfish industry in the light of the original objectives set out to develop the industry. According to the **OECD (1989, 18)** these objectives are as follows:

1. Fill a growing gap between demand and supply for fish and fishery products.
2. Create job alternatives and opportunities, notably for the agricultural and fishing sectors in coastal areas.
3. Sustain the economy of certain depressed regions.
4. Develop an economically healthy and viable industry.

BACKGROUND TO RESEARCH QUESTION

The development of the shellfish-farming sector in Ireland is a highly complex process which could be difficult to understand, stimulate and direct. Shellfish farming systems are diverse, employing a wide range of farm practices and technologies. Shellfish farm systems developed gradually as the understanding of the biological requirements of the shellfish products cultivated on the farm improved. Also shellfish culture techniques employed vary from fairly extensive labour systems, to small-scale family subsistence systems, through to highly intensive systems calling for large-scale investment and a reasonable return on capital. Often, technologies readily available from other activities such as agriculture and sea fishing were simply incorporated into shellfish farm production techniques without appropriate adaptation to the needs of the industry. In many cases, however, this learning or "green thumb" process through trial and error has been fairly rapid.

These farm systems developed gradually as the understanding of the biological requirements of the shellfish products cultivated improved. For example, better control of diseases and water quality management systems were established. These presented serious constraints to shellfish farm production and presented a serious risk to the viability of the farm. The use of technological systems and innovations is necessary for improved performance and should sufficiently cover all biological and technological aspects of shellfish farming. The problems of scale-up from pilot development to commercial operation require different management and entrepreneurial techniques. The economic and social impact of shellfish farming in peripheral coastal regions can no longer be ignored, and negative as well as positive benefits have to be considered. The role of the Government and the EU in adopting a regulatory framework defining the conditions of access to shellfish farm sites and use of the marine environment raises many complex political, economic, social and technical issues. At the same time, these institutions provide the major conditions and support systems for the development of shellfish farming. The question of the shellfish farming industry providing sustainable employment has to be asked. Where capital intensive "new industry" shellfish farms may not be a logical means of reducing unemployment on a national scale, the locational characteristics of the farming of shellfish may provide a useful means of providing employment in otherwise economically disadvantaged regions.

CHAPTER CONTENTS

The research thesis is constructed as follows:

The first chapter of this dissertation is descriptive in nature and examines the early development of the industry and details the establishment of the farms, the shellfish products cultivated on the farm as well as the characteristics of shellfish farm structure, management, finance and marketing. The legislative requirements of shellfish farming and the Government support and extension services for the industry are also recorded. The process of selecting a site for shellfish farming as well as the creation of a shellfish farm enterprise is also detailed.

In chapter two an evaluation of the social and economic influence of shellfish farming is made. A cost-benefit analysis of the impact of shellfish farm production, shellfish farm employment and the social implications of the shellfish farm industry is also undertaken.

Chapter three deals with the research design and methodology used to gather the exploratory information required for the content of the remaining number of chapters of the dissertation.

Identification of the coastal regional zones where shellfish farm activities are undertaken is made in chapter four. The concept of the peripherality of these zones is analysed in the context the social, economic, physical and structural make-up of these coastal zones. Shellfish farm activities as practised in each of these shellfish farming zones is also measured.

Chapter five deals with the impact the EU Directives and Regulations have on shellfish farming.

In chapter six the entrepreneurial and business management characteristics of the shellfish farmer are identified. The business status of the shellfish farmer is analysed, as is the role the farmer plays in creating the shellfish farm enterprise. Examples of various entrepreneurial type activities undertaken by the shellfish farmer are included. The question of the creation of the shellfish farmer as a new type of entrepreneur is also discussed.

In chapter seven shellfish farming as a high risk business is portrayed. An identification of the many risks in shellfish farming from disease related-risks to consumer risks is made. How the shellfish farmer measures, manages, and controls these risks is also observed. Diverting these risks, and the Government's role in risk management, is also studied.

The innovativeness required for the farming of shellfish is explained in chapter eight. The innovative culture is identified and some cases of shellfish farm zone innovations are selected.

In the concluding chapter the main findings of this study are summarised under the broad objectives set for the development of the shellfish farming industry. Recommendations for the future development of the industry are also made.

Chapter One

DEFINING PERIPHERAL COASTAL REGION SHELLFISH FARMING IN IRELAND

Introduction

Aquaculture is defined as the farming of aquatic organisms, including fish, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators etc. It also implies individual or corporate ownership of the stock being cultivated **(OECD: 1989, 18)**. The farming of shellfish is therefore by definition an integral part of the aquaculture process.

The aquaculture industry has progressed fairly rapidly since the 1960s from being a rather restricted and small-scale activity to becoming considered as an important growth industry. Because of the perceived national potential of the industry, many countries, including Ireland, have accorded a degree of priority to the development of this sector. Aquaculture is defined in the Government's National Development Plan 1994-1999 as:

> an indigenous-based industry with considerable development potential for coastal peripheral regions **(Government of Ireland: 1993, 54).**

Knowledge derived from traditional practices and the many years of individual research into certain aspects of the industry has provided the basis for this initial growth in shellfish farming. From originating as a subsistence level farm operation, which still continues in some areas, shellfish farming has in recent years developed into many and diverse types of operation. For example, shellfish farming operations are often combined with agricultural or animal production activities and in many cases this forms part of integrated rural development programmes.

However, the development of shellfish farming in Ireland has not always followed any specific plan. It has largely been influenced by national priorities such as creation of employment and the socio-economic development of peripheral coastal regions **(Bord Iascaigh Mhara: 1993)**; **(Economic and Social Institute: 1992)**.

At the enterprise or project level, shellfish farm planning has not always been complete and often initiated on an extremely short-term basis. This has led to the enterprises facing unforeseen problems, and to the creation of quick solutions which may impede rather than advance the development of the industry.

The concept of national central planning for an industry such as aquaculture has been achieved in some socialist societies or command economies as for example, in Asia. However, in the open economy structure of Ireland, the introduction or expansion of a new emerging industry such as shellfish farming, requires appropriate planning at the national and regional as well as the enterprise level, for speedy and orderly development. For example, infrastructure development, legislation and financial support, long-term research, manpower development and allocation of land and water resources, sustainable use of natural resources and control of communicable diseases, are areas of shellfish farming that still require State intervention. The ability of the State to carry out these responsibilities in this respect requires appropriate assessments of the potential development and possible pace of growth of the industry. The support the industry has obtained so far is by way of financial and technical assistance and there has been a tendency to confuse such support programmes with local, regional and national planning for the industry. However, due to the relatively small size and diversity of the shellfish industry, there is a lack of appropriate resource and economic data and this lack may constitute a major handicap to proper planning in this sector. Because of the absence of many other inter-disciplinary inputs, many cases of undue optimism and vested interest often affected the creditability of the development of the industry not only at national level but also at the local and enterprise level. There is therefore a need to collect data from representative individual shellfish farmers and use this as a basic source of information to help assess the success or failure of the technologies available to the farmers and the suitability of the enterprise and management practices at the farm to achieve optimum production. The development of the industry also depends on the ability of the farmer as a manager or entrepreneur to create wealth from this natural resource.

In the early stages of shellfish farm development the most important consideration was the availability of unutilized or under-utilised shore areas for conversion to shellfish farming use and the culturing of species of shellfish. Assessments of potential sites for shellfish farming were often made casually from topographical maps or by the extent of access to the shore in certain coastal regions. While this initially served the purpose of drawing the attention of the Government support agencies to the possibilities of shellfish farm development, some of these assessments did not prove successful. Many potential regions around the coast were either communally owned or had marginal uses for the local communities who are not always amenable to being deprived of their traditional rights of access.

Apart from the technical considerations for selecting a shellfish farm location, other important characteristics such as information on ownership and accessibility, the hydrographic and water classification situation, the availability of skilled workers, infra-structural development and the closeness to suitable outlets and markets for their products all have to be considered in detail. The social, economic and environmental impact these shellfish farm operations have on these coastal peripheral regions have also to be assessed. Very little investigation was carried out to determine these considerations. While the ideal requirements for shellfish farm sites may have been defined, it is now only in very exceptional cases that the site will meet all the necessary conditions for successful shellfish farming. The shellfish farmer in the past often settled for sites with the expectation that deficiencies could be rectified and any problems overcome at affordable cost and effort.

EARLY DEVELOPMENT OF SHELLFISH FARMING IN IRELAND

One of the first commercial shellfish farm enterprises commenced operation in the Wexford Bay area in the early 1970s and was researched by **Meaney (1975).** This 25 square mile bay was an appropriate site for Dutch-style bottom cultivation of mussels favoured by the natural environment of the shallow bay. There was also a good and abundant supply of local seed, proximity to export markets through the Rosslare ferry service, local community support and co-operation and an absence of competing water users.

The principle of this extensive mussel culture enterprise was to remove seed mussel from rocks offshore and transport them inshore where growth could be accelerated. The mussels were relayed in numbered "parcs" which were dredged at a later stage. Relaying was undertaken during early summer and the grown mussels were harvested and processed from September to March.

Following the initiation of the seed-laying programme in these early development days, it was found that the subsequent seed quality and availability deteriorated. This falling quality also led to decreases in the survival rates of seed. From an average of 1 tonne of seed laid to produce 3 tonne of mussel in the early stages of development, 1 tonne of seed now only produced one tonne of mussel. This deterioration was also accounted for by the increase in predator numbers due to the increasing production of mussels.

New initiatives for developing the industry and increasing the tonnage had to be found. This led to the development of rope-cultured mussel farming, which while practised on the Continent, was a new phenomenon in shellfish cultivation in Ireland. The first serious attempt at this method of shellfish farming was undertaken in Bantry Bay in the late 1970s. The oil industry in that region had collapsed and this led to major job losses and reduced prosperity for the region. Attempts were made to create alternative sources of employment in the area. The Bantry Bay Action Group joined with local fishermen and other interested parties to experiment with this idea of shellfish cultivation **(Bates: 1995)**. The National Board of Science and Technology identified Bantry Bay as an ideal location for shellfish farming, with its deep sheltered waters rich in plankton. The first 3 tonne crop of farmed mussels was sold on the export market in 1982.

With the channelling of Government and EU capital grants, technical support and marketing support, the industry has seen a rapid expansion throughout the coastal regions ever since. There are now over 300 shellfish farm operations of various sizes operating in the shellfish industry.

The rearing of mussels and oysters on Irish shellfish farms is carried out in extensive conditions. This extensive system requires neither supplementary feeding nor a direct energy input to support growth of the species cultivated **(European Commission: 1995, 10)**.

Products Cultivated on the Shellfish Farm

The main shellfish products cultivated on Irish shellfish farms are bivalve mollusc, a type of shellfish having two shell halves which hinge together. They are normally static creatures that bury or attach themselves to the seabed or other submerged surfaces. They feed by filtering small particles out of the surrounding water. Many of the commercial species are common in estuaries or similar shallow or drying areas where nutrient levels are high. Dense beds of the animals can develop in productive areas. These characteristics make bivalve mollusc suitable for cultivation and this is supplemented by breeding and farming the product. Shellfish products adapting to drying conditions tightly close their shells when out of the water to retain a marine environment around their fleshy internal parts. To varying degrees those species can survive for extended periods out of the water and can be traded for human consumption as live animals. Oysters and mussels are suitable for such trade. With the notable exception of oysters, bivalve mollusc is normally cooked before being eaten; although they may have been traded as live animals.

The main products cultivated on shellfish farms are bottom-cultured mussels and rope-cultured mussels (*Mytilus edulis*), **Bord Iascaigh Mhara (1990),** and native or flat oysters *(Ostrea edulis)* and the gigas or Pacific oyster *(Crassostrea Gigas)*, **Bord Iascaigh Mhara (1990a)**.

Mussel Cultivation:

The mussel *Mytilus edulis* is a mollusc found all around Ireland's coast. There is a long history of fishing this bivalve shellfish, not only for human consumption but also as bait. It has been cultivated in Ireland for almost forty years, but on a much lesser scale than on the European mainland. Mussel cultivation started in France 700 years ago. On Irish shellfish farms, bottom culture and suspended culture techniques are used. Bottom culture is an extensive technique: the principle is to locate and fish beds of seed mussels and move these by dredger to sheltered inshore waters. These mussels grow to maturity in about eighteen months and the meat yield is usually 15 to 25 per cent of the total weight. The advantages of bottom culture mussel farming are that the mussels are submerged most of the time and a high degree of mechanization in harvesting the mussel is possible. The disadvantages are that there is a high mortality rate, a low meat yield, and the mussels tend to be gritty.

Suspended mussel culture is a more intensive technique. Ropes on which the mussels grow are suspended from floating structures such as rafts or long lines. Seed mussels are collected from rocks or are obtained by placing collectors in known spawning areas. Mussel larvae settle onto the collectors and start to grow. These collectors are later suspended from the rafts or long lines. The usual growing time to market size is about ten to sixteen months, depending on the location and the method of seed collection. These rope-cultured mussels are thin shelled and sand free and produce a meat yield of about 30 per cent weight. One of the advantages of this type of shellfish farming are that the mussels are totally submerged and are removed from bottom living predators. The suspension of the mussel in this three dimensional environment also makes more use of available space. The disadvantage is that this system requires major investment in boats, winches, grading equipment etc. These mussels are processed and sold in live or fresh form. Suspended cultured mussels fetch about £500 per tonne compared to a price of £90 per tonne ex-farm for bottom-cultured mussels.

Life Cycle of Mussels:

Mussels and oysters have similar life cycles. The mussel releases its reproductive material into the sea, where the eggs hatch into larvae. The female mussel releases up to twenty million eggs at a time, and, depending on the temperature of the water and the availability of food, this may happen several times in a season. Mussels do not become "ripe" in the same way as oysters and they can be eaten throughout the year. Mussel larvae feed themselves in the water for about twenty-one days and when the larvae metamorphose into small mussels (spat), they grow byssus threads, which attach themselves to a suitable firm object. Mussel will grow on almost any surface, from small pieces of gravel to underwater cliffs. The most likely place is on other mussels and they are often found in high clumps, with several generations of mussels living attached to one another in beds. Should the mussel become detached from its anchor, it is generally capable of growing another beard and attaching to an alternative site. However, most mussels attach themselves to an anchorage where they remain. Mussel beds can cover several square miles and reach several feet in thickness. Mussels can be found from the beach to deep water, with most commercial beds in water less than 60 feet deep. Mussels can pump and filter as much as 15 gallons of water in the course of a day and ideally prefer to be submerged at all times. They can survive however, and thrive, in intertidal zones. Growth rates for mussels tend to be higher when fully submerged and intertidal populations tend to grow thicker shells, which gives a lower meat yield. This thicker shell is less vulnerable to chipping and breaking during transport and distribution.

Oyster Cultivation:

Oysters are bivalve two-shelled animals in the family *Ostreide.* There is some 200 species worldwide, but fewer than a dozen are used commercially. Commercial oysters are all from the genera, *Ostera*, which are the flat or native oyster and *Crassostream*, which are cupped or Pacific oysters.

Over-fishing and disease have caused a rapid decline in the native oyster throughout Europe. Ireland is one of the few European countries where there are still wild self-sustaining native oyster beds. Oysters are perhaps the oldest aquaculture product, having been grown by the Romans two thousand years ago. Chinese oyster growers were operating before that but evidence of this is inconclusive **(Wilkins 1989)**. Oyster growing techniques changed very slowly over the centuries and it is only in the last two decades that changes in the industry have developed. This was brought about by the development of secure hatchery techniques and

and innovative methods of growing oysters faster and with fewer mortalities.

Life Cycle of the Oyster:

The oyster can change sex but for most of the time it is either male or female. It produces offspring by releasing sperm and eggs. In the native flat oyster, the eggs are retained in the female's shell after fertilisation and released only after they hatch into larvae. Fertilisation is carried out by sperm which drifts into the female's shell. In most Crassostrea species, both eggs and sperm drift into the water and make contact. Native oysters spawn in Irish waters where the sea temperature exceeds 16 degrees centigrade for a number of weeks. This seed is a vital element in the development of the oyster fisheries of Tralee Bay, Clew Bay and the bays of Connemara, Clarinbridge, and the Foyle. Natural production varies however, from year to year due to weather conditions and other causes. To overcome this variation, attempts are made to produce seed in offshore spatting ponds and in intensive hatcheries.

Oysters produce enormous numbers of eggs. The flat oyster, which produces comparatively few but large eggs, may release as many as one million eggs. Eggs hatch into larvae and then secure their own food supply from the water or from remaining eggs. Once released the larvae float with the currents but are able to move vertically in the water. When fully developed, the larvae settle on a suitable material, which is often another oyster shell. They extrude a minute amount of cement, gluing themselves to the surface. The larvae begin a rapid metamorphosis from larvae form into minute oysters. These tiny oysters are described as spat or seed, they grow rapidly and are just visible to the unaided eye. Many larvae fail to settle properly and are an easy target for many predators. The final result of all these eggs is likely to be at best only one or two mature oysters. In the wild, oysters remain wherever they settle for the duration of their existence, which may be many years.

This natural life cycle, which varies little according to the species, has been adapted in hatcheries to take advantage of the prolific nature of this aquatic animal. In hatchery situations, oysters are induced to spawn and the larvae are fed and maintained in large tanks. The larvae settle on a specially prepared material and are removed from this before the cement hardens. Such seed can be farmed in ways which improve survival rates and improve on the results of traditional oyster growing techniques **(Bord Iascaigh Mhara 1990a)**.

Production Trends in Shellfish Farms

The production trends for mussel products involve extensive cultivation, which is bottom or dredged mussels and suspended mussels grown from ropes submerged in the sea.
Bottom mussel farming has been carried out in Ireland for many years. Prior to the 1980s production levels were under 5,000 tonne. Since then production has climbed to a maximum of 15,000 tonne in 1990. It subsequently declined and production for 1995 was around 5,000 tonne. The reason for this decline in production relates mainly to poor seed production in the Southwest region. The main limiting factor for further expansion in extensive cultivation in Ireland is insufficient seed.

Suspended cultivation of mussels, in contrast to bottom cultivation, is a relatively new development in Ireland and production only passed the 1,000 tonne mark in 1984. Production has increased since that time and 5,000 tonne were produced in 1995. The production regions for rope or suspended mussel cultivation are concentrated mainly in the South West, particularly in the Bays of Bantry, Kenmare and Roaring Water, which probably has the largest concentration of rope mussel production in Europe. There is also smaller production on the

West and the North West Coasts. In contrast to bottom-grown mussels, the production of rope-grown mussels in Ireland is set to expand in the short term. Some estimates point to a doubling of production over the next four years. The uneven growth in Irish mussel production in recent years has been partly due to toxic algal blooms or red tide **(O'Sullivan: 1997, 83 - 86)**.

While over-fishing and disease have caused a rapid decline in the flat oyster throughout Europe, Ireland is one of the few countries where there are still wild self-sustaining native oyster beds. As far back as one hundred years ago, unsuccessful efforts were made to cultivate oyster beds in Ireland but it is only in the past twenty years that modest success has been achieved in this development. Oyster growing techniques changed very slowly over the centuries but it is only in the last two decades there have been vast developments in the industry, due to the improvement in the development of secure hatchery techniques and new methods of growing oysters faster and with fewer mortalities **(Wilkins 1989)**.

The native flat oyster is the more delicate of the two species. It can take between three to five years to reach maturity and prefers more saline water to prosper, and less silty conditions. It is also less hardy than the gigas oyster and is less tolerant of exposure to air, bad handling, and overcrowding.

In contrast the Pacific oyster is very well suited to growth in marine farm conditions. It can tolerate not only lower, more estuarine salinities and increased silt, but can withstand larger periods out of the water and can tolerate more crowding. It is also possible to grow the Pacific oyster to maturity in a much shorter time period such as from eighteen months to twenty-four months. The Pacific oyster would appear to be a more suitable animal to farm in artificial conditions and was first introduced into Ireland in the 1980s. The production levels of shellfish products in Irish farms for 1995 were as follows:

Suspended or rope-cultured mussels	5,000 tonne
Bottom-cultured mussels	5,700 tonne
Native or flat oysters	200 tonne
Pacific or gigas oysters	250 tonne

(Source: BIM)

Characteristics of Shellfish Farm Production and Handling

Shellfish farming can only operate in areas deemed to be "controlled" areas, where the level of seawater is classified for purity and is strictly monitored. This results in locations being selected where population densities are small and where there is no major water pollution or contamination problem. Also for mussel cultivation well-sheltered and deep bays are important considerations.

For mollusc cultivation there is a requirement that all harvesting and production areas are designated and categorised as either A, B, or C, depending upon the degree of water contamination of the area. Areas can also be designated "prohibited". Microbiological standards are laid down for the classification of areas and are based on monitoring faecal bacteria in the mollusc as an indication of sewage contamination. Bivalve mollusc for human consumption and harvesting by farmers of mollusc must only come from, and be permitted in, these designated areas **(European Commission: 1991a)**. Bivalve shellfish seed can be taken from areas not designated as production areas and be transferred to production areas for on-growing, provided that the on-growing period is at least six months before they are harvested for human consumption.

Mollusc from category A areas can be placed on the market for direct human consumption without cleaning or treatment. Mollusc from category B areas, which are subject to low levels of bacterial contamination, must be purified or relayed for the relatively short time necessary to purge them from bacteria, or be heat treated by an approved process at an approved location before being placed on the market. Mollusc from category C areas, which are subject to higher levels of bacterial contamination, must be relayed for at least two months or be heat-treated by an approved means. This relaying must be categorised A or B and is used exclusively for the natural purification of bivalve mollusc. Relaying in the category B area must be followed by purification or further relaying in category A or by heat treatment by an approved means. When placed on the market for human consumption, after cleaning, if necessary, all live shellfish products must meet a product specification that includes signs of life, bacterial counts and safe levels of toxins.

Any required purification or approved heat treatment must take place in an approved purification centre or processing plant. In addition, before live (rather than processed) shellfish products are placed on the market for human consumption, after cleaning if necessary, they must pass through an approved dispatch centre. These dispatch centres are where "conditioning" of the shellfish products such as washing, cleaning, grading or wrapping of the live shellfish takes place. Conditioning is the purging process commonly known as "degritting". The live shellfish are wrapped and labelled in the dispatch centre and must remain so until offered for sale to the customer, retailer or caterer. Farmers must not operate a purification or dispatch centre unless granted approval and allocated an approval number, and must be operated in a specified manner. Purification and dispatch centres may be combined on the same farm. Basic requirements are laid down for conditions of harvesting, handling and transporting the shellfish products, for the operation of relaying areas, for wrapping and labelling the product, for preservation and storage and for the transport of the shellfish. Certain requirements are laid down for the premises, equipment, and operating practices of purification and dispatch centres **(European Commission: 1991)**. Regulations are established to monitor and control the shellfish farm operation to ensure that the requirements are met. Samples of shellfish farm products are taken to check for toxins and microbiological contamination, and prohibition orders closing particular areas should there be a risk to public health can be enforced.

An essential part of the requirements of shellfish farming is the documentation of a "paper trail" from harvesting to retailing of live mollusc shellfish. This is to assist in monitoring and to enable tracing back to source if problems arise. The gatherers or collectors of the shellfish products must obtain official movement documents before harvesting the shellfish. A completed movement document must accompany each batch of mollusc from the production area to the relaying area, purification, or despatch centre, or processing plant. This movement document gives details of the gatherer, source and destination of the shellfish, and it must be retained by the person receiving the consignment. A permanent transport authorization is used instead should the gatherer and the receiver of the mollusc be part of the same business. Records of batches of live bivalve mollusc received and despatched must be kept by the operators of relaying areas, purification areas, and despatch centres. The labelling of packages of live bivalve mollusc dispatched must incorporate a health mark detailing country of despatch, approval number of despatch centre, species of shellfish, date of wrapping and date of durability or a warning that the shellfish must be alive when sold.

In specified circumstances, farmers harvesting small quantities and trading all their catch locally are exempt from parts of the official shellfish farm regulations. These circumstances arise when small quantities of shellfish come from category A areas and are transferred directly by the farmers to retailers, caterers or consumers in the domestic market. Small quantities of shellfish are deemed not to exceed 25 tonne of product and the quantities of species, such as mussel, must not exceed 20 tonne, nor 5 tonne of oysters. These farms are exempted from the conditions of harvesting, handling and transport of raw material (including the requirement for movement documents) and from the dispatch centre, wrapping and health mark requirements. They remain subject to the general requirements for hygienic handling, to the product specification and to the preservation, storage and transport requirements.

All countries within the European Economic Area are subject to the same food safety requirements and trade between these countries is unhindered. Shellfish farm products should be protected against stress, damage, and contamination when harvested and must not be exposed to extremes of temperature. Shellfish should be separated from any debris, sorted if necessary, washed, containerized and placed in a protected environment as soon as possible after harvesting, and should be taken for relaying, purification, dispatch or processing with the minimum of delay. The protective storage/transport environment should provide protection from vermin and other sources of contamination and sufficient protection from the elements to maintain cool, moist conditions. For short periods, of storage and transport of the raw material, a mollusc temperature range of 2 degrees celsius to 10 degrees celsius is recommended. For longer periods of transport and storage a temperature range of between 2 degree Celsius and 5 degree Celsius is preferable.

The consumption of contaminated shellfish is a significant cause of food poisoning. The risks are from sewage contamination of the inshore waters and from the occurrence of toxin producing algae. Because of their feeding method, these mollusc accumulate any bacteria and viruses from sewage contamination and any toxins from algae and their cysts if present in the water. Gastro-enteritis and other serious diseases such as hepatitis can result from sewage contamination, whilst algal toxins can result in various forms of poisoning, including paralytic shellfish poisoning (PSP) and diarrhoeic shellfish poisoning (DSP).

Bivalve shellfish products appear robust but all are perishable and sensitive animals, including those that can survive out of the water. In the live state they are prone to temperature stress and physical shocks. If overheated, whether in or out of the water, they will die. Overheating in water can induce spawning and then death. If they are physically dropped or otherwise damaged they are likely to die within a day or two. The effects on the animals of all these forms of stress are cumulative and repeated incidents of relatively minor mishandling can result in the death of the animal. Shellfish products to be purified must be handled carefully and not held at too high a temperature or for too long, otherwise they may die, or not function during cleaning and their safety cannot be guaranteed. Even when the shellfish are well handled and remain alive, their eating quality deteriorates when they are held out of the water, to the extent that their flavours can become sour and undesirable to the consumer well before their lack of any physical response indicates death.

The robustness of the shellfish products varies not only with species but also with growing conditions and season. Species that survive in the intertidal zone will be less robust if grown in deep water. As the shellfish spawning season approaches (when there is an *r* in the month), the shellfish becomes undesirable and in many cases it is impractical to trade in them as live animals. They also remain in this poor marketable condition for a period after spawning.

When taken out of the water, live shellfish are best held in cool, moist conditions that slow their metabolism and prevent them from drying out. In these conditions they will survive and maintain acceptable flavours for the longest period. However, storage temperatures as low as 0 degree centigrade can cause thermal shock resulting in their early death, particularly when the shellfish are in a weak intrinsic condition. When immersed storage is used, the seawater conditions must be suitable for the species concerned and great care must be taken over the cleanliness of the water to avoid any possibility of the animals ingesting contaminants.

Shellfish Farm Locations

The production regions for rope mussel cultivation is concentrated mainly in the South West, particularly in the Bays of Bantry, Kenmare and Roaring Water, which has one of the largest concentrations of rope mussel production in Europe. There is also a small production level in the West and the North West of the country.

Bottom mussel cultivation is concentrated in the Southeast (Wexford/Waterford), the Southwest region (Cromane/Tralee), the Northwest Region (Donegal) and the Northeast region (Carlingford/Mornington).

Native oysters are cultivated mainly in the Southwest (Tralee) and West coasts (Galway Bay).

These shellfish enterprises are all located in very peripheral and rural areas along the coast. Most of these are small-scale operations carried out by local people, many of whom have other occupations or other sources of income. As the farms can only operate in areas where the level of seawater is classified for purity and is strictly monitored, the locations selected generally are where the population density is small and where there is no major pollution problem. There are over 300 such enterprises in existence and most would produce less than 5 tonne of product per farm. Most areas where these farms are located have high emigration levels, low GDP per capita, lack of resources, low population density and a dearth of economic activity **(European Commission: 1992).**

The economic status of most of these areas where shellfish farming is that they have:

- lower than average income levels
- higher than average national unemployment levels
- subsistence agriculture or poor soils with very small farm units
- higher labour dependency ratios
- very poor physical and communications infrastructure and very limited industrial development

However, in these peripheral coastal areas shellfish farming is seen as having positive interactions which include the need to maintain good water quality and a clean, biologically attractive environment. The presence of shellfish farming operations can promote high quality treatment of existing or potential discharges to coastal waters. There are also negative interactions on a broad front. These include visual intrusion in scenic coastal regions, the use of water space in direct competition with other users, including fishing and water sports, competition over limited onshore users, the use of chemicals such as brocades, and potential conflict with other forms of wildlife, such as birds and dolphins. The development of shellfish farming in the peripheral coastal regions concerns issues of co-ordination, integration, consultation, public participation, the balance between development and conservation to the fore **(Department of Arts, Heritage, Gaeltacht and the Islands: 1997, 102/3)**.

Markets for Shellfish Products

Almost 90 per cent of Ireland's shellfish production is destined for the export market. The domestic market is limited due both to the relatively small population and to the absence of a strong shellfish consumption tradition. The main markets are France and the UK with smaller amounts going to Spain, Holland, Belgium, and Germany **(O'Sullivan: 1997, 83-86)**. Bottom culture mussels are sold in France and the UK, with smaller amounts going to Spain, Holland, Belgium, and Germany. The bulk of mussels going to the French market are fresh rope-cultured mussels. The high transport costs and the difficulty of maintaining "just-in-time" deliveries cause problems for the farmer. Mussels destined for the UK market are mostly frozen mussels and prepared recipe meals.

The market for dredged mussels in France varies from year to year depending not only on domestic production in France - mainly from the Barfleur region of Normandy - but also on the production in Holland and the UK. In recent years, Barfleur production has been low, resulting in higher returns to Irish producers. Typically, dredged mussels are sold in bulk form to France. There importers transfer the mussels to holding tanks for "resting" and for subsequent delivery in smaller packaging to wholesale and retail markets.

Live rope-cultured mussels are marketed either directly by the farmers themselves or through specialist shellfish exporters. Rope mussels are less robust for travelling to more distant markets than the dredged mussels.

A major marketing difference between the rope and dredged mussels is price. Due to higher production costs, rope mussels are more expensive to produce. However the higher price normally reflects a higher quality: rope mussels being cleaner, sand free and tending to have higher meat yields of between 25 and 35 per cent compared to between 15 and 30 per cent for dredged mussels.

The higher price means that the rope mussel producer encounters more selling problems in selling to markets such as France. In the French market, Irish rope mussels are sold into the suspended mussel segment of the market, which is dominated by French bouchot mussels. Demand for Irish rope mussel in France tends to increase as the French bouchot season comes to an end (normally in January/February). This period is often difficult for Irish rope mussel producers as the risk of spawning increases from February. In general, French demand for live Irish rope mussels varies from year to year depending on the level of the French bouchot production. This uneven demand in the French market for rope mussels has encouraged Irish rope mussel producers to switch from supplying the live trade to supplying the processed mussel sector.

The Irish processed mussel sector has undergone a number of important changes over recent years. Traditionally this sector was dominated by the production of frozen dredged mussels either in meat form or in a half shell form. Partly due to more intense price competition in the frozen sector and to stronger prices for the live product, production of frozen dredged mussels declined in recent years. Vacuum packed mussel products and IQF frozen mussel products, as well as chilled vacuum mussel products, have been developed.

The main market for the gigas oyster is in France. However, the demand for these oysters has declined in recent years resulting in price reductions. The French oyster producer groups have co-ordinated in an effort to promote the sale of oysters. This has not altogether proved successful **(Bord Iascaigh Mhara: 1997b.1)** and the French retail trade stocks less of the product. The restaurant trade in France does however, suffer from a shortage of larger gigas oysters with a higher meat yield, and there is a continuing demand for this product.

Strong production of the flat oyster in France and in Spain has led to a decline in the demand for the native Irish oyster. Poor demand in general for flat oyster in recent years has also led to substantial price reductions for the product. Increased production of oysters in the English farms has also contributed to the decline in both price and demand for the native Irish oyster.

Because of the peripheral location of the shellfish farms in Ireland, frequent deliveries to export markets can be very costly. The shellfish farmer has therefore many competitive and cost disadvantages in servicing these markets. In addition to the peripheral disadvantages, the Irish shellfish industry is characterized by a fragmented production structure and a lack of co-ordination by producers in marketing and selling.

Structure and Profile of Shellfish Farm

Shellfish farm enterprises have slowly progressed from the status of a minor sub-section of fisheries to that of an emerging independent sector. In an administrative context it is still generally considered a part of the fisheries industries under the control of the Department of the Marine. The involvement of a number of other sectoral elements in the evolution of the modern shellfish farm gives it a distinct sectoral characteristic different from that of most other part-time rural activities. Nevertheless the majority of shellfish farm operations in Ireland consists of small holder type enterprises. These shellfish farms were generally created by middle class scientists, by agricultural farmers, and by fisherman co-operatives. Although the initial aim of developing and promoting these types of peripheral coastal region activities was to create much needed sources of employment in the area, the present trend is to develop suitably sized shellfish farm units that would provide an appropriate livelihood or a comfortable income to the shellfish farmer. These types of enterprises generally qualify for credit facilities, grants, subsidies, and extension services provided by the Government. Where such essential support services have been properly organized and implemented, these small type enterprises owned and operated by families with the part-time assistance of paid workers have been successful to a degree. Some shellfish farm co-operatives have been equally successful, have prospered under favourable conditions, and have served well the economy and the living standards of some members of the local community.

The operation of bottom shellfish farming normally involves large areas of the coast, low levels of capital investment per unit area, low operating costs, low general management and low yields per unit area. The farming also tends to be very labour intensive. Those engaged in this type of farming are mostly fishermen operating on a casual basis.

Rope or suspended systems, however, are characterized by dense stocking, stock selection and manipulation, intensive management and environmental control, partial mechanisation of operations and a high production per unit area of volume of water. The level of intensity in operations is governed by technical, economic and social factors. In many cases suspended shellfish farming progressed from bottom shellfish farm operations.

Most shellfish farm operations are small-scale. Small businesses in Ireland are defined as being "operations employing less than 50 people, turnover under £3 million and usually managed by owners" (**Government of Ireland: 1994,2**). This definition has been applied to manufacturing firms and it was only during the 1980's that it was broadened to encompass the development of other services and enterprises. As a result very limited research or information is available on the development or progress of new type businesses such as shellfish farming. Whilst there was ample financial support from the EU and the Government for this industry, the amount of basic empirical information on the creation, development and progress of the industry is limited. There is also a problem in that there are few registration requirements for new entrepreneurs in establishing a new business in Ireland. Entrepreneurs are not legally obliged to register their business except with the tax authorities and with local government for the payment of rates. The shellfish farmer can trade under his or her own name or under a registered existing business and so assumes total and personal liability for the debts of the enterprise. Alternatively, the shellfish farmer can register the enterprise as a co-operative, partnership, or public company, in which case members of the public may purchase shares.

In bottom shellfish farm operations the majority of farms are classified as co-operatives or limited companies. This may be due to the fact that these farms cover a greater expanse of water and are used by many people as a recourse for fishing or shellfish farming. The licence to operate in such areas would be given on the understanding that the co-operative would have responsibility for the orderly management and control of the fishery activities in the designated area. Bottom farming would also generally require the need for further processing of the shellfish product such as cleaning, grading and depuration. In this case the establishment of a limited company would be the route to take in creating the business. By contrast the majority of suspended shellfish farm operations would be classified as sole traders. These would be small, part-time operators, many of whom have an other business or source of income. Their primary responsibility would be to cultivate a relatively small volume of product and sell it on to bigger enterprises.

There is also a lack of information on the success or failure rate of these enterprises. There was however, a rapid rise in the number of operations during the past twenty years. In 1982 there were just twenty-one shellfish farm operations and this number has grown to over 300. In 1994 these farms produced 500 tonne of gigas oysters, 2,000 tonne of rope-cultured mussels and 4,000 tonne of bottom-cultured mussels. However, only approximately fifty such farms produced in excess of 5 tonne of product **(McMahon: 1995, 2 -6)**. Many of these shellfish farm enterprises are operated on a part-time basis and the farm could be classified as a part-time farm. There probably is a need for a distinction between part-time shellfish farmers and part-time shellfish farms. However, this research dissertation does not pursue this topic in any great depth. The definition of a part-time employee is an employee who works on a continuous basis on agreed shorter working hours i.e., less than twenty-five hours a week **(Forfas: 1996, 24)**. This definition does not comply with the workload of a part-time shellfish farmer. The farmers of sea-reared rainbow trout define part-time and casual labour as "not working more than 10 hours per week or a total of 3 months on the farm" **(Bord Iascaigh Mhara: 1997a)**. Nor does the definition of a part-time agriculture farmer suit the description **(Higgins: 1984)**. Shellfish farmers claim that their activity on the farm is very much influenced by the amount of husbandry required at specific times and this is further and necessarily very much influenced by the seasonality of their operations. Tidal conditions must also be taken into consideration and these may require short periods of intense physical activity on the farm.

A part-time shellfish farmer may take up an off-farm job for several reasons such as a motivation for financial gain. While some are not primarily motivated by financial considerations they are unlikely to take up a second job unless they are better off financially as a result. Some part-time shellfish farmers claim that they have taken up second jobs as a hedge against the uncertainty of generating an income from the farm. Others indicate that they already had off-farm jobs before they became involved in shellfish farming. Due to the small size and production capacity of many of these farms around the coast, it is likely that the operators of these farms would not earn adequate incomes from this activity and would therefore need to have other sources of income. It cannot be assumed that these part-time farmers will find other work outside of their shellfish farm activities as this is determined by forces outside their control, and they have to compete directly with others for jobs that may become available outside the industry. This situation may compromise shellfish farm development policies of extra job creation in these peripheral regions. Most part-time shellfish farmers do not see themselves as giving up either their farming activity or their other jobs. The whole question of subsidising part-time shellfish farm operations should be examined, in so far as most of these farms will not expand their present activity at a rapid pace, or perhaps at all.. The farmers engaged in a full-time activity generally tend to be third level graduates with a biology, zoology or science degree, and who had the background and the opportunity to practice their skills in this environment.

Managerial positions account for about 70 per cent of the workforce, reflecting the high ownership and managerial level of these farms; 10 per cent have middle management functions, 10 per cent have responsibility for technical functions and the remainder perform operational functions. The majority of staff in the managerial positions are also engaged in technical and operational roles but they are the major decision-makers in the operation and the ultimate authority on the farm. There are four times as many part-time shellfish farmers as the full-time farmers. Most of these part-time farmers are employed as operatives and are engaged in such functions as seabed operators or long-line operators.

Management and Organisation of Shellfish Farm Enterprises

During the early stages of shellfish farm development most of the farmers involved in the planning and operation of these enterprises were mainly people who had a scientific background or training. The need for expertise in other allied disciplines became increasingly evident as the sector progressed and also as a result of the competitive nature of the Single European Market. There are many institutions in Ireland where biological and fish farm courses are undertaken but very little has happened in the move towards introducing inter disciplinary programmes for those engaged in shellfish farming. At present there are few programmes in Ireland achieving the coverage required for broad-based understanding of the subject. While there may be a wide variety of general courses geared towards running a business, these types of programmes fall short of the very practical instruction on what is required for shellfish farmers to develop their entrepreneurial skills. In recent years there has been a great increase in specialists in related disciplines such as diseases, nutrition, genetics, reproduction and seed stock production, etc. While the importance of basic theoretical knowledge in the selection and application of technologies is deemed to be necessary, the vital importance of practical know-how and experience at farm level is widely considered desirable, especially by the industry. Very few shellfish farms can afford to have specialists in all the disciplines now required in the Single European Market environment, and therefore the shellfish farm manager will be expected to have the overall knowledge and information to deal with emergencies or at least until the assistance of a specialist can be afforded.

The most important ingredient found in the more successful shellfish farm operations was the level of motivation of the founder of the farm. **Rondinelli and Ruddle (1978)** observed that the key to successfully running any small type rural enterprise was the quality of its management expertise. The present day shellfish farm operations not only involve the management of the overall technical operations but also familiarity with the many and varied new EU Directives and Regulations covering the operation of such an enterprise. The operation now requires a proper combination and operation of production factors (such as land, labour, capital, location and choice of type of enterprise) to bring about a maximum and continuous return to every unit of the farm. The basic consideration of any small type operation should be economies at all stages. Nevertheless shellfish farm management procedures draw heavily on principles of biology, technology, sociology, psychology and other related disciplines. Practical information obtained from actual field experience should be used to plan the most effective farm organisation and management practices to achieve optimum production efficiency and to maximise shellfish farm earnings.

Even though not enough basic information has yet been collected through appropriate aquaculture farm management research, some shellfish farm enterprises have strive to make the best use of general business management expertise to organise and operate shellfish farm enterprises, but with only partial success. In recent times some research on fish farm management systems integrated with agriculture management has been undertaken **(Lightfoot: 1990; ICLARM: 1993)**. There is a need to extend such studies to cover all the major aquaculture systems under different field conditions, to develop management procedures suited to different culture species, aqua-climatic conditions, resource base, environmental implications, markets and socio-economic conditions. These results would be of considerable value to farm managers in planning their activities and to the Government and State agencies charged with formulating shellfish farm development policies. The information base in all these areas is relatively underdeveloped in comparison to the biological and technical aspects.

and does not allow for any comprehensive evaluation of the many shellfish farm management requirements.

In addition, few attempts have been made to estimate the actual manpower requirements needed, based on appropriate data on development potentials and plans, expected technological changes and input needs, farm outputs and processing and marketing. Most projections are based largely on guess work and restricted to public sector needs and requirements. **Nash (1992)** points out that most countries engaged in shellfish farm operations do not have the baseline data and are therefore not in a position to use the type of methodology necessary to estimate future manpower requirements in aquaculture. Despite these shortcomings, the Irish shellfish farm industry continues to attract potential shellfish farmers willing to initiate shellfish farm development programmes and schemes.

In only a small number of the shellfish farms was there any attempt at defining the roles of the staff in the enterprise. Rarely was there a distinction between managerial, technical or operational roles. The owners or managing directors were engaged in a diverse range of activities, from financial control and planning, to diving, welding, and transport. Middle management was engaged mostly in production and staff control. The technical personnel were responsible for health and husbandry, broodstock management and environmental control. The general operative level engaged in dredging, grading and packing. In the majority of the farms all of these functions were carried out by only one or two people with the help of some part-time labour when the demand necessitated.

The co-operative shellfish farms are organized by an appointed board of management who works in a voluntary capacity. Where the manager of the co-operative was employed in a full-time capacity he usually reported to the board of management. The manager is generally responsible for planning, production, sales, and the supervision of work. Shellfish farm managers were mostly male and aged in their late thirties. Operatives were also predominantly male and aged in the mid-thirties. Many managers came from agricultural backgrounds.

In recruiting for positions in shellfish farming, employers looked for people with some background in the biological sciences. Experience and motivation were also considerations. Other qualities sought were physical strength and a willingness to work, reasonable intelligence and numeracy skills. Positive attitude and "self starters" were also important criteria when recruiting staff. Promotions in this industry are rare and transferring from part-time to full-time employment was considered to be promotion.

Financing the Shellfish Farming Industry

There are four main sources of direct financial aid for the shellfish farm industry. These are provided by way of grants from Bord Iascaigh Mhara, Udaras na Gaeltachta, the Marine Institute and from the EU. The allocation of these grants ranges from pilot development stage to final commercial stage and is facilitated by way of capital subsidy grants and bridging loan grants. Under the terms of the Operational Programme for Fisheries 1994 - 1999, **(European Commission: 1994)**, £11 million was set aside for the development of aquaculture in Ireland. While these grants may appear small, the grant aid ratio to sales by the aquaculture industry was 30/1 whereas the grant aid ratio for other industry over the same period was 27/1 **(Economic and Social Research Institute: 1992)**. Also in recent years there has been a very substantial increase in public support for new enterprises and small business development. The Government sees the small firm sector as a "source of enterprise, innovation and growth"

(**Government of Ireland: 1994, 10**). It aims to "stimulate the development of small businesses and create an economic climate which will promote sustained growth". Over forty policy measures have been introduced by the Government and by the EU in support of these objectives. Despite this enthusiasm and despite the commitment of substantial resources in thus area, relatively little attention has been given to the serious economic evaluation of the impact of these measures. In the shellfish industry the cost benefit analysis has a number of limitations and any reference point for economic analysis in this peripheral region industry is not as yet clearly specified. There is an understanding that the shellfish farm industry is very much linked to the social evaluation of the peripheral region. As yet the contribution the industry has made to these peripheral regions and communities is not measured

Grant - Aiding the Industry

An Bord Iascaigh Mhara/Irish Sea Fisheries Board (BIM) is one of a number of State sponsored organizations charged with the responsibility for the promotion and development of the shellfish farm industry. Part of this function is the grant aiding of the industry. Before any such grant aid is awarded, the potential shellfish farmer has to meet certain criteria. This involves the production of receipts for any expenditure, certification of any monies made in relation to the project, evidence of tax clearance, and all documentation proving the right to establish a shellfish farm enterprise. This means that all necessary planning permission, offshore licences, fish culture licences and other required licences under the Fisheries Act will have to be produced. All local Health Inspector requirements must be observed.

A pilot enterprise development stage provides for grants of up to 50 per cent on fixed assets for any one project. Qualifying expenditure comprises expenditure on new fixed assets or for improvements of assets intended for use on the shellfish farm. Eligible investors can be individuals, partnerships, companies, or co-operatives, providing all have the necessary expertise to establish a shellfish farm enterprise. In the commercial phase of the development of the shellfish farm enterprise BIM may provide capital subsidy of 10 per cent of eligible fixed asset expenditure and this in turn would qualify the enterprise for a further EU grant of approximately 40 per cent. Qualifying expenditure for commercial projects and eligibility of investor are the same as for pilot projects. There is also in operation a Resource Development Grant scheme for shellfish farming which provides assistance towards the cost of feasibility studies, and supports financially the commercial application of research and development findings for project areas likely to result in the establishment of shellfish farm enterprises. For these feasibility studies, the upper limit for eligible expenditure is set at £30,000 with grant aid at a rate of 50 per cent.

Udaras na Gaeltachta provides similar type aids in the Gaelic speaking areas. In these areas up to 65 per cent of the capital cost may be made available for shellfish projects. Of these grants up to 40 per cent can be obtained from FEORA and the balance from Udaras.

In 1994 the EU introduced the PESCA Initiative **(Bord Iascaigh Mhara: 1994)**, which is intended to address problems relating to fisheries management and conservation policy in the context of the Common Fisheries Policy, which impact on coastal communities dependent on the fishing industry for livelihood. The aim of this scheme is to assist communities dependent on fishing to diversify from traditional activities to alternative means of income generation, job creation and development of new economic activity thereby protecting the social fabric of peripheral coastal communities. The PESCA Programme provides financial assistance to viable alternatives to traditional inshore fishing, such as shellfish farming.

In addition to these grants there are other areas of financial assistance available to the potential shellfish farmer. For example, the IDA provide grants for enterprise developments such as for grading, packing, cleaning of shellfish. These types of grants are also available from the likes of SFADCO, and from the many Leader and County Development Programmes. The EU introduced a number of Directives to ensure that Community's measures are compatible with national measures and with the objectives and instruments of the EU Regional Policy. A Multiannual Guidance Programme based on these Directives sets out the objectives and the means necessary to develop technically viable and profitable facilities for the farming of shellfish. Under these programmes **(European Commission: 1986)**, the following information concerning the enterprise must be clarified:

1. The importance of aquaculture in the national economy and the various regional economies concerned
2. The initial situation of aquaculture by type of farming, region, and species produced
3. The estimated potential of aquaculture production in the region concerned
4. The impact on the aquaculture industry and the foreseeable trends in the market for aquaculture products
5. The description of the strengths and weaknesses of the aquaculture industry and the requirements covered by the programmes
6. The investment needed during the period covered by the programmes to obtain objectives pursued
7. The prospects and investments envisaged for the establishment or development of protected marine areas

8. The measures planned for the protection of the environment

The level of grant aid under this programme for the development of shellfish farming is 40 per cent of the capital costs, provided there is an enabling contribution of 10 to 30 per cent by the State. Grants for protected marine areas and other such structures are 50 per cent in the case of projects which are implemented within the framework of development schemes for sea fishermen who scrap operational fishing vessels.

The EU criteria for financial aid for the shellfish industry specifies the following:

1. The projects must relate to (a) physical investments in the construction, equipment, modernization or extension of installations for the farming of mollusc, or (b) measures to protect or make fuller use of coastal marine areas by the installation, not deeper than 50 metres isobath, of fixed or moveable obstructions for the delimitation of the protected areas and for the protection or development of fishing resources
2. This Community aid may be granted to public, semi-public or private projects.
3. All projects must relate to investments exceeding 50,000 ECU (IR £39,000)
4. Projects must offer an assurance of yielding a profit in due course
5. Projects must be for purely commercial purposes and be implemented by persons possessing sufficient occupational competence
6. Shellfish farming projects must be implemented at locations where water quality is maintained in accordance with national and Community guidelines
7. All projects must comply with the EU's Directive on Environmental Impact

Licence Requirements for the Operation of a Shellfish Farm Enterprise

Of the many problems confronting the Irish shellfish industry, the licensing of shellfish cultivation caused the most problems and the licensing regime operated under the Fisheries (Consolidation) Act 1959 was considered cumbersome **(Irish Shellfish Association: 1991)**. The introduction of the Fisheries Act 1980 exacerbated the situation and it was inoperable in most cases. As a result only 4 per cent of shellfish farms had licences to operate. Apart from the unacceptability of the situation from a legal point of view, this created difficulties for farmers in obtaining loan finance and in dealing with local conflicts. Shellfish farms operate within a complex web of legal instruments granted under a succession of legislation. The logic for this situation is the fear that any privatization of the sea and its unknown potential could have unpredictable consequences. There was a belief that the development of shellfish farming would enrich a new class of entrepreneur through the gratuitous granting of common resources without ensuring a fair return to the public. It could mean abandoning an opportunity to distribute the benefits of a natural resource over a wide spectrum of society and could force commercial fishermen out of business. In addition to this unknown potential, there was also the danger to the environment of the possibilities of introducing new species of shellfish into the system and the pollution effects of the industry itself. In response to this unsatisfactory situation, the Government introduced new legislation in 1997 in an effort to address this problem **(Gilmore: 1996)**.

The Department of the Marine and Natural Resources is the regulatory authority for the shellfish industry. Land-based operations are regulated by both the Department of the Marine and Natural Resources and the relevant local authority. The Aquaculture Division within the Department of the Marine and Natural Resources is responsible for the vetting and licensing of all operations. All aquaculture operations are assessed by the Department of the Marine and Natural Resources according to the provisions of the Foreshore Act 1933, the Fisheries (Consolidation) Act 1959, the Fisheries Act 1980 and the Fisheries (Amendment) Act 1997, and where relevant by the local authorities, under the provisions of the Local Government (Planning and Development) Acts. Each shellfish application is assessed by a "vetting committee" comprised of the Department of the Marine and Natural Resources, the Central Fisheries Board and the Marine Institute technical and administrative staff. Certain bodies are formally consulted during the course of the assessment procedure, including the Department of the Environment and Local Government and certain local authorities. Successful applicants are issued with an aquaculture and foreshore licence. Under the provisions of the Fisheries (Amendment) Act 1997, decisions of the Minister for the Marine and Natural Resources in relation to aquaculture licences can be appealed to an Aquaculture Licences Appeals Board. The principle national legislation governing the shellfish industry deals mainly with licence requirements and includes the following:

- Foreshore Act 1933
- Fisheries (Consolidation) Act 1959
- Fisheries Act 1980
- Fisheries (Amendment) Act 1997 and
- Local Government (Planning and Development) Act 1963

(Department of Arts, Heritage, Gaeltacht and the Islands: 1997).

Shellfish farm enterprises are generally land-based and marine-based operations. Land-based operations may require the following licences or permits:

1. Planning permission from the relevant authority, in compliance with the Local Government

(Planning and Development) Acts

2. An effluent discharge licence from the relevant local authority, in compliance with the Local Government (Water Pollution) Act 1977
3. An aquaculture licence, under the Fisheries (Amendment) Act 1997
4. A foreshore licence from the Department of the Marine and Natural Resources, under the Foreshore Act 1933. A licence is only necessary where any part of the proposed development crosses or impinges upon the foreshore (the area from the average High Water Mark to the 12-mile limit)

For marine-based operations, an aquaculture licence under the provisions of the Fisheries (Amendment) Act 1997 is required. In addition, the placement of farm structures on the foreshore requires to be licensed under the Foreshore Act 1933. An application for a shellfish farm licence is made to the Minister for the Marine and Natural Resources, as licensing authority. Generally, the Minister is obliged to determine an application within four months of the date on which the applicant has complied with the requirements of the regulations. These regulations have yet to be published but are likely to include, inter alia, provision for the making of public notices and for public access to the application documents, a requirement for environmental impact statements for certain applications, the making of submissions and observations by the public, and the submission of additional information on the application. Statutory consultations with specified bodies are also likely to be required under the regulations. The legislation also allows for the issue of trial licences to facilitate investigations and experiments. Decisions by the Minister on aquaculture licences can be appealed to an Aquaculture Licences Appeal Board, representative of the various interests in aquaculture. This Board has the discretion to hold oral hearings as it sees fit. Generally, appeals should be determined within a four-month period. The matters to be considered in assessing applications or appeals are set out in Section 61 of the Fisheries (Amendment) Act 1997. These include, as appropriate to the circumstances of the case:

- the suitability of the place and waters
- other existing or potential beneficial uses of the place or waters
- the statutory status, if any, of the place or waters
- the likely effects on the economy of the area
- the likely ecological effects
- the effect or likely effect on the environment generally
- the effect or likely effect on the man-made environment of heritage value in the vicinity

The introduction of the new licensing system under the Fisheries (Amendment) Act 1997 closely parallels the established planning system, and allows for a good level of public involvement. However, there is no provision for overall guidance in the form of an "aquaculture strategy", analogous to the Development Plans of local authorities, within which each application could be assessed, and which would establish suitable "carrying capacity" thresholds for particular areas. This new system of licensing arrangements however, has still to be implemented and enforced by law. When it is in force it should prove to be more straightforward than the former system under the Fisheries Act 1980, which sought to designate areas in which aquaculture could take place with just a single public hearing. However, in practice, the designation of areas in which aquaculture could take place proved very difficult, and public perception interpreted the designation as giving priority to aquaculture over alternative uses. As a result proposed designations were strongly opposed, leading to difficulties in granting licences.

Principal EU Shellfish Farm Legislation

With the advent of the Single European Market a number of EU Directives and Regulations were introduced affecting the aquaculture and shellfish industries. The main ones concerning the shellfish farming industry are:

- Council Directive Laying Down the Health Conditions for the Production and Placing on the Market of Live Bivalve Mollusc **(European Commission: 1991a)**
- Council Directive Laying Down the Health Conditions for the Production and Placing on the Market of Fishery Products **(European Commission: 1991b)**
- Council Directive Concerning the Animal Health Conditions Governing the Placing on the Market of Aquaculture Animals and Products **(European Commission 1991)** and,
- Council Directive Concerning Quality Required of Shellfish Waters **(European Commission: 1996)**

The first three of these Directives refer to fish health and the marketing of aquaculture products. The fourth Directive concerns the designation of areas in which shellfish production can take place. The waters in these areas must then be continuously monitored by the Department of the Marine and Natural Resources **(Roinn na Mara: 1994)**.

European Council Regulation 4028/86 **(European Commission: 1986)** also relates to the fisheries and aquaculture sector. This Regulation requires that structural measures within the framework of multi-annual programmes ensure that Community measures are compatible with national and regional objectives.

For most shellfish farm operations, a foreshore licence is required in addition to an aquaculture licence. There are, at present, no time limits on the determination of foreshore licences, and this is considered to be a constraint on the development of the industry. The development of the amended aquaculture licensing system may bring about improvements in this delicate situation.

There are also many environmental aspects to the development of shellfish farming to be considered. These include Directives on water quality, dangerous substances, conservation of birds and conservation of natural habitats **(Department of the Marine: 1994)**.

Government Support and Extension Service Provided to the Shellfish Farms

The development of peripheral region shellfish farm operations has the support of the Government and State agencies. Such support is by way of grant aid, technical support and market promotion assistance. Commercial sea fishing and the agriculture industry have historically been subsidized by the Government. But as aquaculture does not come under the legal definition of agriculture or fishing, comparable support could not originally be claimed by the aquaculture sector. The Department of the Marine and Natural Resources however, has taken over the direct responsibility for the management, budgeting, and control of the industry. This helped widen the source of support for the industry and to some extent has strengthened the status of this sector in national policy planning and strategy of the industry.

Among the supports provided to the shellfish farm sector, one which is of special importance is the extension service provided by An Bord Iascaigh Mhara. The main feature of this service is the channelling of shellfish farm technology and guidance to farmers. The aim of this service is to assist the industry reach a level of organisation and effectiveness similar to that experienced in the agriculture sector. But these expectations have as yet to be fulfilled. The most important reason is the inadequacy of resources and manpower allocated for this type of extension work and the relatively poor priority accorded to it. Furthermore, it is not always easy to find personnel with the required qualities to work effectively in such an extension service. The extension agent works with shellfish farmers and has a key role to play in this development. He has to be first and foremost an experienced technician with hands-on experience in the systems of shellfish farming. These agents have to have the right attitude and personal the qualities necessary to enable them to work with shellfish farmers of varied background and to succeed in helping solve their problems, and to persuade them, if necessary, to employ new and improved technologies when required. The extension agent's training has to include not only shellfish technologies, but also specialised skills required for the successful operation of a shellfish farm. Often the qualifications required are far above the skills of a development officer employed in other extension service agencies. Bord Iascaigh Mhara employs ten people in the aquaculture extension service and the majority of these have a technical qualification in aquaculture.

Some aquaculture extension work is also carried out by other State development agencies in combination with support services such as in enterprise or rural development schemes. However, these extension services seldom give priority to shellfish farming and the technical knowledge and expertise required usually falls short of the actual requirements. Surveys carried out by **Swanson (1990)** reveal that many extension agents are under-qualified for their jobs and often have unrealistic targets to meet in their own field. With inadequate training and communication support, this makes it difficult for the extension agent to cover the area adequately. It would be unrealistic to expect these agents to handle adequately an additional field, such as aquaculture.

Another important support, which the industry expects from the Government agencies, is in the diagnosis and control of communicable shellfish farm diseases. With the expansion and intensification of shellfish farming, the occurrence and spread of disease and subsequent loss of stock have caused problems for the industry. Though the diagnosis and treatment of a number of diseases are now known, there are many that cause major stock losses, such as those caused by viruses, that have no known remedies. Many communicable diseases are too complex to diagnose precisely, because of the inter-linkage of primary and secondary infections and are therefore classed as syndromes of one type or other. These constraints, together with the problems of controlling the spread of communicable diseases and the public health implications of shellfish farm practices, have served to focus on the need for a holistic approach to health and disease management. Besides greater efforts to diagnose and treat diseases, and to prevent diseases caused by nutritional deficiencies, such an approach should include environmental protection and pollution control, human health and epidemiology, site selection, choice of suitable facilities and techniques, sanitation and regular monitoring and implementation of regulatory measures for the control of communicable diseases.

While these State support and extension services form a major part of the development of the shellfish industry it is vital that the shellfish farmer has access to new technology and is trained in the skills to apply it. The main objective of these extension programmes is to transmit this technical knowledge in a systematic manner and enhance the chances of success on the farm. A well-designed and operated extension system should combine, transform, and disseminate vital information to the shellfish farmer. **Meyer et al. (1983)** suggests that this wide scope of action can be best managed only by the adoption of an integrated health management programme under the direction of an extension service department.

Information and Technical Service for the Shellfish Farm

The dissemination of technological information and increased opportunities for contacts between key personnel has played an important role in the development of the shellfish farm sector. Fisheries associations and societies, and in many cases universities and scientific bodies, have provided the forum for the shellfish industry to meet and discuss their experiences and problems. Associations that have undoubtedly influenced developments in the shellfish industry are those whose members are farmers and operators directly involved in shellfish production and marketing. Such groups are the Irish Shellfish Association and the Irish Aquaculture Association. In many cases they have been able to make their collective voices heard and muster the necessary political support to influence Government policy. They also have been able to initiate technology transfer and improvements and to develop niche markets for their products. Both of these organizations, however, have only recently become members of the Irish Farmers Association as they felt that the strength of this organisation as an umbrella organisation would further empower their bargaining status **(Aquaculture Ireland: 1997, 2)**.

There still continues to be a dearth of vital information that both investors and shellfish farmers need when planning shellfish enterprises. Information, for instance, on what capital investment is required to establish an economically viable farm under a given set of conditions, performance of the selected technology in terms of production, production costs, and sustainability. This type of information, if available, has not been compiled and analyzed for shellfish farm operational purposes **(Pillay: 1994)**. The building up of such a data bank is a need, which has been pointed out by many shellfish farmers. Probably because of the complexity of the required investigation and the reluctance to reveal the details of farm production operations, no serious attempts have yet been made to collect and compile such information for general use.

SUMMARY

Shellfish farming is now a developing enterprise within the aquaculture sector. In 1995 total production of mussels and oysters reached over 14,000 tonne and total employment both full and part-time was over 2,000 people.

The National development aims of the industry **(Department of Arts, Heritage, Gaeltacht and the Islands: 1997, 100)**, are as follows:

- to continue sustainable expansion of output, increase productivity, competitiveness and employment, and to meet the demand for raw materials for the processing sector
- to stimulate investment in new products and to develop production methods for new species of shellfish
- to encourage modernization and expansion of existing projects and, in particular, to bring about more efficient production of priority species
- to achieve self-sufficiency in seed supplies
- to minimize disease incidence
- to encourage the adoption of more cost-effective and environmentally friendly production techniques

In addition a number of medium-term sectoral objectives are set by the Department of the Marine. These include:

- ensuring compliance with conservation, control, health and hygiene and water quality regulations
- support a significant increase in employment
- increase output by over £50 million over 1992 levels

(Department of the Marine: 1997, 18)

The farming of shellfish is deemed to have several advantages over traditional fishing. The shellfish are not subject to any quota and fishing vessels used are not considered part of the fishing register, but are eligible for grant aid. One disadvantage is that since shellfish cultivation invariably takes place in inshore waters, it can be subject to user conflict **(Marine Institute: 1996)**. However, one of the problems inhibiting its speedy development has been the question of issuing licences for shellfish operations. This licensing arrangement was always perceived as a deterrent to securing development and many operators were uncertain as to the long-term viability of the enterprise. The issuing of licences was a cumbersome procedure and was seen as one of the biggest problems in the security and development of the industry **(Irish Shellfish Association: 1991)**.

The EU introduced a number of measures by way of Directives and Regulations in order to improve and adopt structures and work practices within the shellfish industry **(European Communities: 1993)**. These Directives relate to the health conditions for producing and placing shellfish products on the market and extends to Directives on the working conditions of part-time shellfish farm operators. These Directives may have a profound impact on the way the industry is managed and controlled in the future.

Also the initial welcome given to shellfish farm enterprises by coastal communities became somewhat tempered during the late 1980s by a growing concern about pollution and other potential adverse effects, and by the demands for greater control over their development at local level. Local public perception of shellfish farming has swung from a general acceptance to a much more critical response **(An Taisce: 1993)**. The visual impact of shellfish farm activity depends to a great extent on the nature and scale of the operation and on the sensitivity of the location. Mussel rafts and long-lines can be very conspicuous, particularly if the rafts are numerous and support sheds and grading equipment on deck. The loss of wilderness character in areas of underdeveloped landscape is a complex and undefinable issue. This concept of wilderness is central to the EU recognized value of such landscapes where intrusion of such activities will disturb the wildlife and introduce technological noise, litter accumulation and can have unpleasant associations in the mind of the public.

The strategy of locating shellfish farms, which can be fairly technically advanced and complex operations, in peripheral coastal regions, has not been fully researched. Local communities with few skills in dealing with the potential, limitations, or challenges of this type of economic development may be an inhibiting factor in the development of the industry. The degree of local participation in the initial strategy for shellfish farming and the absence or presence of mutually agreed goals for social development could also be a factor in successful or unsuccessful participation. For example, while the aim of establishing shellfish farms is to help sustain and support employment in these peripheral regions, this in itself may not be sufficient motivation for success. While shellfish farming may have contributed to the economic development of certain regional coastal areas i.e., Bantry Bay, as yet it has not been fully demonstrated that shellfish farming will help to sustain the livelihood of people dependent on this industry. On the contrary, some fishermen and the local communities depending on tourism for their livelihood rejected them out of an apprehension that shellfish farming would eventually destroy their source of income. There is also potential for conflict between shellfish farmers and other amenities of the coast such as fishing and water sports and this is likely to continue. Competition from other interests for limited on-shore development land will also be an issue **(Department of Arts, Heritage, Gaeltacht and the Islands: 1997, 106)**.

In order to sustain the development of enterprises that exploit a natural resource from the sea, such as the cultivation and farming of shellfish, there must be successful integration of the economic objectives of shellfish farming with the social and environmental priorities of the local community. Attempts will have to be made whereby the development of shellfish farm enterprise merges and supports the pattern of sea and shore use, lifestyles and occupations of the peripheral communities where these enterprises are based. A policy as refined and sensitive as this may not be easy to formulate. Any strategy will have to aim to avoid any possible confrontation between the shellfish farm operators and the needs of the local community.

Shellfish farming operations may still offer opportunities for strengthening some threatened but cherished elements of the way of life of the peripheral coastal communities and at the same time provide employment and create wealth within the region. While the concept of shellfish farming may appear in some ways frugal in modern food production businesses, it has shown that it can be well adapted to its environment and has maintained a balanced coast and land use. It is also characterized as small scale, labour-orientated, and compatible with a variety of part-time occupations. **Storey (1981: 335-45)** identifies these types of small-scale indigenous enterprises as best suited to adapt to the socio-economic structures of peripheral regions. However, it is the large-scale operator who will have greater access to the necessary environmental information which is essential when applying for a licence to operate a shellfish farm enterprise. This situation could make it more difficult for the small-scale operator to compete. In addition this could lead to a widespread uptake of suitable and available shellfish farm sites resulting in a possible depletion of sites for local enterprises.

THE SOCIAL AND ECONOMIC IMPACT OF PERIPHERAL SHELLFISH FARMS

Introduction

The main aim of this chapter is to undertake a preliminary evaluation of the social and economic impact shellfish farm activities have on peripheral coastal regions. While a substantial amount of information is available on the biological and technical aspects of shellfish farming, information on the social and economic situation is by comparison relatively underdeveloped. In some ways this situation does not allow for a comprehensive evaluation to be made of the industry. There are many reasons for the poor status of this information base, including the problem of identifying appropriate socio-economic indicators. At a Euraqua '92 Conference, the Director General for Fisheries, in his introductory speech alluded to such difficulties in noting that:

> The collection of statistics on the economic and social aspects of aquaculture in the European Community is not a straightforward process.
>
> **(European Commission: 1991d, 10)**

Yet the poor status of information on these aspects does not properly reflect the significance that is attached to this subject. Many reports and statements supporting the significance of the industry advocate the social and economic benefit that shellfish farming has in these peripheral regions. Unfortunately, very little research was conducted to substantiate these claims. However, there is now a greater general interest in the social and economic impact of shellfish farming as resources become more limited and there is a greater interest in the environment and coastal management. The need for an effective economic and social policy with regard to the sustainable development of the aquatic environment becomes more pressing.

A review of the aquaculture industry in Ireland undertaken by the ESRI **(Economic and Social Research Institute: 1992)** and by Bord Failte **(Bord Fáilte: 1991)** did make reference to the social dimension of aquaculture in local communities. They found that the initial welcome given to aquaculture by coastal communities along the west coast of Ireland became tempered during the late 1980s by growing concern about pollution and other potential adverse effects and by demands for greater control over its development at a local level. Public perception of aquaculture has swung from a general acceptance to a much more critical response. They also found that identifying the key reasons for the changing social attitude to shellfish farming is not easy. Some of the suggested reasons why these problems are encountered were that the nature of the relatively remote coastal regions which provided the best sites for aquaculture operations have a history of marginalization of the communities living in these areas, with population structure damaged by heavy emigration, leaving a residue of a sense of powerlessness before outside agencies **(Byrne: 1991)**. The strategy of locating these technically advanced and highly capitalized enterprises in communities which may not have the necessary skills for dealing with the potentials, limitations or challenges of this type of economic development was also queried, as was the absence of local public participation in the initial strategy for shellfish farm development, and therefore no mutually agreed goals for social development of these enterprises.

The main objective for developing the shellfish farm industry in coastal peripheral regions was the creation of jobs in these areas by focusing strongly on partnerships with coastal communities **(Bord Iascaigh Mhara: 1993, 1)**. While the Government supports and encourages the development of shellfish farming, the objective of creating more jobs requires a more detailed approach. This policy of job creation may not be sufficient and a far greater understanding of who gains and who loses in this regional coastal development strategy must be examined. For example, it has not been demonstrated that shellfish farming will help sustain the livelihoods of people dependent on inshore fisheries, or even that the impact of shellfish farming will be neutral towards inshore fishing. On the contrary, groups of local fishermen in Bantry Bay and Dunmanus Bay are actively resisting the further development of long-line mussel farming, out of an apprehension that these activities will eventually destroy their livelihood **(RTE: 1998)**.

In an attempt to examine whether it is possible to rationalize the development of shellfish farming in terms of its economic function at a peripheral regional level, it is important to consider the type of analytical framework which may be employed. **Edwards (1987, 134)** for example, maintains that economic analysis, by virtue of the powerful tools at its disposal, has an important role to play in assessing the outcomes of allocating resources among different and often competing uses in a coastal zone. The economic and social importance of the shellfish farm operation may be measured by either assessing the economic impact which it creates or by attempting to estimate its economic value. However, an important distinction in terms must be made between the economic impact and the economic value of shellfish farming. For example, the economic impact of shellfish farming in a region may be defined in terms of changes in its key parameters such as farm output, farm product prices, and employment creation. According to **Gittinger (1983, 474)** the economic value of shellfish farming may be defined as a reflection of its value or worth to the peripheral region community as a whole. This economic value is quite distinct from financial value which is expressed in terms of opportunity costs. This relationship between economic impact and economic value of shellfish farming can be examined by the application of an economic cost-benefit analysis (CBA). **Shaw and Bailey** **(1990, 275)** attempted to establish such a framework by which both the social and the economic impact of aquaculture might be evaluated and which would also include the identification of some key socio-economic costs and benefits. In the analysis of the shellfish farm industry this framework will be used, which will also help assess policies relating to this resource development.

IDENTIFICATION OF SOCIAL AND ECONOMIC IMPACT OF SHELLFISH FARMING

Economic and social analysis should be seen in its broadest sense as a means by which policy makers receive guidance on the use of resources in order to promote the greatest return for society as a whole. This economic or social analysis should be a part of the policy evolution process, which allows for the evaluation of alternatives and in turn for agreement on priorities for development action. For the development of the shellfish enterprises, this action will be influenced to a greater or lesser degree by the Government and State support agencies. These economic, social and environment adjustments are now firmly established on the political agenda and are taking a more prominent role in the debate on future directions in rural and peripheral adjustments. This requires the need for more appropriate and operational economic models. For example, in a paper describing the position in rural society **Newby (1992, 18)** states:

> We are at a crossroads in the history of our rural society and urgent consideration is required about the appropriate policies which will guide the destiny of our countryside into the twenty-first century and beyond. In that respect, the future of the countryside hangs in the balance.

In delivering the Presidential Address to the Agricultural Society of Ireland, **Davis (1993)** argued that economists should consider the adequacy of existing models for rural analysis and perhaps to enlarge or develop new ones, otherwise there is a risk of being marginalized and being perceived increasingly as being irrelevant to the rural adjustment process.

The development of agriculture has resulted, over time, in producing many frameworks both for economic and social impact assessments. Some advances have also been made in developing socio-economic models for the Sea Fisheries Industry (**J. P. Hillis et al: 1994**). Some of the models used in that research were devised by **Gordon (1954, 124-142)** and by **Beverton and Holt (1957)**. Similar types of economic and social analysis of the shellfish industry have not advanced at the same pace. However, the development of a cost-benefit analysis framework for the aquaculture industry by **Neiland et al. (1991)**, did define some of the important concepts and terminology of economic analysis of the aquaculture industry. They applied economic cost-benefit analysis in assessing proposed public programmes or policies relating to resource development. This CBA technique systematically identifies and organizes economic benefits (anything that contributes to an objective) and costs (anything that reduces an objective) in a number of stages as follows:

Stage 1. Definition of the boundary of the analysis (e.g., peripheral coastal region shellfish development project)

Stage 2. Identification of costs and benefits (e.g., provision of infrastructure versus increased fish supply)

Stage 3. Valuation of costs and benefits in two stages:

a) Financial evaluation (e.g. market prices for commodities)

b) Conversion of financial to economic values (expressed in terms of opportunity costs to allow for market imperfections in the allocation of resources between alternative uses)

Stage 4. Comparison of economic costs and benefits over time under various alternative scenarios to assess the net economic benefit (value) returned

For the purpose of the analysis of the Irish shellfish farm operations, measures of economic impact can be included in Stage 2 of this simplified CBA approach whereas the economic value (net economic benefit) is determined at Stage 4. Social effects (e.g., new job opportunities, improved rural services etc.) do not lend themselves easily to this type of evaluation. A common approach is to categorize them into intangibles, identifying them carefully, and record their interaction with other factors within the analysis. There are certain limitations to this type of evaluation technique and these have been highlighted by **Pearce and Nash (1981, 225)**, by **Gittinger (1982, 505)** and by **Mishan (1982, 384)**. Because of the limitations of the socio-economic database relating to the Irish shellfish industry, it is not possible to undertake a detailed economic evaluation at the present time using an economic CBA approach. However, using the data collected in this research dissertation, it is possible to document, quantify, and review the economic impact of shellfish farming in Ireland.

For Stage 1 of this analysis, the boundary of analysis is the total shellfish industry in Ireland. For Stage 2 a preliminary identification of some of the potential social and economic impacts (or benefits and costs) of the shellfish industry might be as follows:

Benefits

Increase in shellfish supplies to market

Possible export earnings

Creation of employment

Conservation of social structure

Improved services and infrastructure in regions

Costs

Environmental damage and disruption

Conflict over resource usage

Disruption of social structure

Competition with traditional fisheries

Loss of traditional regional jobs and occupations

In order to undertake this preliminary review of the impacts (benefits and costs) of shellfish farming, a number of key questions have to be asked which may encapsulate many of the issues involved.

Question 1

Is Shellfish Farming Making a Significant Contribution to the Supply of Shellfish Products from Ireland?

In answering this question we have to ignore the much earlier and traditional production of shellfish products in Ireland. Most of this production was developed in the last century or earlier this century. For our analysis we will use the production figures from the time that modern shellfish farming was promoted in Ireland which was in the early 1970s. The major types of shellfish products produced on these farms were both the gigas oysters and the rope-cultured mussel. The production of these varieties has been somewhat erratic. Over a five-year period the following production and values were recorded:

Oysters

Year	Production (Kg)	Value (£)
1992	1,366,253	2,280,811
1993	391,761	1,027,042
1994	365,019	845,645
1995	437,841	1,011,294
1996	1,276,226	1,777,879

Mussels

1992	7.013.591	7.257.329
1993	2.899.747	2.735.651
1994	5.595.098	7,025.287
1995	7,860.482	7,902.771
1996	9,589,970	12,958.210

It is also interesting to contrast these figures for farmed shellfish products with, for example, periwinkles which are classified as wild shellfish:

Periwinkles

Year	Production (Kg)	Value (£)
1992	1,763,341	1.802.358
1993	1,035.036	1,033,451
1994	1.240.013	1,778,708
1995	872,818	1,067.531
1996	1.064.478	2,109.289

The total production and value of a natural sea resource such as periwinkle was greater than that of oyster production.

However the role of shellfish farming as seen by the EU is made clear in the text of the regulation CEC 4028/86 **(European Communities: 1986, 4 -7)** on Community measures to improve and adapt structures in the fisheries and aquaculture sector 1-2:

> Since the Community has a deficit in fish products it must endeavour to find new sources of supply.
>
> (Preamble, 1)

Experience has shown that the development of aquaculture has helped improve the position as regards the supply of fishery products; therefore further encouragement should be given to the sector.

(Preamble, 2)

Joyce (1991, 21-25) stated that the shellfish industry in Ireland was seen as having a distinctive niche in the market place, that of high quality seafood products and these products would complement, rather than compete with the supply of wild fisheries in the market-place.

However, the inconsistency of the production of farmed shellfish production has not altogether met this criterion. Also the occurrence of "Red Tide" and large-scale mortalities due to unfavourable weather conditions add to the problems of production. Farmers are also importing seed from France and with it risk importing infection into the Irish stocks. Large-scale mortalities in gigas stocks of all sizes in all areas of France throughout the summer/ autumn of 1997 were observed, increasing fears of an unknown infectious agent. This situation could have a potentially catastrophic impact on the production and consumption of shellfish farm outputs. Research is being undertaken into pathogens in the oyster that are resulting in mortalities not caused by the traditional effects of heat or lack of oxygen on the health of the oyster **(Jacob: 1997)**. Environmental restrictions and shellfish disease will continue to constrain the development of shellfish products and market potential for some farmers.

Despite the early, generally optimistic, forecasts for shellfish farm development which can be found in both the Government and State support agencies' literature, there are observers who deem the development of shellfish farming to be less than optimistic. **Murphy (1992, 12)** for example, blames the many mistakes made by the State agencies, the universities and the farmers themselves, for the poor output from the industry after the investment of substantial sums of grant-aid money. Likewise, **Wijkstrom (1990, 129)** noted that the future role of aquaculture in supplying products has not been analyzed to any significant extent. However, Wijkstrom does state that oyster and mussel farming are more likely to be able to contribute to the overall supply of food products. In exploring the possibilities for further technological development in aquaculture, he concludes that sea-farming may ultimately lead to an overall increase in product supplies.

Question 2

Has Shellfish Farming Generated New Employment?

The creation of employment opportunities in depressed coastal peripheral regions of Ireland is often cited as one of the most important reasons why local and national government have been willing to encourage the development of shellfish farming. It is estimated that there are approximately 1,500 people engaged in shellfish farming in Ireland, but as in the rest of Europe, it is difficult to substantiate the actual number of jobs created in the industry. Definitions of full-time, part-time and casual employment on shellfish farms have still to be established. Also there is no means at present to establish if these are new jobs or whether workers have simply transferred from one activity, for example from sea-fishing to shellfish farming. With regard to employment multiplier effects of shellfish farming, researchers such as **Shang (1990, 211)** have pointed out that there are many practical problems in the calculation of these measures of employment benefit and that more detailed information is needed about the relevant economy in which the farm operates.

Should there be many jobs created in these peripheral regions, the communities may be exposed to certain social and economic risks by the emergence of this new industry. In particular, communities which become heavily dependent on shellfish farming and switch away from more traditional occupations, may be increasingly vulnerable to external financial strains and "boom and bust economics" **(Scottish Wildlife and Countryside Link: 1990, 27)**. Research by **Pollnac (1990, 165 -191)** found that people working in commercial aquaculture will have to adjust to a new way of life. This adoption of a new way to earn a living and a change in one's life can have a profound impact on family life. He also identified other classes of people, apart from the shellfish farm worker, that may be involved in the jobs created by the establishment of the shellfish projects. They include the entrepreneur or investor. This may involve an individual, a co-operative, or companies of various sizes. A third group of people who might be added to the job creation numbers is the providers of goods and services to the shellfish farmer. These could be machinery suppliers or services, transport operators, material suppliers, seed suppliers etc. However, statistics on the amount of time involved by these groups in the operation of the shellfish farms are difficult to establish. The economic cost of jobs created in the shellfish industry is high. A report on the value for money from the structural funds (CSF) in the aquaculture industry was undertaken by the **Economic and Social Research Institute (1997, 2-18)** and found that the cost-per-job created (but not necessarily sustained), in the aquaculture industry is estimated at about £21,000 and well in excess of what would be the norm for Forbairt grant aid to indigenous industry.

Question 3

Has Shellfish Farming Generated Benefits for the Consumer other than Increased Supply of Shellfish Products ?

The Irish shellfish industry relies to a great extent on the "live" shellfish market. The customers for these products are generally the large shellfish wholesalers and importers. Supplying these customers with this raw material has proved extremely difficult since there are generally substantial supplies of raw material already available and the Irish shellfish farmers often find it difficult to compete on a cost-per-tonne basis with continental sources. Shellfish farming in Ireland is still very much seen as a crofting type business with the majority of the farmers with one or two rafts producing a couple of tonne of product per year. These small farms on the periphery are problematic when it comes to serving the customer. The UK and the European markets are the main target markets for Irish shellfish products and the shellfish farmer has many competitive and cost disadvantages in serving these markets. In addition to the peripheral location disadvantages, the shellfish industry is characterized by fragmented production structure and a lack of co-ordination by the farmers in servicing the customer. In the modern business enterprises, regardless of size or industry, it is deemed important to care for the customer. Enterprises now have to choose the minimum level of service in order to satisfy their target customer, and at the same time must have a degree of consistency in maintaining this pre-determined level of consumer benefit. Consumer needs and aspirations for service quality from the supplier are in constant evolution and consumer studies show that customers are increasingly demanding **(Horovitz: 1990, 10)**. Competition in the shellfish markets has intensified in recent years and shellfish traders and consumers are being offered a greater diversity in choice and service. The customer for shellfish products is now more selective and better informed about the product and demands increased quality. Also, as the shellfish is sold into the export markets these products must adopt standards to match their markets and stay abreast of competition in these markets.

Operating from a periphery base can also cause other problems for the shellfish farmer and his consumer. As most of the farm product is exported, the problem of communication is more complicated when the farmer does not have direct contact with the consumer. As the shellfish farmers deal directly with shellfish traders and middlemen, the farmers are unaware of the service these dealers give the consumer. An example of this situation is that the dealers in the French market make no distinction between their own domestically produced shellfish products and what they purchase from Irish shellfish farms. One of the ways to make communication with the customer more effective is to negotiate joint promotions with these dealers. This type of collaboration naturally depends upon the relative strengths of the parties involved, and, the better the shellfish farmer is known to the final customer, the easier it is to convince these middlemen to co-operate in promoting the image of the Irish shellfish product. The situation for Irish shellfish farmers is that they are operating from a very weak position in this market.

Proper handling and treatment of the shellfish product along this distribution chain can also cause difficulties. There are many cases where the Irish products were sold to the middle-man and when they finally reached the consumer, they had become contaminated **(Bord Iascaigh Mhara: 1997)**. Very little by way of processing or value-added of Irish shellfish products has been developed so in this way the customer is unable to distinguish the origin of the shellfish product. Efforts to develop an IQF mussel product technique and have it licensed by a shellfish farm co-operative in 1992 were unsuccessful due to lack of support from the shellfish farmers **(Cowman: 1995, 10 /11)**.

Question 4

Has Shellfish Farming Produced Any Other Beneficial Social Impact?

It is often argued that shellfish farming in the appropriate location can be a focus for peripheral coastal region development and stabilization. Further, the creation of employment opportunities in depressed peripheral regions has an important dimension. This labour intensive type industry could be a source of full and part-time employment. However, it must also be recognized that shellfish farming as a focus for rural development under the wrong circumstances is capable of producing as unsatisfactory an outcome as any other activity. Should shellfish farming be promoted as a new component of any peripheral coastal region, it must be carefully evaluated using a wide range of criteria (social, technical, environmental, economic etc.). Without this evaluation, shellfish farming may evolve into a "resource sink" **(Neiland et al: 1991, 479)** consuming capital, labour and intermediate products while generating few benefits in return.

With regard to shellfish farm development around the coast, there are a number of related issues regarding the role of shellfish farming in these regions. For example, should shellfish farming be seen as a focus for economic development, with regional selective assistance schemes providing capital and grant-aid investment for the development of those farm enterprises, or should market forces alone dictate the development of the industry and its structure? It could be argued that given the very high risk factor (disease, climatic etc.) associated with shellfish farming activities, any inclusion of explicitly short-term social objectives (employment creation, economic activity etc.) as a trade-off against viability and profitability leads to a danger that enterprises will be selected with a poor chance of long-term survival. Businesses that are financially strong are more likely to survive in the face of adverse changes in the environment, and by supporting the strongest business, social as well as economic objectives will be achieved **(Shaw and Bailey: 1990, 275)**. Social issues such as income distribution and labour/community mobility with reference to the Irish shellfish farming industry have not been studied to any great extent. However, in other parts of the world where shellfish farming is practised, particularly SE Asia, the social impact of aquaculture has been given more attention. For example, **Bailey (1988, 31-44)** provides an interesting study of the social impact of shrimp aquaculture development.

One area where the establishment of shellfish farming activities may be of benefit is in the promotion of the concept of Integrated Coastal Zone Management. This system is defined as a continuous process of administration which seeks, through more efficient and holistic management to:

- establish and maintain the sustainable use and development of the resources of the coastal zone so as to improve the quality of life and the human communities dependent on these resources
- maintain the biological diversity and productivity of coastal ecosystems, and to improve the quality of the coastal environment

(Department of Arts, Heritage, Gaeltacht and the Islands: 1997, 7)

Shellfish farming can provide a good example of the type and range of issues that can be more effectively addressed when establishing an Integrated Coastal Zone Management scheme. The positive social aspects of shellfish farming include the need to maintain good water quality and a clean biologically attractive environment. The presence of a shellfish farm operation in a region can promote high treatment of existing or potential discharges to coastal waters. Also tourists to the region help provide an additional market for the shellfish products grown in the region. However, shellfish farming is now perceived as having negative interactions with other interests in the region. Visual intrusion in scenic coastal areas, the use of water space in direct competition with other users, competition over limited on-shore development land and potential conflict with other forms of wildlife. While the significance of many of the social conflicts are more perceived than real, the positive and negative impacts remain to be addressed.

Question 5

Has Shellfish Farming Produced Significant Benefits Where Development Has Occurred?

This question is perhaps the most difficult to answer given the poor status and economic databases available on shellfish farming. In a cost and benefit analysis approach to this problem. there are major difficulties in attempting to evaluate and compare the numerous variables that could be included in such a study. For example, it would be difficult to make an economic contrast between the objectives of increases in shellfish production or generation of employment and the objectives of wilderness conservation or preservation of the social structure in a community. Again it is difficult to rationalize a decision to use the resources in a peripheral coastal location for the purpose of developing shellfish farming, as opposed to using the resource for an alternative activity such as, for example, sea angling. In rationalizing the visual impact of shellfish farming and its environment, consideration must also be given to the economic impact this has on the region. The interaction between the landscape, the shellfish farm operation and the viewpoint of the community is a complex issue. The complexity and variety arising from the combination and interaction of land and sea is only now being examined and the need for a formal Integrated Coastal Zone Management system is seen as the best way to address these issues.

Some work has been undertaken in Scotland (**Cobham Resource Consultants and Fisheries Development Ltd.: 1987, 70**) where the economic aspect is considered to be in the competition for water space, land, and infrastructure. This competition for water space between shellfish farming and other activities in coastal regions depends upon the following:

1. the type and scale of the shellfish farm enterprise
2. the management practices and attitudes of the shellfish farm operators, and

3. the extent and variety of other activities and beneficial uses of the same or nearby areas

In the ESRI Survey **(Economic and Social Research Institute: 1992, 176)** the main concerns expressed by other resource users of the coastal region zones were as follows:

1. loss of areas formerly available for water sports
2. loss of formerly available fishing areas, the damage to fishing gear by fouling or entanglement with fish farm structures, or mooring lines
3. potential obstruction to navigation caused by fish farms, particularly at night or at times of poor viability by unlit rafts or long lines
4. loss of traditional yacht or fishing vessel anchorages, some of which may provide essential shelter needed for protection from storms
5. obstructions caused by seabed debris from fish farms
6. limitations on public access to water or to the shore

The Government is now increasingly faced with difficult decisions over access to resources in such situations. This again points to the need for a co-ordinated coastal zone management plan and the need to examine the possibilities for the integration of activities in order to avoid resource usage conflicts and prevent environmental damage while sustaining an appropriate level of economic activity. Economic analysis techniques such as CBA have an important role to play in addressing such pressing issues. **Pearse and Nash (1981, 225)** emphasise their usefulness as follows:

> The discipline of CBA (or similar formal technique) at least forces the process of evaluation to list all gains and losses and to weigh up their relative values. This may seem a small virtue. But in a world where decisions are made more often than not

on irrational assessments, it could remain the single most important attribute of any calculus designed to assist the decision-making process.

The economic viability of indigenous enterprises in rural or peripheral regions has also to be considered. In a study of rural policy in Ireland **(Hobson 1993: 22-34)** states that the trends of economic concentration and centralization occurring within an increasingly open economy have had a strongly adverse effect on rural areas of Ireland since the 1950s. He says that agriculture and the other traditional primary activities such as forestry and fisheries, along with their linked supply and processing industries have all been deeply eroded by these influences in terms of both the survival of enterprises and the employment content of those enterprises that have survived. He states:

> The linen industry of Northern Ireland is a classic example of the devastating results of this trend. While the economy modernised on the strength of the inward investment into branch plants during the 1950's and 60's this former stable industry with its linkages firmly bedded in both the rural and urban economies went through its final decline. The leather industry and numerous other natural resource based manufacturing activities have followed the same pattern, withering in the face of a free market and an inability to modernise their processes and end product marketing, or concentrating their activities into the areas of greatest comparative advantage, as has been the case with the dairy industry, and thereby reducing the spatial spread of benefits.

These trends, which have by no means been confined to the rural economy, have been compounded in rural areas of Ireland by the dramatic changes brought about by the restructuring of agriculture. The persistent labour shedding from agriculture and the falling viability of the small farm in the face of rising living standards and expectations about life such as access to education, modern health care and modern forms of interaction have further eroded the base of the rural economy. Hobson's research found that growth centre strategies have proved inadequate to counter the trend of decline in peripheral regions. The poor record of exogenous investment to forge strong local linkages and the subsequent leakage of wealth from local economies and the rise of local, single industry economies has tended to result in unsustainable and, in many cases, short-lived growth, with the backwash from the centre swamping the fragile local economies: **Cuddy (1992, 15-22)** states:

> We get a hierarchy of towns and cities where functions are moving upwards and the towns at the bottom of the ladder are always under threat as are their hinterlands.

However, there is still a willingness amongst policy makers to explore new approaches to peripheral region economic development as part of an overall reassessment of strategies for tackling unemployment and social and economic decline in disadvantaged regions. Shellfish farming is identified as an area for possible economic and employment generation. There is also a change in emphasis away from patronage delivered from the centre towards policies directed at the enablement of local initiative in taking the lead in the planning and implementation of development in rural areas. Schemes such as the Pilot Programme for Rural Development 1988-1990 and the PESCA initative for coastal marine development are some of the initiatives where local communities are the primary movers and which incorporate measures for action on a number of fronts **(O'Cearbhaill: 1992)**.

Taking into account all these situations, the question of whether or not shellfish farming has contributed economically to the area is very difficult to evaluate. To judge on purely financial terms and returns for the shellfish industry, the **Economic and Social Research Institute (1992)** survey found that of forty-four rope mussel culture farms surveyed, thirteen were loss makers, fourteen had incomes of more than £10,000 and the remainder had incomes of less than £10,000. Their research further found that the more "commercially" run farms with paid labour and high investments were significantly less efficient than farms run on a "family" basis with low inputs of paid labour and low borrowing. Perhaps some indication of the economic benefit of the shellfish industry on a national scale can be gleaned from the results of a survey conducted into aquaculture enterprises conducted in 1991 **(O'Connor and Whelan: 1991)**. This inquiry collected information on the level of stocks, sales, cost of production, capital and labour employed etc. Shellfish output from the 123 shellfish farm enterprises responding to the survey was estimated at £IR6.8 million. Costs, including labour and depreciation were £IR4.9 million, giving a return of unpaid labour of £IR1.9 million. This would indicate that the average output from a shellfish enterprise would be just over £IR55,000. The most profitable enterprises were bottom mussels and native oysters. Rope mussels showed a lower but still positive return. Returns from Pacific oysters were less favourable. However, the survey did indicate that the figures had to be treated with caution as many of these peripheral enterprises were at an early stage of development and production had not come on stream at the time of the survey.

SUMMARY

The social and economic impact of shellfish farming in the peripheral coastal regions of Ireland has as yet not been subject to rigorous evaluation and examination. Reliable information on the contribution this industry makes to the peripheral region wealth creation and employment content is also limited.

The vast majority of these shellfish farms are small, the industry is young and fragmented, and the farms are owned and managed by independent individuals or by locally formed groups. These enterprises differ from small, indigenous urban-based enterprises in that they are situated in peripheral regions with sparse populations and where there is a general lack of supportive economic activity in the region. These enterprises are also heavily dependent on export markets for their produce and this causes problems with both customer service and market communications. More research is needed therefore to identify the critical social and economic success factors that are created by the development of these remote enterprises. By using the cost-benefit analysis in measuring the social and economic impact of this industry, more questions were asked about the industry than were answered. For example, shellfish production levels are so unpredictable due to disease and climatic conditions it is difficult to judge the contribution these products will make to the overall supply situation. Employment generation is not clear because the amount of jobs in other activities that were lost as a direct result of having the natural resource taken over by shellfish farming has never been evaluated. Irish shellfish products have little brand identification so the final customer has no knowledge that the products originated in Ireland. There are now a growing number of objectors to the unplanned and indiscriminate establishment of shellfish farms around the coast and the environmentalist lobby sees little positive social impact of the industry in some regions. Finally,

there is little proof that there will be any significant sustained benefits derived from the establishment of these farms in the regions.

There are many other related features of the shellfish farm industry to be considered. For example, **Jones and Clarke (1976)** suggest that the level of entrepreneurial or enterprise activity in these type of peripheral regions will be greatly influenced by the collective psychological attitude of the community which can vary from region to region. An identification of the characteristics of each of the regions where shellfish farming is practised would be necessary and whether these characteristics are either favourable or unfavourable to the process of developing these enterprises, could be a major deterrent to the successful development of these enterprises. As the strength of local entrepreneurial cultures varies from region to region, any empirical testing between the relationship of local culture and enterprise activity could be difficult to interpret. **Lloyd and Mason (1984)** further found that unless there was a high proportion of managerial skilled workers in the area the potential of enterprise development in peripheral regions was greatly reduced.

The question whether these shellfish farm enterprises were intended to meet fully or partly the socio-economic needs of the community in the region is not fully established. On the assumption that the potential for shellfish farming in a certain location is established, some priority has to be given to the study of the community in the region. This study should aim at identifying the basic needs to be fulfilled and those that can be met through a shellfish farm development programme. For example, if an increase in family income is needed to afford the specific necessities, the project has to be designed to yield at least that minimum income required. So knowledge of the level of economic and social infra-structure development, and the cultural and political context in which the programme has to be implemented, is necessary for an appropriate shellfish farm project design. The technology of the shellfish farming system to be adopted will have to be carefully selected, not only on the basis of the agro-climatic and hydrological conditions of the area, but also on the skills and educational background of the shellfish farmers and the socio-economic systems of the peripheral region.

The need for the participation of the local community in planning and implementing the enterprise is a widely accepted ideal **(Pillay: 1994)**. Projects organized through community groups and co-operatives have established mechanisms for broad participation in decision making and benefit sharing. Even though the ideal solution is seldom achieved, the community gets the opportunity to express their views and perhaps influence decisions. Pillay found also that success rates for community developed projects were higher when members of the group had reached a certain socio-economic status. He maintains that the option for creating shellfish farm enterprises is either to concentrate on highly motivated individuals or family units or to form or seek the intervention of community-led organizations and agencies. Many of the basic needs of the coastal community can be factored into individual or family needs and the activity that meets these needs and leads to improvement in their standards of living on the aggregate, may constitute social benefits to the community as a whole. The improvement in the economic well-being of the shellfish farmer and his employees can be expected to result in their having greater political pressure and assertiveness to seek from the State and support agencies greater assistance and financial aid. Such an approach, however, may sometimes lead to the accumulation of the benefits of the development of this natural resource from the sea for just a few individuals. The assumption that the well-being and success of receptive and progressive individuals will motivate the rest of the community to adopt the same productive activities may not always prove true. The close involvement of community groups has the potential to reach the peripheral community and its individuals more easily and motivate them to adopt development activities. However, the effectiveness of such community groups depends largely on their objectives, their motivation, and the dedication of their members.

Ideally, participation in such community enterprises should be spontaneous and with the free will of the community. However, in practice this involvement is achieved through educating the community on the potential benefits of developing shellfish farm activities in the region. While this participation by the State and Government support agencies is initiated at the early stages of development, it is important that it is maintained throughout the implementation stages. **Gibb and Scott (1986, 81-101)** saw that the overriding objective of Government support and development agencies was the maximisation of employment opportunities and their assistance tended not to be enterprise orientated. Besides this inherent conflict, there are additional inconsistencies because the local authorities sometimes simply do not know what the real problems of peripheral enterprises are, preferring to place their subsidy where the traditional responsibilities and perceived needs of the small enterprises overlap. They put forward the case that attention will have to be focused on ways of developing regional indigenous enterprises and that the policy of developing job creation in these areas remains weak.

The economical size of the shellfish farm to be developed has also to be investigated. Generally, small-scale shellfish farm enterprises provide more employment opportunities per unit of capital investment than larger farms. In addition they have the advantage of being more widely distributed geographically and locally owned, enabling improved distribution among the peripheral regions. The development of these farms has to a large degree been focused on small-scale farms in people-orientated enterprises. However, little information is known as to what constitutes an "economic" size farm where available, for example, the targeted income to be earned by individuals or families would conform to the minimum economic size of the particular type of farm. For example, in order to achieve and maintain increased shellfish farm production to meet demand of the farmer's market, the only way of achieving this is through large-scale production. These small-type shellfish farms may make some impact on local consumption, but maintaining regular supplies to export markets can prove difficult and expensive for these small-scale operators. Economies of scale of production, economic arrangements for transport, storage and processing are inherent weaknesses for these small operators. While large-scale operators may have the capacity to develop their own processing and marketing arrangements and introduce mechanization of their operations and so save on labour, the capital cost of these activities may not be a profitable option. Should the shellfish farm be developed only as an additional or part-time activity, the enterprise has to be compatible with, or more easily integrated with, the farmer's ongoing activities and maintain production at minimum cost.

In order, therefore, to hope to achieve sustained prosperity from the development of shellfish farming there must be successful integration of the economic goals of the farm with social and environmental priorities at all levels. It would be preferable that these goals be agreed at local and at national level. Any policy favouring the development of shellfish farming and the structure for the industry must merge with the patterns of land and shore use and with the lifestyles and occupations of the local communities.

It is important next to assess the nature and possible causes of the creation of these shellfish farm enterprises and identify the critical factors which influence their performance and development in these peripheral regions. Whether these enterprises suffer from constraints on their growth because of their peripheral location, the many inherent economic and social risks involved and the lack of skilled shellfish farm managers and entrepreneurs requires further research and study.

METHODOLOGY

Introduction

Research methodology approaches reflected in the literature are many, each contributes to the search for knowledge, and each has sets of procedures or methodologies that guide it. The initial research methodology undertaken in compiling this dissertation was the discursive approach. A wide variety of material serving many purposes concerning the development of the shellfish industry in Ireland was used. This included Government policy documents, European Commission proposals and recommendations, State agency reports, research material from universities, speeches, conference papers etc. Much experience garnered from the practical experience of shellfish farm administrators and shellfish farmers was contained in this material and many varied propositions or theories were implied. But as the implicit propositions were collected from various sources, they led to many inconsistencies or contradictions. Some of these represented viable differences in explanations of the way shellfish farming is managed and operated and as to how it should be developed. As a source of information and knowledge they were of interest for more structured research. Unfortunately, however, some of these propositions derived from practical experience and were immersed in other propositions stemming from non-experientially based sources such as observations of "experiences" that did not appear to accord with what actually takes place on the shellfish farm. Also this type of literature was very often very persuasive in nature and intended to advocate a particular cause i.e., create sustainable employment and jobs in peripheral coastal regions.

However, by using this discursive approach methodology it helped provide one of several starting points for the information seeking process. This discursive research approach may not be amenable to structured analysis for verifiable information, as it is not necessarily organized for verification. However, it did serve many useful functions. It drew attention to certain aspects of the industry, created awareness of the importance of problem areas and provided insights and propositions that were amenable to test and potentially be verified by more "scientific" methodologies.

The methodology used to obtain answers to these problem areas consisted of many different field research strategies. Many approaches were used in designing these field studies and there were no firm rules as to which method was the most appropriate. This field-study approach used for researching the industry was structured in order to permit generalization about the industry which extended beyond the immediate source of information. Also this data and information was obtained from a representative sample of the shellfish farm population in such a manner that inferences drawn from the sample observed could be attributed to the population as a whole.

As the process explanation of shellfish farm enterprises had to be investigated over a long period of time, a longitudinal study of the industry was adapted. Since this type of study extends over a period of time, the many phenomena having to do with shellfish farming and its operations involving time spans of many months, and in some cases years, could be observed. The longitudinal study method however, does have certain limitations. For example, over a period of time the shellfish farmers and their organizations may change, which means that different people may be used to obtain information about different sequences in the process. However, by concentrating on focal units such as the shellfish farming zones, and using crosssectional field study strategies, some of these limitations could be overcome. These longitudinal field studies also allowed any "cause and effect" relationship to be determined, since the sequence of events was observed over a period of time. However, at the commencement of this research study no meaningful, broadly applicable guidelines were available to deal with the many diverse and specific issues to be addressed. It was important therefore, to identify a number of specific points to assist with field research studies. These were as follows:

1. What was it that structured the design of the study and what was the research question?
2. Was the nature of the information to be derived and were the characteristics of the study design evident? What was the background and significance of the research question?
3. What are the research problems and how does one know what is actually measured?
4. What methodology should be used as the basis for confidence in the results?

What Structured The Design Of The Research Question And What Was The Research Question?

The research question posed in this dissertation is:

> Does, and will the development of the shellfish farming industry, located in peripheral coastal regions of Ireland, meet the criteria and objectives originally set out for this industry?

This question will be empirically tested against the stated objectives of the industry, which are to stimulate economic and social activity in peripheral regions and help create employment. The following broader objectives set for the development of this industry will also be measured:

1. Fill a growing gap between demand and supply for fish and fishery products
2. Create job alternatives and opportunities, notably for the agricultural and fishing sectors in coastal areas
3. Sustain the economy of certain depressed regions
4. Develop an economically healthy and viable industry

(OECD: 1989, 18)

It is also intended that the results of these findings will help identify barriers impeding the expansion of the industry, explore opportunities for developing this natural resource, and quantify operational practices and procedures needed to manage this resource.

The findings of this research should be of benefit to the Government, Government support agencies as well as to policy makers involved in the promotion of the industry who may find the results of interest and provide a useful document in the planning and assessing of future programmes for the development of shellfish farming in peripheral coastal regions.

Practising shellfish farmers, potential shellfish farmers and students of enterprise development may also find the results of the research useful.

What is the Background and Significance of the Research Question?

The development of the shellfish-farming sector in Ireland is a highly complex process, which can be difficult to understand, stimulate, and direct. Shellfish farm systems are diverse, employing a wide range of different farm practices and technologies. Shellfish farm systems developed gradually as the understanding of the biological requirements of shellfish product cultivation on the farm improved. Also, shellfish culture techniques employed vary from fairly extensive labour systems, to small-scale family subsistence systems through to highly intensive systems calling for large-scale investment and a reasonable return on capital. Often technologies readily available from other activities such as agriculture and sea-fishing, were simply incorporated into shellfish farm production techniques without appropriate adaptation to the needs of the industry. However, in many cases this learning or "green thumb" process through trial and error has been fairly rapid.

These farm systems developed gradually as the understanding of the biological requirements of the shellfish products cultivated improved. For example, better control of diseases, and water quality management systems, were established. Previously these had presented serious constraints to shellfish farm production and were a serious risk to the viability of the farm. The use of technological systems and innovations needed for improved performance became necessary. Problems of scale-up from pilot development to commercial operation required different management and entrepreneurial techniques. The economic and social impact of shellfish farming in peripheral regions can no longer be ignored, and negative as well as positive benefits have to be considered. The role of the Government and the EU in adopting a regulatory framework defining the conditions of access to shellfish farm sites and the use of the marine environment raises many complex political, economic, social and technical issues. At the same time these institutions provide the major conditions and support systems for the development of the shellfish farm industry. The question of the shellfish farming industry providing sustainable employment has to be tested. For example, where small-scale shellfish farms may not be a logical means of reducing unemployment on a national scale, the locational characteristics of the farming of shellfish may prove to be a useful means of providing employment in otherwise economically disadvantaged regions.

The supposition that shellfish farming is capable of achieving set objectives will have to be tested against this changing background. Government support and investment for this sub-sector of fisheries has been considerable and continues in the belief that this industry has the potential to generate employment and enhance production. Much of this rationale is based on the perceived high-economic benefits that can be derived from this development and the belief that relatively greater scope exists for growth in this sector than in that of captured fisheries. A number of surveys and reports commissioned by both the Government and the European Commission helped identify the social and the economic impact the aquaculture industry has on the economy; **(e.g. Economic and Social Research Institute: 1992: European Commission 1991d: 1992: and 1993a)**. Numerous other reports and surveys highlighted various aspects of the aquaculture industry such as environmental issues and coastal zone management **(European Commission: 1995a; An Taisce: 1993; Department of Arts, Heritage, Gaeltacht and the Islands: 1997)**; on structural policy; **(European Commission: 1986)**; on regional development **(European Commission: 1987; 1991c)**; on industry development **(European Commission: 1991d: O'Connor and Whelan: 1988)** and on training and education **(Aqua TT: 1994)**.

However, the majority of these reports and surveys concentrated on the total aquaculture industry and made little distinction between shellfish farming and finfish farming and therefore treated the industry as one entity. Early investigation into the industry during this research clearly identified a distinction. Finfish farming requires many and distinct practices and procedures, and its life cycle, risks, costs and markets and have their own patent social and economic considerations. While finfish farming and shellfish farming are an integral part of the aquaculture industry, in nature and practice each can be treated as a separate entity.

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What are the research problems and what has to be measured?

Many surveys and reports have been commissioned by the Government and by the EU mainly to identify the social and economic impact the aquaculture industry has had on the economy and the community. Reports on the industry highlighted many aspects, such as the effect on the environment, coastal zone management, structural policy, economic development and training and education. Most of these reports, however, concentrated on the physical entities rather than on the social and organizational behaviour aspects of shellfish farming. There was also the problem of surveying the total aquaculture industry, which included salmon, farming and in many ways this distorted the true image and understanding of the shellfish farm industry. During the early stages of researching this dissertation it became evident that there was a clear distinction to be made between these two natural resource marine-based industries. Finfish farming requires many distinct practices and procedures, have a different product and life cycle, risks, costs and markets and has its own patent social and economic considerations. While finfish farming is an integral part of the aquaculture industry, in nature and practice each type of marine farming has to be treated as a separate entity.

In the shellfish farm industry, very little was known regarding the characteristics of the shellfish farmer. The problems and opportunities for creating economic shellfish farm enterprises and viable production units were rarely assessed. Ways of measuring the social and economic impact of these farms were often under-researched. Identifying the operational and business risks involved were poorly calculated. Innovation in shellfish farming was mainly carried out by research institutions and often this technology was not conveyed to the shellfish farm for practical implementation and testing. The level and frequency of decision making and the survival rates for this industry were unrecorded.

The research undertaken in this dissertation was to quantify and qualify theses entities. For example, the peripheral environment in which these farms operated had to be assessed as regards the opportunities and barriers these regions would have on the sustainability of the industry. The entrepreneurial characteristics of the shellfish farmer had to be identified. The risks taken and the innovations needed to manage these operations had also to be considered. The impact on the social and economic fabric of the communities in which these farms operated needed to be addressed. Finally, the implications of shellfish farm legislation and regulation on the development of the industry had to be observed.

What Methodology should be used as the basis for confidence in the results?

There is always some degree of uncertainty in any measurement. Before one can adequately interpret the results obtained from a series of measurements, an estimate of this uncertainty is needed. It is notoriously difficult, but not impossible, to establish a reliability measure for certain types of data collection procedures such as interviewing and participant observation. Nor can such research be without bias. The information available to the author during the early stages of this research consisted mostly of secondary data. The shellfish farms were identified from a list compiled by the Irish Sea Fisheries Board/An Bord Iascaigh Mhara. This list referred to applications for grant aid assistance under its pilot programme for shellfish farm development. The accuracy of this information as a procedure for determining whether these shellfish farms became operational or not was not available. The amount of information required to complete these applications was also limited. A number of miscellaneous reports were also available which referred to specific aspects of the industry such as applications for site inspections and requests for shellfish farm licences. Another source of secondary data was that which could be obtained from the technical staff of the Irish Sea Fisheries Board who were directly involved in the development of the industry. However, this knowledge was with the individual rather than on paper or computer disc. Generally, this knowledge was very valid and valuable as a source of information and perhaps more so than the formal sources available at that time. Most of the shellfish farms were operated by individuals or family groups and were classified as sole traders. The majority of the shellfish farm operations were clustered in specific coastal regions such as Bantry Bay, Galway Bay, and Donegal Bay. It was quite common for ownership of these shellfish farms to be amalgamated or be taken over by local operators. Due to the initially poor source of secondary data available on the shellfish farms, the task of designing a methodology to gather information to answer the research question was difficult.

The first important consideration for data collection for this dissertation was that the author had access to information and that there was co-operation with a target group within the industry. Another aspect of this type of data-collecting study was that if certain events occurred within the industry, this could help in yielding requisite data about the industry.

The author held the position as Director of EU Affairs with the Irish Sea Fisheries Board for the duration of compiling this dissertation. As this organization was charged with the responsibility of developing the industry, the author had direct access to the shellfish farmers. In addition, with the advent of the Single European Market in 1992, new EU Directives and Regulations were required for the industry. With the introduction of these regulations it allowed for a "cause and effect" relationship to be determined. This event took place without the deliberate intervention of the author and therefore the essence of conducting this field research was that the author was prepared to observe the industry and to capitalize on changes and variations that occurred in the actual situation to be observed. Some of the data obtained answered questions, other data enabled the author to infer answers or to infer certain relationships between sets of variables. It was important however, that the information collected was reliable and was what the author was seeking. However, perhaps the most fundamental and best method of initially enhancing the reliability of the answers in this research was that the author administered the questionnaires and conducted the interviews personally with the target audience in this research. Discussions with the respondents and examination of responses helped to develop the data-collecting procedure.

Binder (1966, 248-249) states that even in a strictly statistical approach to research, the researcher is advised to:

> Use all available weapons of attack, face problems realistically and do not retreat to the land of fashionable sterility, learn to sweat over data with an admixture of judgement and intuitive remininatio, accept the usefulness of particular data even when the level of analysis available is markedly below that available for other data in the empirical area.

Longitudinal Study

This longitudinal study of the Irish shellfish industry extended over a period of four years and was directed at a number of focal points, which were the subject of measurement. These focal points were the shellfish farms and the peripheral coastal regions where they operated.

In this longitudinal study, observations were made at repeated times on the management of these shellfish farms, the risks taken and the innovations introduced by the shellfish farmer, the markets for the farm produce, the impact these shellfish farm operations were having on the local community, and the implementation and compliance with rules and regulations. These observations were conducted with a sufficient frequency so that an understanding of the dynamics of shellfish farming could be achieved and measured. This longitudinal type study would appear to be similar to the case study, but a case study on the shellfish farm industry may be developed either retrospectively after all the events have transpired, in real time as the events occur, or overlapping both periods. In contrast the data collected in this longitudinal study was primarily collected in "real time" so that observations made were not unduly changed by the distortions that were likely over the passage of the time it took to conduct the research. The case study approach, which the author initially considered undertaking, would primarily have been a narrative account of the industry with supporting data of a series of related events presented as one body, the shellfish farm industry itself. Conversely, this longitudinal type study of the shellfish farm industry is less concerned with the "case" itself but rather focuses on the phenomenon of shellfish farming.

This longitudinal study approach to the shellfish farm industry involves exploratory or proposition-- testing field study and is subject to the same research design problems -- including measurement, reliability, meaningful extraction of information from data, the validity of inferences etc. The special feature of this type of research however, makes it possible to determine that one type of event, or a combination of events, precedes an effect. This understanding may often allow inferences about cause-and-effect relationships to be made. But when these inferences are made, the nature of the process by which the inferences are made can be crucial and therefore must be evaluated with care.

In this sense of being able to provide support for inferences about relationships among the many variables associated with shellfish farming, the design considerations for a longitudinal study are similar to a field study. The key feature distinguishing the longitudinal study from the field study is that in the field study the state of a number of focal units is determined at one point or one limited period of time, whereas in the longitudinal study the states of the focal units are measured repeatedly **(Douds and Rubinstein: 1978)**. The data for a longitudinal study are primarily collected in real time - that is, more or less as the events are occurring. This "more or less" involves a difficult, basic methodological choice in the design of the longitudinal studies. In general, it is not possible to take measurements continuously in a practical situation involving the behaviour of individuals.

An alternative approach is to collect data at regular intervals. If the nature of the phenomena involved is such that changes cannot take place rapidly, then this choice is appropriate, but in studies of behaviour this assurance is rarely present. However, in field situations, regularly scheduled data collection by the researcher may be the practical choice. In evaluating the results of a study one must consider the inaccuracies of data with varying times between the occurrence of events or changes in the situation and the time when the data was collected. Even if the instrument is reliable, the quantity measured may have changed from the value it had at the time it would have been desirable to measure it. Again, there are no specific rules as yet to evaluate the choices in designing the methodology or evaluating results. Many factors are involved - the nature of the variables, the nature of the phenomena, characteristics of the instruments, characteristics of the participants, etc., and the overall, combinatorial effect of these in the context of the methodology and procedures chosen as well as their individual features taken one at a time (**Tull and Hawkins: 1990**).

The time span covered by a longitudinal study varies considerably. The defining characteristic is that the change in a phenomenon through time is measured. Common usage would seem to be that if a study in organizations is called "longitudinal", time spans of the order of months or years are involved (**Rubenstein et al: 1973**). A major problem with the shellfish farm industry was the loss of subjects, not only from such factors as movement among farms or unwillingness to continue co-operation, but in this particular case the uncertainty as to how many and which shellfish farms entered and left the focal area of shellfish farming during the compilation of this study.

Research Strategies Used to Create and Collect Data

The methodology used for collecting the qualitative data required for this longitudinal research study of the shellfish farm industry consisted of postal questionnaires, interviews and surveys, focus groups, mini-groups, field experiments and observation techniques. The basic principle underlying this type of data was to help the author understand the many variables associated with this industry through the eyes of the shellfish farmer. This data was also used to describe and explain the inner working of the phenonema associated with shellfish farming. As all data tends to be the social construction or creation of the researcher, the main difference between this type of qualitative data and quantitative data is in the classification procedure. Some of the qualitative data collected for this research was loosely structured and classification occurred during or after the data collection phase. This hermeneutic research approach, which produced large amounts of information, allowed the concepts, categories, and propositions of the phenomena of shellfish farming to emerge. The advantage of this type of data collection and information gathering was that rather than producing theoretical abstraction regarding the shellfish industry, it instead reflected the practices and procedures required for creating social and economic values in the development of an indigenous peripheral natural resource industry.

As Director of EU Affairs for An Bord Iascaigh Mhara/Irish Sea Fisheries Board, the author of this research dissertation was responsible for assessing the likely impact of the establishment of the Single European Market in 1992 would be on the Irish sea-fishing and seafood industry. A number of EU Directives and Regulations were to be introduced to create a framework for this Single Market. In order to assess the awareness of the industry of the likely consequences of the evolvement of a Single Market, the author designed an open-ended, multi-choice questionnaire (Appendix A), which was mailed to the 152 seafood processing companies and enterprises registered on the Bord Iascaigh Mhara list of seafood exporters. This type of questionnaire left the respondents free to offer any replies that seemed appropriate in light of the question and thus, opinions were expressed that were quite divergent from what the author expected. Related to this was the fact that this questionnaire elicited a wide range of responses. The properties of this type of question were particularly suitable for the exploratory type of research the author wished to engage in. Also it provided the author with a basis for judging the actual values of the respondents and with a "feel" for the interest the industry had in the development of a new business environment. Because the questionnaire included a multi-choice element, this made it easier for the author and the respondent and helped secure co-operation in administrating other types of surveys. There was of course the disadvantage that the respondents rarely elaborated answers, some gave clear and in-depth answers while others, who may have had equal knowledge, were more reluctant to express themselves. A total of thirty-eight responses to the questionnaire were received. These questionnaires were exploratory in nature and were designed to discover the attitude the seafood industry had to the perceived problems they would face and the many variables related to them. The general findings are summarized (Appendix B). A representative sample of twenty of these enterprises which had returned the completed questionnaire were selected to be interviewed by the author. Ten of these companies were involved in shellfish farm production.

These interviews were arranged so that a situation analysis of the development of these shellfish farms could be assessed. The interviews with the shellfish farmers were unstructured, direct interviews, and focused on the many variables that created the stated management problems and opportunities. The factors that led to the problem/opportunity manifestations and the factors that led to management concern with the problem were isolated. These interviews allowed the author freedom to create questions and probe responses which appeared relevant. Both the postal surveys and the interviews did provide certain information concerning the structure of the shellfish industry and its capability to deal with the new environment of the Single Market.

As a result of this information gathering process it emerged that the industry sought more information on the further development of the Single Market. In response to this need the author, in consultation with the fishing industry and the EU Directorate of Fisheries, organized the first seminar to be held in Europe to debate the introduction and compliance of the Single Market Directives which would be of relevance to the Irish seafood industry. This seminar was held in Dublin in the autumn of 1992 and the participants included fish processors and exporters, fish wholesalers and retailers and aquaculture farmers. The seminar was built around the theme of the introduction of the EU Council Directive Laying Down the Health

Conditions for the Production and Placing on the Market of Fishery Product (European **Community: 1991a)**. At this seminar the guidelines and the requirements of the seafood industry in this new market environment were discussed and debated.

Following the impact this seminar had in addressing and examining the future requirements of the industry, representation was made by the shellfish industry to the author to conduct a special seminar for the shellfish industry so that specific Directives affecting their industry could be discussed. This seminar was held in Bantry, County Cork in the winter of 1992 and dealt specifically with the Directive 91/67/EEC Covering the Animal Health Conditions Governing the Placing on the Market of Aquaculture Animals and Products **(European Community: 1991)**. The introduction of this Directive was seen as having major implications for the future development and operation of the shellfish farming industry. As the context of this Directive evolved around a number of contentious issues for the shellfish farmer, it meant the information flow at the seminar was relevant. Issues such as cultivation, productivity, health rules, and disease control were on the agenda. Other areas such as grants, maintenance, suspension, restoration, and withdrawal of approval for the establishment of farms were also debated and discussed. Following this seminar, a sense of the identity of shellfish farming as an industry became established and the information flow between the industry and the author increased substantially.

At that stage the author became aware of the absence of data and information concerning the whole phenomenon of shellfish farming. Knowledge of the many variables such as the socio-economic impact of the industry, the management and operation of these enterprises, its relationship with the local communities were never properly assessed or measured. At this stage the author commenced this research dissertation.

Questionnaires and surveys as a major source of information gathering did not appear adequate as the shellfish farmers appeared to be unwilling, and in some cases unable, to give answers they considered to be an invasion of their business privacy, could adversely affect their self-perception or prestige, to concern motivation that they did not understand or could not verbalize, or for many other reasons. Therefore additional approaches to obtaining such information were necessary.

In early spring of 1993 the author conducted a series of "focus group" workshops in the shellfish farming regions Cork, Galway, Waterford, Donegal and Louth. The main theme of these workshops was to initiate discussion with the shellfish farmers and assess their capabilities to comply with the principles of the new EU Directive. It was intended also that each of these groups be designed to reflect the characteristics of the shellfish farm industry. These workshops were limited to between ten and fifteen individual shellfish farmers who included full -time as well as part - time farmers. At these workshops the author, as moderator, was able to establish rapport with the group, structure the rules of group interaction, and set objectives. The aim of the workshops was to provoke discussion on the reality of introducing the concepts and principles of the EU Directives and to summarize the group's responses to determine the extent to which they would be capable of complying with the Directive. Representatives of the Department of the Marine were invited by the author to participate at these workshops as this organization would be the body charged with implementing the EU Directives.

The interaction progress induced by these group situations produced a number of potential advantages. Each shellfish farmer was able to expand and refine his opinions in the interactions with the other members. This process provided more detailed and accurate information than could be derived from each separately. The group interview situation also was very vocal as the group felt they were representing an industry and this led to a more stimulating situation than that which could prevail at a standard depth interview. This heightened interest made for more meaningful comments and observations. In addition, the security of being in a group with similar needs and desires encouraged the participants to make a contribution to the group which otherwise they may not. The questions raised by the author were addressed to the group as a whole rather than to individual farmers, and the answers contained a degree of spontaneity normally not produced by other information techniques. Furthermore, individual farmers were not under any pressure to invent answers to questions. However, care had to be taken to ensure that these initial information methods did not lead to too much reliance being placed on the information that they produced. Therefore, certain reservations had to be borne in mind regarding the quality and accuracy of the information gleaned from these workshops. For example, the shellfish farmers who attended the workshops and actively participated in them may be different in many respects from the farmers who wished not to attend. Some participants at the workshops may have engaged in "politics" in this group setting and gone along with the group rather than express their own opinions. Also there was no guarantee that all the information was accurate or complete. At some of these workshops a shellfish farmer with a strong opinion on the topic being discussed could substantially alter the expressed views of the group. Also, on occasion, the author may have introduced biases in the group discussion by shifting topics too rapidly, encouraging certain answers or failing to cover specific problems and issues. The author also had to recognize that any generalization from these initial focus groups to the total shellfish industry might be a risky undertaking. The author was therefore aware of the potential errors in this type of interview.

As a follow-up to these workshops, and to understand the range of occupational profiles of these farms (managers, supervisors, operatives, technical, administrative and others) a research questionnaire was designed (Appendix C). In conjunction with an EU sponsored Force Programme, twenty-two aquaculture farms were visited. Nine finfish farms were visited by Force staff and the author visited thirteen shellfish farms. Because of the detailed nature and number of questions on the questionnaire, the number of farms was limited but selected carefully. Selection was based not only on ensuring that a range of sizes and location of shellfish farms were chosen but also on finding co-operative, reliable farmers willing to participate in the survey. This meant that the responses were not a random representation of the views of the industry but these select groups helped express the thinking of shellfish farm owners and managers who were aware of the requirements and practices on their own farms which was likely to relate to the situation on other farms. Completing the questionnaires required a visit to the farm and an observation of the practices on the farm. The shellfish farms visited were offered anonymity as it was recognized that some of the questions sought commercially sensitive information. The results of the survey did help to produce a profile of the personnel structure of the farm, the responsibilities of the workers, general qualifications and the perceived training needs of the farmer. One of the strong points coming from all of the farms was the belief that shellfish farm workshops played a vital role in the development of the industry as they brought together expertise and knowledge, and provided a platform for discussion and debate.

Chapter Four

THE PERIPHERALITY OF SHELLFISH FARM-COASTAL REGIONS

Introduction

Many analyses have described how different regions within a country or within a large group of countries have shown different rates of economic performance. The EU is no exception to this phenomenon. A number of detailed studies have viewed the basis of various economic indicators on how the regions of the EU compare with each other. For example, the Third Periodic Report on the Social and Economic Situation in the Regions **(European Commission: 1987)**, devised a synthetic index of peripherality based on living standards, productivity, unemployment and job requirements in the period 1981 - 85. That report showed that, with the EU average being 100, Darmstadt in the Federal Republic of Germany was the highest ranked, at 172. The lowest ranked region was Basilicata in Italy with a rating of 36.9. The Republic of Ireland was defined as a single region and its position was just sixth from the bottom of the rankings with an index of 47.6.

The Fourth Periodic Report **(European Commission: 1991c), published** in 1991 confirmed that peripheral regions continue to be disadvantaged relative to central regions. Ireland was ranked as the twenty-fifth lowest region based on GDP per capita over the period 1986-88. With the EU average of GDP per capita at 100 in those years, Ireland's GDP per capita was 64.5.

Comparative unemployment rates graphically illustrate the severity of Ireland's economic problems. In the years 1988, 1989 and 1990, out of 166 regions, Ireland had the fourteenth highest unemployment rate. With an EC average unemployment of 100 in those years, the index of unemployment in Ireland was 187.4.

Keeble, Offord, and Walker (1986) in their study of the Peripheral Regions in a Community of 12 Member States **(Irish Trade Board: 1986, 136-7)**, calculated the Index of Peripherality function as follows:

$$\mathbf{Pi} = \sum_{j=i}^{n} \mathbf{Mj/Dij + Mi/\ Dii}$$

$$\mathbf{j = i}$$

Where Pi is the accessibility or peripherality of region i, Mj is a measure of the volume of activity in region j, and Dij is a measure of distance between region i and region j. Mi/Dii incorporates the contribution of the region's own volume of activity (Mi) to its overall peripherality index. Summing for all other regions under consideration, and adding the "own-region" component, yields the overall peripherality index for region i.

The components of their formula are arrived at as follows:

Mj : measured as regional gross domestic product in region j expressed in either ECUs or purchasing power parities

Dij : the shortest road distance between the largest cities or towns in regions i and j. Sea-crossings are measured in distance terms and weighted to reflect actual shipping costs for container lorries and roll on/roll off ferries within the Community

Mi : regional gross domestic production in region i

Dii : an estimate for internal distance costs for internal distance cost for region i calculated as follows:

$$\frac{1}{3}\sqrt{\frac{\text{area of region i (sq. kms.)}}{\Pi}}$$

This gives a distance value which is one-third of the radius of a circle of the same area as region i and allows for the clustering of economic activity within most Community regions in and around their central metropolitan nodes.

Having identified the results for sixty regions within the EU, the research showed that Ireland overall had an index value of 3,576. By comparison, regions such as Cumbria in the UK and Corse in France had an index of 4,823 and 3,387 respectively. The Highlands and Islands of Scotland had an index of 2,992 and most of Greece had an index of less than 2,600.

Regarding the peripherality and social structure of the fishing and aquaculture regions in the EU, the Commission of the European Communities Directorate-General for Fisheries commissioned in 1992 a number of studies on the Regional, Socio-Economic Studies in the Fisheries Sector **(European Commission: 1992)**. One of the terms of reference of these Regional studies was the identification and characterization of fishery dependent zones and to analyse the socio-economic impact the fishing and fisheries related industries had in these regions. The Report on the Irish Fishing Industry found that relative to the extent of the resource found in the waters surrounding the Republic of Ireland, the scale of the industry is small, indicative of the disadvantageous terms which Ireland accepted in participating in the Common Fisheries Policy, and the poor economic standing and development of the country as a whole. The Republic of Ireland remains a peripheral region of the Community, and its fishery industry is concentrated in areas that are peripheral within Ireland itself. The sector as a whole was grossly under-capitalized, was organized along traditional, conservative lines, and supported an insufficient number of successful entrepreneurs, visionaries, and modern managers. Each of these factors works against the future well-being of the sector.

However, a Summary Report of these studies was undertaken in 1993 and this report identified a number of discrepancies in this research **(European Commission: 1993a)**. While the Commission's terms of reference were fully covered, the detailed analysis of the fisheries sector and the detailed analysis of the labour market caused certain problems. In practice the Commission found it difficult to find consultants equally skilled in both these fields to undertake the research. In commissioning the Regional Studies, the Commission selected those with sound experience in fisheries and consequently the assessment of the labour market issues could only be presented in general terms. The Summary also pointed out that the studies were constrained by data limitations. For example, in defining specific zones for analysis, these could not be determined on the basis of one single indicator like "employment dependence" alone, but other characteristics needed to be considered. Only brief references were made to the aquaculture industry in these studies.

A number of common characteristics exist in the definition of peripherality in various regions and countries **(Irish Trade Board: 1992)**. Some of these are:

- The smaller countries have not developed a cohesive, horizontally and vertically well-structured production base and therefore the demands on Government industrial policies are far-reaching. The ability of Government industrial policy to offset peripherality is increasingly being questioned
- The small size of the majority of enterprises is unfavourable
- Many of the large enterprises are controlled by foreign capital
- The indigenous sector is dominated by traditional labour intensive industries which are highly exposed to growing competition from low wage countries
- There is a dependency mentality due to the lack of effective local control over the use of resources with the major economic decisions being taken at the core
- There is a loss of dynamism and a comparative lack of innovation as new ideas are imported
- In Ireland additional impediments to industrial development include:
  - the small size of the domestic market
  - distance from large and concentrated centres of population
  - technological backwardness relative to the more advanced Western economies

While the shellfish farming industry could be described as having all the characteristics of an industry based in a peripheral area of a peripheral region there is very little empirical data or information on structure, employment and productivity in these coastal shellfish farming regions. The next chapter attempts to identify the regions where shellfish farming is conducted and to gauge the level of employment and productivity in these regions as well as examine the level of peripherality in these zones.

DEVELOPMENT PROBLEMS OF PERIPHERALITY

The main features of the Irish economy which are relevant to the European Community's aim of developing economic and social cohesion, and to Ireland's capacity to share fully in the benefits of the completion of the Single European Market, are identified in the National Development Plan presented to the European Commission in 1989:

> Low income and output levels; a population structure resulting in rapid growth in labour supply and a high dependency ratio; persistently weak labour demand leading to unemployment and emigration; constraints imposed by budgetary imbalances and public sector indebtedness; high access costs resulting from the country's peripheral location; poorly developed infrastructure hindering development and adding to costs; a heavy dependence on agriculture both for employment and output; weakness in the industrial structure; low investment levels by Community standards and dependence on capital imports.

This review of the Irish economy also presented a series of impediments to economic development. While aquaculture and fisheries enjoy significant natural and environmental advantages and have considerable potential for further development, inadequate infrastructure and the country's geographical peripherality impose high costs on production. (European Communities: 1990, 9-10).

Because of this situation the European Support Framework provided for activities which take place in rural peripheral areas and contributed to their development. For example, in areas where fishing and aquaculture was a source of employment, measures concerning the improvement of conditions for the marketing and processing of shellfish products were implemented as part of the Objective of the Reform of Social Funds.

Shellfish Farming Zones

Ireland has one of the lowest population densities in the EU, at fifty-one people per square kilometre. The national population is small in number, 3.53 million, and highly dispersed in nature, typical of a predominantly rural economy. The farming of shellfish is dissociated from the main urban centres of Ireland and is concentrated within rural areas along the extensive coastline. Given the small and dispersed nature of the population, and the non-involvement of the major urban centres in shellfish farm activities, the areas of influence of the shellfish sector are very limited, conforming closely to coastal communities only.

The major coastal regional zones where these shellfish farms are concentrated are:

1. The Donegal coastline
2. The coasts of Sligo, Mayo, Galway and Clare
3. The coast of Kerry and Cork
4. The coasts of Waterford and Wexford
5. The coast from North Dublin to Carlingford Lough

The total population in these regions is estimated at 560,000 people or 16 per cent of the national population. The density of population per region is lowest in Connemara at twelve per square kilometre. The largest expanses of low population density in Ireland are notably in southern Donegal, west Mayo and Connemara, and western Cork and Kerry.

The Regional, Socio-Economic Studies Report on the Fishing Industry in Ireland commissioned by the EU **(European Commission: 1992)**, examined the peripheral status of the fishing zones around Ireland. The general findings were that the economic status of these peripheral regions where fishing activity was concentrated was exemplified by the following:

- lower than average national income levels
- higher than average national unemployment levels
- subsistence agriculture on poor soils with very limited farming units

- higher labour dependency ratios; very poor physical and communications infrastructure
- very limited industrial development

There are difficulties in attracting suitable industry to these locations. The handicaps in location, poor infrastructure and the lack of any local raw materials, have made it difficult to develop or create the necessary stable and long-term activity needed. For these reasons, the development of natural and marine resources in particular were identified as offering a significant advantage in developing stable and acceptable long-term economic activity in these regions with advantages in their location and offering employment for which many of the skills required were perhaps available locally.

Coastal Region of Donegal

Economic Indicators

Donegal has a land area of some 483, 000 hectares, a population density of twenty-seven persons per square kilometre which is well below both national and EU averages. The county is mountainous, with agricultural land deemed to be of poor to very poor quality. It is also a county of striking national landscapes, and areas of wilderness. This ruggedness which is highly valued by visitors, is also indicative of the great difficulties experienced in generating a living from the land. Much of the farming activity is of subsistence/semi-subsistence nature, with very small plots of land (below 40 hectares in size). The GDP for the IDA region of Northwest Donegal is estimated to amount to £1,288 million. On a GDP per capita basis, this gives a figure for the region of £6,047. By comparison, average GDP per capita for the EU for 1988 was £11,418, and for Ireland it was £7,337. This figure is nearly half the Community average and reflects the very low level of economic activity in this region.

The unemployment rate in the region is one of the highest in Ireland at 25 per cent. This gives a high dependency rate (the number of people dependent on each wage earner) of three. For the whole of Ireland this figure is 2.28, and for the EU, 1.35. There is an active "black economy" operating in this part of the country, but even this does not diminish the extremely high unemployment levels, by national and EU standards, operating in this peripheral and poorly developed region. There is also net migration from the region, estimated to amount to 1.5 per thousand of population per year. This is indicative of urban drift and the movement of younger members of the workforce to other parts of Ireland or abroad.

Shellfish Farm Activity in the Donegal Region

The farming of shellfish in this zone extends from Lough Foyle in the north of Donegal to Ballyshannon. This coast provides only a handful of sites which were only marginally suitable for shellfish farming. It is one of the stormiest coasts in Europe and the bays are sandy, open, and low in productivity, and are therefore poor sites for shellfish farming. In contrast, Lough Foyle, which is a broad, open and largely shallow expanse of water straddling the sea boundary between Northern Ireland and the Republic, offered considerable potential for the development of native oysters and bottom culture mussels. Also, Lough Swilly had considerable potential for shellfish farming, particularly for bottom culture mussels. Although the Lough is 40 kilometres long and is one of the best deep-water anchorages on the coast it is generally too exposed for suspended culture. The main potential lay in the extensive areas of intertidal grounds at the southern end of the Lough and in the Leannan Estuary. Oyster beds were known to exist in Lough Swilly for a long time. Historical notes on the oyster fisheries of Ireland **(Went: 1962, 195-223)**, mentioned the existence of an oyster fishery at Fahan in the early part of the seventeenth century. Mulroy Bay and Broadwater also were seen as being ideally suited for the development of extensive and intensive shellfish farming.

Most of the workers engaged in the shellfish industry in this region rely on Social Welfare payments to supplement any income they get from shellfish farming. The shellfish farm enterprises are very much fragmented and the general production output in most of these shellfish operations is less than 5 tonne of product per farm. There is no real focal point for the industry and there is very little depuration or processing of the product undertaken in this region. One of the reasons for this situation is that most of the sea area and seashore comes under classification A. The shellfish product can therefore be taken from the water and sold for direct consumption. Very little ancillary activity is undertaken in the processing or semi-processing. The majority of the production is sold to a French broker who arranges collection directly from the farm. This broker calls on the farms about three times a year and arranges to purchase the entire stock. It is collected from the farm and exported directly to France. The farmers are paid directly by this broker. Also since the advent of the Single European Market and the removal of the restrictions on the free movement of goods within the Market, this broker developed a scheme whereby French gigas oyster seed could be imported to Donegal and allowed to grow to maturity in the waters of the Irish farms. While this project was initially welcomed by most of the Donegal shellfish farmers, as they would be provided with seed and have a guaranteed outlet for the mature product, the danger of the importation of possibly diseased seed into the Irish farms posed a threat. The Department of the Marine and Natural Resources and the French shellfish authorities have as yet not fully sanctioned this arrangement and the interpretation of the EU Regulation as to whether this is allowed is being reviewed.

Údaras na Gaeltacht has a strong commitment to the development of the shellfish industry in this region and the long-term prospects for further support for the industry is evident. The long-term payback periods for these enterprises are however, deemed to be a disincentive for investment. Also the fragmentation of the shellfish farm enterprises and the geographical disadvantages of being far removed from the export marketplace causes additional problems for the success of these enterprises.

In this region there are two educational institutions that offer courses and programmes in aquaculture. The BIM Training School in Greencastle conducts a practical fish farming course and the Letterkenny Institute of Technology has a one-year certificate in fish farming technology. In 1996 there were over 60 shellfish farms in the region and the employment level was 150 people. The region produced 1,000 tonne of mussel and 300 tonne of oyster during this period.

Coastal Region of Sligo/Mayo/Galway and Clare

Economic Indicators

This region covers the coastal area from Sligo to the Shannon Estuary, but exclusive of Galway City and Shannon industrial regions. This area encompasses the predominantly Gaelic speaking coastal region of Connemara, the Aran Islands, and the islands of Clew Bay. This is identified as having the poorest socio-economic standing of all the regions of Ireland. This region has a land area of some 294,000 hectares, and a population of 63,000. This indicates a population of some eighteen persons per square kilometre, well below the national average of fifty-one persons per square kilometre. To some extent due to the traditional isolation and small size of the communities, and their consequent requirements for self-sufficiency, exploitation of adjacent marine resources has always formed an important component of the local economy.

GDP for the IDA region of West Ireland in 1990 was estimated to be £1,846 million, indicating a per capita GDP of £6,279. This figure is a little over half the average of the EU. The rate of unemployment, as estimated from the 1986 census, was 16 per cent. Net migration from the region was estimated for the period 1985 /86 to be 1.7 persons per thousand.

Shellfish Fish Farming in this Region

This coast has the most extensive area in Ireland for shellfish farming. It extends from Drumcliff Bay to the Shannon Estuary. This area also has the most diverse conditions for establishing shellfish farm activities. For example, Drumcliffe Bay dries out to expose large areas of sand flats at low tide and is only marginally suitable for oyster culture, Sligo Harbour is limited due to the discharge of industrial waste and sewage into the harbour and Killala Bay has poor potential because of the exposure of large amounts of freshwater flowing in from the River Moy. However, some areas in this region offer excellent potential as sites for the development of shellfish farming. For example, Achill Sound has a long and historic tradition for oyster laying in this area (Brown: 1904, 48), while the bay covers an enormous number of sites with different characteristics, separated by drumlin peninsulas and islands. Also Kiltieran and Camus Bays were once described as the best oyster spatting areas in Ireland. Galway Bay, with the inlets of north Clare, could be treated as one unit, to develop an integrated shellfish industry. There are suitable areas for oyster spat collection, the growing of oysters in both intensive and extensive culture, for fattening oysters, for nursery rearing of young spat in upwelling systems and many other farming activities. All of the waters in this area are designated either a category A or category B status. The quality of the product is such that it can be sold on direct for human consumption or requires minimum purification.

Even though the terrain of this area is not dissimilar to that of the Donegal region, the industry is much better organised and co-ordinated. This region also has a long maritime tradition. Research and academic facilities for the development of the shellfish industry are also located in the region. The University of Galway has an aquaculture department and offers graduate and post-graduate courses in aquaculture. The Institute of Technology in Galway also offers degree programmes and certificates in aquaculture science. The Shellfish Research Centre is based in Carna. Also Udaras na Gaeltachta has a strong influence in this region and is actively engaged in the development and financing of the industry. There are many community-led projects such as the Leader Programme, operating in the region and these have targeted shellfish farming as an attractive and potentially sound source for employment and development.

A very progressive shellfish processing company is established in Westport. The majority of the shellfish farmers in this region sell their product directly to this plant. As the establishment of purification plants and processing plants can be prohibitive for the majority of the shellfish farmers, it is more economically viable to sell the product to the processor which in turn organizes the marketing and selling of the product. In many ways this system is akin to the tradition of the dairy farmers bringing milk to the local co-operative or dairy for further processing and distribution.

In this region over 400 are employed in the 150 shellfish farms. Over 800 tonne of mussel and 200 tonne of oysters were produced in the region in 1996.

Coastal Region of Kerry and Cork

Economic Indicators

Centred on the Harbour of Bantry, this region incorporates the four main peninsulas making up the Southwest coasts of these counties. Excluded from this region are the large urban areas to the east of the region, especially the area surrounding Cork City. In the western parts of Cork and Kerry, smallholder agriculture predominates. The coastline in this region is fjord-like, rocky, and open to the full force of the Atlantic Ocean. The communities in the region are small and dispersed and the road system in this region is particularly poor, increasing its isolation from the rest of the country. This region, however, also incorporates some of Ireland's principle tourist attractions, notably Killarney and the Ring of Kerry.

The region comprises a population of 107,000 people and an area extending to 477,698 hectares. The population density is twenty-two persons per square kilometre and net migration is high. Unemployment in this relatively small workforce is 16 per cent and the labour dependency rate for the region is 2.32.

GDP for the region in 1991 was estimated to be £3,870 million. Per capita, this gives a figure of £7,200, which is slightly higher than the other shellfish farming regions. Reasons for this are likely to relate to the considerable agricultural and industrial wealth around Cork City and the eastern parts of these two counties. GDP from the region is estimated to amount to £773 million.

Shellfish Farming in this Region

The shellfish farm coastal region extends from Tralee and Brandon Bays across to Youghal Harbour. This coastal region has potentially some of the most productive areas for the development and operation of shellfish farm activities. For example, Tralee Bay itself holds the key to the re-development of the Irish oyster industry. So prolific was the spatfall in this bay in 1981 that 100,000 spat could have been collected for a capital outlay of about £30 **(Partridge and Roantree: 1981, 44)**. The main oyster bed covers 300 hectares in the Inner bay east of the Fenit Pier. The Bay is shallow and there are extensive areas of sand and mud which dry out at low tide. During fine weather these banks are heated by the sun and act as a heat storage reservoir, warming the water as it passes over them at low tide. Thus, the bay has the capacity to heat up rapidly in good summer weather to provide the ideal temperature conditions for oyster larval survival and settlement.

Castlemaine Harbour is a major mussel fishery particularly for bottom culture mussels and the mussel has good meat yields. The potential exists for a local processing plant as the supply of bottom mussel could well support such a project. Bantry Bay affords reasonable shelter for most of the Harbour area and this area has developed into the largest rope-cultured region in Ireland. Growth levels in this bay are also impressive. There are many other suitable sites around this area. Dunmanus Harbour and Dunbeacon Harbour, well-sheltered harbours, are well suited for bottom culture farming **(Partridge and Roantree: 1980, 27-29)**.

However, there are areas that only offer limited potential. Ballydehob Harbour lacks depth and shelter. Schull Harbour and Baltimore Harbour are popular yachting and sailing centres and so shellfish activities are restricted. Cork Harbour is the only area in Ireland where shellfish farming has to contend with a large human population and concentrated industry. In the past the harbour was famous for its flat oyster **(Brown: 1904, 148)**. Shellfish growth is exceptionally good, the enclosed nature of the harbour and the influx of nutrients promoting plankton growth. However, the question of domestic and industrial pollution into the harbour, and its environmental effect, is causing concern for the shellfish farms.

Most of the waters around this region are classified in category B, which means the product has to be purified or relayed before dispatch.

Shellfish farming has grown more in this region than in any other during the past ten years and it is now the leading area for mussel cultivation. The region has a number of processing and depuration plants, which process the product from the surrounding farms. The main market for the product is into France but in recent years efforts have been made to add value to the product which can now be exported to the UK retail market and to the domestic market. The University in Cork also has an important aquaculture research and development department and this fact has certainly helped in the development of the industry in this region. The Institute of Technology in Tralee offers a certificate course in fish farming technology.

In 1996 shellfish farm production in this region was over 5,000 tonne of mussel and 200 tonne of oysters. Over 1,000 people were employed in the region during this period.

Coastal Region of Waterford and Wexford
Economic Indicators

Dunmore East is a major fishing port in the region and its history as a fishing centre goes back over a century due to the annual massing of the herring shoals nearby for spawning in December and January **(Partridge and Roantree: 1980, 42)**. The region includes most of

Waterford and Wexford counties, but excludes urban Waterford. The area around Helvick is a designated Gaeltacht area and the traditional working habits in this area were farming and fishing.

The population of the region is around 88,000 and the area of the region is 206,000 hectares. Given a population density of forty-three people per square kilometre, it is the highest figure after the East coast. These counties comprise relatively rich agricultural land, and contrasting areas of well-developed modern agriculture and less developed small-holder farming. This region also has a dry mild climate for most of the year. GDP for the Southeast Region, comprising the whole of the counties of Wexford and Waterford, is estimated at £2,520 million for 1990. On a per capita basis this amounts to £6,546. Unemployment in the region has a high level of 22 per cent and the dependency ratio is high at 2.48 persons per wage earner.

Shellfish Farm Activity in the Waterford/Wexford Region

The main area of shellfish activity in this region extends from Dungarvan Bay to Wexford Harbour. Dungarvan Strand consists mostly of large expanses of rather unstable sandbanks intersected by a few narrow channels draining the area behind the embankment at the western end. There are some small areas at the west end of this bay suitable for oyster culture, but the area is difficult to access. Waterford Harbour provides the only location on the Southeast coast where suspended culture of shellfish can be carried out. Despite the belief locally that native oysters were once plentiful in the harbour **(Went: 1962, 195-223)** concluded that there is no evidence that oysters were ever prolific in Waterford Harbour. Below Passage East, where the estuary broadens out and on the eastern shore there are large sandy strands. Bottom culture mussel cultivation is carried out in this area. However, the constraint on the development of this area for shellfish farming is that it is an important shipping and navigational channel and this coincides largely with the areas of major potential for suspended culture. The harbour also receives industrial and domestic discharges.

Bannow Bay is a small bay on the south coast of Wexford. A large part of this bay dries out at low tide leaving a few narrow channels intersecting broad expanses of unstable sand flats. The bay, draining rich farmland as it does, provides a very rich environment for shellfish culture and very good growth for shellfish products is maintained.

Wexford Harbour is still the prime Irish site for bottom mussel cultivation and is perhaps an excellent example of successful integrated shellfish farming operation. It is the major bottom culture grower and has the biggest shellfish-processing factory in Ireland. The success of the Wexford mussel industry is due to a fortuitous combination of factors and circumstances which has not so far been paralleled anywhere else along the Irish coast, at least for extensive shellfish farming. These were:

- A highly favourable natural environment for mussel culture with warm, rich water, absence of predators and good quality water
- Absence of competing water users
- Good geographical location for exports, close to ferry terminal etc.
- Proximity of abundant supplies of mussel seed
- Existence of a viable vehicle for the development of the industry (including the vital processing end) with initiative, appropriate skills, and business acumen
- Community backing and co-operation, with involvement of local fishermen
- Availability of shellfish research and development, technical and financial assistance

One of the concerns for this area is the quality of water in the harbour. There are localized problems with sewage and discharge into the harbour. The water quality is now classified as B to C, which means all product in the area must be processed before sale. The water classification in the region as a whole varies from category A (Bannow Bay) to category B.

The numbers engaged in shellfish farming in the region (excluding those engaged in processing) totalled 300 people. Production from the area is made up of 500 tonne of gigas oysters and 3,000 tonne of bottom culture mussels.

Coastal Region North Dublin to Carlingford Lough

Economic Structure

This region extends from Howth in North Dublin to Carlingford in County Louth. Although this stretch of coast includes a small part of County Meath, as there is no shellfish farming in this county, it is not included as part of the structure of this region. The population of the rest of the region is estimated at some 235,000 people with an area of 72,000 hectares. The population density is 235 people per square kilometre. The GDP for the east and north east coast is £11,165 million and £1,242 million, respectively. On a per capita basis, the GDP for the Dublin region is £8,357 and for the Northeast £6,274.

Shellfish Farming Activities in this Region

The only area involved in shellfish farming in this region is in Carlingford Lough and to a small extent Mornington Bay. Carlingford Lough is the only sizeable lough on the east coast of Ireland, apart from Wexford Harbour. Because of its strategic position close to the main centres of population in Ireland and Britain, its proximity to the Continent, and the relatively low use made of it by other water users, it is a prime site for shellfish development. The Lough is about 15 kilometres long and varies from 2 to 6 kilometres wide. The outer part of the lough is used for navigation as far as Warrenpoint. Salinity in the lough is generally high and this is attributable to the fact that there are no rivers of any size draining into the lough. At the turn of the century Carlingford was an important centre for oyster production. At the head of the lough there were two beds of native oysters which yielded 1,500,000 oysters annually and gave annual employment to 240 men. Carlingford was also used as a storage and fattening depot for American Oysters (*Crassostrea Virginia*) destined for the UK seaside resorts. The oysters were shipped from America in barrels in March/April and laid directly on the beds in the lough. They were taken up during the summer season from July to the end of October. The mature oysters were then exported to Britain by rail and sea **(Brown: 1904)**. Along with many other beds of native oysters in Europe the Carlingford stocks, for various reasons, became depleted, and finally died out during the early decades of the century. In the absence of any documented history of the trade in American oysters it can only be assumed that this section of the oyster business suffered a similar decline at about the same time. Renewed interest in oyster culture in Carlingford began in 1970 with trial transplants of native oysters into the lough. The results showed that the shell and meat growth were excellent and that a high quality oyster could be produced **(Barry: 1981, 19)**. However, it was later trials carried out in 1973/4 using hatchery-produced Pacific oyster seed that led to the rejuvenation of commercial oyster culture in Carlingford **(Whilde: 1971, 3)**. Since 1977, culture of Pacific oysters has developed using a system of cages placed directly on the bottom of shallow water.

The water in this lough varies in quality. The territorial waters within the boundary of Ballagan Point, Cranfield Point are classified category A and B, whereas the territorial waters within Warrenpoint Harbour are classified as category C. The distribution and abundance of mussel stocks in Carlingford Lough has been the subject of several past studies. A preliminary survey of the mussel stocks in Carlingford Lough was conducted in March 1968 **(Edwards et al: 1969, 14)**. Mainly as a result of these studies a commercial fishery was established in 1969. Efforts to establish a mussel farm industry after the style of Wexford Harbour have not been successful. The main reasons for this were:

- Although seed mussel do accumulate on light piles in the Lough, banks of seed mussels are rare and there is no other source of seed available close to the lough
- There is only a very limited amount of bottom suitable for relaying
- The mussel quality was poor, possibly due to the amount of silt on the seabed

The water quality in the Boyne Estuary from Mornington Pier to Bluff Point is designated category C status. Some bottom mussel cultivation is carried out in this area but the product has to be processed before it is allowed to enter the market-place.

The total production of shellfish from the whole region was 200 tonne of gigas oysters. There were 60 people employed in this production.

SUMMARY

In this chapter an identification was made of the coastal regions of Ireland where shellfish farming activity takes place. While there may be many perceptions, definitions and understandings of the term coastal zone, they all embrace the shoreline, where land and sea meet. The **European Commission (1995a, 16)** defined the coastal zone as follows:

> The coastal zone is defined as a strip of land and the sea territory of varying width depending on the nature of the environment and management needs. It seldom corresponds to existing administrative or planning units

The influence of the sea on the land, and the land on the sea, extends much further than the shoreline. The coastal zones are among the most dynamic, complex and diverse of all environments. Any physical processes, such as the development of shellfish farm operations, can alter the shape and character of these regions over a relatively short period of time. The coastal regions can also support a range of diverse natural communities that can respond to these changes. The economic and social activities within these coastal zones reflect the natural complexity of the area, and change both seasonally and over time. The selection of these areas as potential sites for shellfish farming has traditionally been very much influenced by the quality of the water in the zone and by assessibility to the shore and sea. Evidence of past shellfish production operations also encouraged further investigation into the possible establishment of a shellfish farm enterprise. Suitable site selection for shellfish farm operations has been one of the major criteria for shellfish farm development.

However, there are now being introduced many requirements of nature conservation which will lead to the designation of substantial parts of the coastal zones around Ireland. Proposed Natural Heritage Areas, Special Areas for Conservation, Special Protection Areas etc., will all

have a future impact on the availability of coastal areas for shellfish farm development. For example, The EC Bird Directive (79/409/EEC) makes it mandatory for Member States to establish a network of Special Protection Areas throughout the country with the aim of protecting sites of vulnerable bird species. The effect of these designations on current and future shellfish farm operations is uncertain. Some of the proposed designated areas are prime shellfish farm cultivation areas. There is a view that some shellfish farm activities will not be affected but any new activities or projects considered damaging should not be undertaken without prior consultation with the National Parks and Wildlife Service of the Office of Public Works in order to avoid significant damage to the site. Shellfish farming is generally regarded as a benign activity so the directive may not adversely curb existing shellfish farm activities or hamper a reasonable level of expansion.

Having identified the location of the shellfish farm zones, it was established that these zones are considered to be peripheral regions in Ireland. Whether these peripheral zones present a barrier to the development of these shellfish farm operations has as yet to be established. Various aspects of distance costs and the absence of scale economies may be considered as barriers to development in these peripheral regions. Distance costs can be divided into tangible, physical costs such as those related to transport and distribution and other forms of distance costs. This distance from the market transport cost however, may not be that highly significant. Other non-tangible costs could include costs arising from information gathering and technical support, communications, and management time devoted to overcoming these problems. The indirect effects of not being in the midst of the market is another significant factor for the shellfish farmer. Because of the complexity of the shellfish farm operations, it is necessary that the shellfish farmer is not impaired in the successful operation of his business due to lack of advice and assistance with shellfish product development, with technological changes in the farm operation and with other new ideas that may inhibit process on the shellfish farm. These indirect costs impair the capacity of the farms situated in these peripheral regions to catch up on more prosperous central regions.

Some of these indirect costs include:

- **Information Gathering Costs:** problems in gaining up-to-date market intelligence and contacts, market research, marketing, finance etc., all of which are of increasing importance to the shellfish farmer. Anticipating market demand for his shellfish product and the need to plan production and supply is vital for the success of the farm.
- **Customer Contact Costs**: A consequence of remoteness and peripherality is the problem of maintaining close customer contact. Peripheral location inhibits the cultivation of direct personal relationships between sellers and buyers and places restrictions on the ability of the shellfish farmers to gather vital information on changing trends in customer buying practices and habits. Information on market prices is also essential, as the shellfish market can prove very volatile. This remoteness factor is a significant barrier not alone in terms of the actual difficulties which it creates but also in relation to perceived difficulties which may have even greater impact.

  This perception of distance-related problems in supplying customers may be the basis for reluctance to buy from the periphery for a variety of reasons including perceived risks of breakdown in supplies and doubts about quality control. The shellfish farmers may also lack confidence in attempting to break into what they perceive as the large, sophisticated and demanding market centre. Uninformed perceptions can exaggerate these difficulties.

and attempts by the shellfish farmer to overcome these problems can involve substantial expenditure of time, effort, and money.

- **Economies of Scale Costs**: The vast majority of these shellfish farms have very small production units and would find it difficult to achieve any level of economies of scale required to compete in the export market.

Creating employment in these zones through the creation of shellfish farm activities as yet, has not been fully quantified. Estimates of employment in these shellfish farming peripheral zones are difficult to measure due to labour mobility problems. Distinction cannot always be made between the number of residents employed in the region, those working in an adjacent region and the non-residents already working at another job in the region. This problem is especially relevant in regions in the vicinity of larger economic centres, such as the cities of Cork, Galway, and Waterford, where commuting is the rule rather than the exception. The issue of part-time employment is also difficult to assess. There are many different definitions of part-time work. For example, in the study of part-time agriculture farmers, **(Higgins-1983)**, definition was one who has worked for four or more weeks in an activity other than farming on his own farm, in the year prior to the survey. Other activities are defined as wage work, self-employed work off his farm or self-employed work, excluding farm work, on his farm. It also includes farm work on a farm other than his own farm where he is paid for such work. Putting a minimum time requirement for his off-farm activity such as this is consistent with procedures used elsewhere **(OECD: 1978)**

This difficulty with the definition of part-time shellfish farmers also raises the question of whether some of these operations could be classified as part-time shellfish farms.

The volume of production from these shellfish farms is also difficult to assess. The quality of data and values of production from the farms is poor. Reliance on the farmer giving an accurate estimate of production levels may not be a good indicator of production. Little or no statistics are kept. Since the establishment of the Single European Market in 1992, there is no longer an obligation on an exporter to file statistics of his exports should they be below £50,000 in value. Estimates of production levels can be distorted should the farm have to cease production due to disease or pollution. Some statistics are kept for the Central Statistics Office but the information supplied by the shellfish farmer is generally on a voluntary basis. Some attempt was made in 1996 to obtain the production levels of gigas oysters. This survey was carried out to establish the possible loss to shellfish farmers of their production of oysters as a result of a virus which wiped out the gigas oyster stock in most farms during the hot summer of 1995. A compensation package was initiated by the Government to cover possible losses to the farmer. Again, obtaining reliable information on production levels was impossible **(Bord Iascaigh Mhara: 1996a)** The prevailing impression of these shellfish farming operations is that of a small-time business, operating in a region which is peripheral, remote, sparsely populated and lacking in economic activity.

The next objective will be to examine the social and economic impact these shellfish activities have on these peripheral regions. On a macro-economic scale in Ireland the farming of shellfish is relatively insignificant. This raises the question as to why shellfish farming, as a means of utilizing this natural resource, attracts so much attention from public authorities. One important justification which is given is that this industry has a significant and positive social and economic function at a regional level, particularly in those regions with depressed and marginal local economies characterised by high rates of employment, high emigration rates and containing communities who experience a generally low standard of living.

Chapter Five

Shellfish Farm European Single Market Directives and Regulations

Introduction

The importance of shellfish farming in Ireland in social and economic terms has to be balanced with due consideration for national and European legislation and law which will impact on the further development of shellfish farm enterprises. With the creation of the European Single Market, general legislation covering food hygiene was introduced in order to establish standards to protect public health and give confidence in the quality of food products. In the absence of border controls the necessary basic standards and control measures had to be established throughout the shellfish farm industry of each Member State, for all shellfish products, from farming and cultivation to retail sale. This harmonisation of the shellfish farm industry would allow the free, hygienic movement of shellfish products throughout the Community.

For the economic, social and nutritional benefits of the development of the shellfish industry, including the production sector and all associated enterprise activities, this meant that the industry would be subjected to a greater degree of appropriate regulatory control. While each State within the European Community had its own legal framework which influenced the way its shellfish farming industry developed, it was recognised that within the Community there was a need for a greater degree of co-operation between States and the general unification of relevant regulations governing such issues as market protection, product quality, disease control, and hygiene and environmental considerations.

The Single European Act was the legal expression of all the Member States' desire to further European integration through the development of the Single European Market. This resulted from the Commission's White Paper of 1985, which identified some 300 trading barriers and proposed that these be removed by a programme of legislation, all of which was to be enacted by the 31 December 1992. The European Commission introduced legislation in the form of Directives which required each Member State to transpose the provision of the Directive into law within specified time limits. Should any Member State fail to fulfil these obligations, then the Commission would seek a European Court of Justice ruling to enforce the Directive. Throughout the whole procedure of formulating these rules, the shellfish industry could influence the decisions made. The channel through which the shellfish industry in Ireland could accomplish this was the Department of the Marine and Natural Resources. However, such influences were mostly exerted at the Community institutions where it was felt that this was for the good of the European Community as a whole.

One of the earlier drawbacks to free European trade was the presence of technical barriers, in the form of different regulations, which made it difficult for Irish shellfish farmers to compete in the market thus preventing trade in products across national borders. The adoption of the EU Directives was intended to remove these technical barriers which were particularly evident in the food industry through national laws controlling the use of additives, packaging and labelling. Rather than attempting to specify the composition of all food products, the EU Directives concentrated on establishing a system of food safety and fair trade measures. The strategy of mutual recognition was introduced under which Member States allowed the importation of shellfish products, whether or not they complied with the rules applying to their own domestic production. This harmonisation of the shellfish industry had the potential to open up new markets in other countries for Irish shellfish products. This was intended to give greater confidence to consumers in the safety of the shellfish products produced and marketed. Apart from the food hygiene Directives, many other general Directives were introduced which, although not specific to the shellfish industry, would still impact on its management, operation and development.

THE REQUIREMENTS AND IMPACT OF EU DIRECTIVES AND REGULATIONS ON THE IRISHSHELLFISH FARMING INDUSTRY

As the creation of the Single European Market became a reality, the implementation of the EU legislation and Directives would impact on many aspects of the shellfish industry. It was important that any opportunities the Single European Market presented to the industry would be grasped and turned into advantages. It was equally important that the industry fully appreciate the potential pitfalls and avoid any unforeseen difficulties. Within the industry in Ireland there was a certain complacency regarding the implementation and compliance with these Directives. In order to increase the awareness of the industry to prepare, and most importantly to act in anticipation of the new situation, a number of workshops were conducted on a regional basis by the author. While these workshops and seminars were initially designed to explore the health and hygiene implications of the EU Directives, many other aspects of the shellfish farm industry were discussed and examined.

Issues such as the business opportunities open to the shellfish farmer were introduced, the new marketing environment and the availability of distribution channels were issues which had to be addressed. Methods of transportation and the need to understand customer preferences as well as opportunities for the development of new product all presented challenges for the shellfish farmer. Work practices on the shellfish farms would have to be regulated.

Another important aspect of the introduction of these Directives was the financial cost to the farmer. Investment in the industry by the shellfish farmers themselves was not substantial but any new changes introduced would now require additional capital and finance.

There are many EU Directives impacting on the shellfish farm industry concerning product hygiene, water quality and environmental issues which together affect the operation and development of the industry in Ireland. The following Directives are by no means the only ones contributing to the legislative environment but are of immediate concern to the shellfish farmer.

Council Directive (EC/911492) Laying Down the Health Conditions for the Production and Placing on the Market of Fishery Products

The purpose of this Directive is to protect human health by setting common health conditions for the production and sale of fishery products. Only fish products intended for human consumption are affected by this Directive.

Under this Directive the Irish shellfish farmer has to:

- comply with the EC rules regarding on-shore establishments covering general conditions for:
  - premises, equipment and their hygiene
  - staff hygiene
- comply with the EC's special conditions for handling shellfish products on shore covering:
  - fresh products
  - frozen and quick frozen products
  - processed products
- comply with the EC's rules regarding identification of consignments (either through labelling or in accompanying documents):

- storage and transportation of products
- packaging

- be prepared for:
  - inspections by EC experts
  - regular inspections of work practices by Irish officials.

Impact of this Directive on the Shellfish Farmer

The farmer will have to ensure that basic standards of hygiene and product safety for raw material, landing places, premises, equipment, practices and products are maintained. This Directive will result in far more frequent inspections at all stages of cultivation and production and will apply to all sizes of shellfish farm. These inspections will generally be carried out without prior warning, and will cover any, or all, of the following:

- raw material and ingredients
- materials in contact with shellfish products
- staff hygiene
- premises, transport, machinery and equipment
- cleaning and maintenance of products

The farmer will have to be fully aware of the requirement of this Directive and this is of paramount importance. In the vast majority of cases this Directive will require substantial upgrading of required shellfish farm practices and operations. The shellfish farmer will have to comply with the provisions adopted and these are necessary in order to fulfil the official inspection requirements of this Directive.

The higher cost of shellfish production in Ireland and the peripheral location and distance from markets put the Irish shellfish industry at a competitive disadvantage. The shellfish farmer's marketing advantage is the production of a top quality product with a clean, healthy image. However, the number of fully approved shellfish purification facilities is small and therefore a greater number of these facilities will have to be established and will have to meet the specifications of the Directive. Similarly, additional approved shellfish despatch centres will have to be created. These facilities will be a major investment for the shellfish farmers.

Council Directive (EC/911493) Laying Down the Health Conditions for the Production and the Placing on the Market of Live Bivalve Molluscs

The purpose of this Directive is to set common public health standards for the production, handling, storage and distribution of live bivalve molluscs in the EC. It is also designed to ensure that shellfish imported from non-EC countries conforms to these health standards. Under this Directive any business/premises or operation must comply with the standards laid down in the Directive. Business includes gatherers and harvesters of wild shellfish, shellfish farmers, and shellfish purification and dispatch centres. The Directive covers live molluscs, including oysters, mussels, cockles and scallops (bivalve molluscs) as well as whelks (gastropods) but not prawns, lobsters, and crabs, (crustaceans) as these are covered by the Fishery Products Directive.

The shellfish Directive aims at attaining an "end product standard" and a certain level of quality is expected to be met before sale for consumption. All live shellfish for human consumption must:

- be fresh, alive and free from dirt

- have low levels of bacteria
- have no salmonella or toxic or objectionable substances
- not have dangerous levels of paralytic shellfish poisoning (PSP) or diarrhetic shellfish poisoning (DSP).

In this Directive the classification of shellfish harvesting areas must accord with the levels of contamination in shellfish. The classification of shellfish harvesting areas is crucial to the Directive. Shellfish from areas with more than the permitted level of contamination allowed for direct human consumption must be either purified to achieve the desired hygiene standard or re-laid in clean waters for at least two months.

Impact of this Directive on the Shellfish Farmer

This Directive will have the most significant impact on the shellfish industry for those engaged in the catching, growing, handling and marketing of live bivalve molluscs. The costs of upgrading parts of the industry to meet the required standards can be considerable, as will be the ongoing costs to the industry of monitoring the bacteriological quality of the molluscs.

Farmers will have to comply with harvesting and transportation rules in order to avoid excessive damage to, or contamination of the molluscs. They will also have to ensure that their purification plant, dispatch centre or relay site is approved by the Department of the Marine and Natural Resources. The premises they use for the handling and storage of live bivalve molluscs must meet the Directive requirements covering:

- construction and design of buildings
- cleanliness of buildings and equipment
- lighting

- toilet facilities
- supply of clean drinking and sea water

The farmer must further comply with general hygiene rules relating to:

- staff
- premises
- equipment
- working conditions
- storage

The farmer must also respond to the health authorities' control covering the inspection of premises, supervision of harvesting areas, laboratory testing of samples and the checking of storage and transport conditions. The location and boundaries of harvesting areas must be clearly defined by the Department of the Marine and Natural resources. The shellfish farmer may have to submit as many as thirty samples of the harvesting water on a weekly basis to an approved laboratory for analysis. The rules regarding hygienic conditions for storage and transportation of molluscs after treatment at the dispatch centre will also have to be observed as will the requirements for wrapping and marking each consignment. The shellfish farmer will have to comply with the EU rules governing the welfare of the shellfish products during international transportation of live shellfish and be prepared for inspections prior to long journeys. The appropriate documentation will be required and random and on the spot inspections can be expected. The shellfish farmer will have to supply a " shellfish health" label with each consignment giving the species name, country of origin, dispatch centre number and date of packing. This should ensure greater consumer confidence in sales of live shellfish.

Council Directive (EC/91167) Concerning the Animal Health Conditions Governing the Placing on the Market of Aquaculture Animals and Products

The purpose of this Directive is to set common standards for the placing on the market of fish and shellfish originating both in the EU and in other countries. It is also intended to prevent the spread of serious diseases of fish and shellfish in the EU.

The main objectives of this Directive are to ensure:

- that before sale, the product meets the EU's health standards
- compliance with the EU's rules is maintained regarding the transport of live shellfish
- that the shellfish operator complies with the requirements of the Department of the Marine and Natural Resources in order for Ireland to maintain the status of 'approved' zone.
- that the necessary official 'movement' documents and records are maintained
- there is strict adherence to the rule regarding the placing on the market of shellfish or these imported from other EU countries
- that the rules regarding the importation and placing on the market of shellfish products from non-EU countries are observed
- that all consignments of shellfish and shellfish products are labelled to show the name of the farm, the content of the load, the destination and the means of transport
- the farmer must comply with the rules regarding the on-site inspection of the farm by EU veterinary inspectors.

Impact of this Directive on the Shellfish Farmer

This Directive allows for effective precautions to prevent the spreading of disease due to the transport and movement of stock. The Directive imposes strict rules on the movement and transfer of stock from one farm location to another. This also includes the transportation and importation of all live shellfish.

The requirements of the Directive stipulate disease free status for the product as well as for the brood-stock and the farm from which the product originates. Cleaning and disinfecting of transport containers and the changing of water during transport are covered by specific rules

Diseases which come within the scope of the Directive, the farmed species to which they relate, and the conditions for approval and non - approval of geographic zones in respect of these Directives should be known by the farmer. The rules include requirements for the health inspection of farms and laboratory examination of stock at regular intervals. Any movement of stock and products between zones will be regulated according to the health status of the zones concerned and will require consignment documents to certify status of the source zone or farm. Each consignment will require to be labelled to identify the farm of origin.

Controls on imports from third countries into the EU will take into account the state of health of the shellfish products and there will be rules enforcing the control of diseases within these countries. Only countries approved by the EU will be allowed to export shellfish products into the EU. Also if live shellfish are to be re-laid in any approved coastal zone they must be certified as coming from an approved zone. Because shellfish are free to move and be re-laid in all other Community waters, it may be impossible to ensure that large quantities of shellfish that have been growing in the open sea for a time will not contain a number of 'hitch-hiker' species. These species may be potential pests, parasites or predators. The effect of this free movement of shellfish for the Irish shellfish farmer is that, for example, partially importing grown gigas oysters from France, where seed may be collected cheaply from the wild, into Ireland for on-growing in better quality waters, with subsequent economic gain, may be given precedence over the risk of unintentionally importing undesirable species, and the risk of long-term damage to the Irish shellfish farm industry.

Council Regulation (EC) No.4028186 on the Improvement of the Conditions under which Fishery and Aquaculture Products are Processed and Marketed

Under this Directive Community funds are made available to facilitate the improvement of the conditions under which fishery and aquaculture products are processed and marketed. A prerequisite of participation in the scheme is the approval of a sectoral plan covering the entire fisheries and aquaculture sector prepared by each Member State. This plan will describe the fishery of the Member State including a financial plan over a maximum period of five years.

This Directive lays down that the Community may participate in the financing of investments which:

- contribute to the economic and social cohesion of the Community
- take account of the needs of the less favoured regions
- contribute to improving the situation of the production sectors of fishery and aquaculture basic products. In particular they must guarantee the producers of those products an adequate and lasting share in the resulting economic benefits
- help to direct production and processing towards the objectives pursued by the Common Fisheries Policy through the structural measures.

These objectives are to:

- Improve in the long-term, the marketing and processing structures for fishery and aquaculture products
- improve the marketing and distribution networks for fishery and aquaculture products
- help to improve the hygiene, quality, preservation and packaging of products, or contribute to the better use of by-products
- promote technical innovation and the processing and marketing of new or under exploited species
- help to adapt processed products to consumer demand at reasonable prices
- contribute to market stability for fishery and aquaculture products
- help to ensure the regular and adequate supply of raw materials to the fishery and aquaculture product processing sector, or enable such supplies to be modified by an appropriate production process
- take account of the Community's fishery products deficit and the need for a balanced exploitation of the Community's internal resources

Impact of this Directive on the Shellfish Farmer

Typical investments benefiting from this Directive include premises and /or equipment intended in particular for the development or rationalisation of facilities for processing and packing products for retail and auction markets, facilities for storage, cold storage, deep freezing and bulk packaging of products. They will also include pilot or demonstration projects for the processing or marketing of species (especially new ones), shellfish treatment, water filtration, and equipment required for processing and marketing from the time of harvesting to final consumption.

Assistance may be given:

- to public, semi-public or private organisations
- to investments that can be shown to be technically and economically viable
- to investments that permanently guarantee the Community origin of the bulk of raw materials
- only to investments that receive a minimum of five percent support from the Member State
- only to investments between £25,000 and £6 million

Assistance may not be given:

- for the retail of fishery products
- towards the purchase of land
- to work started before the application for assistance
- to products destined for non -human consumption, except the better utilisation of product wastes

The shellfish farmer will have to consider if he needs to change his production and processing facilities to comply with the requirements of the Single European Market. He will need to consider if his operation justifies expanding his present facilities and is it possible to evaluate the potential benefits of improving production standards. He will have to assess the resources needed for product development and define the need to employ additional expertise, technology and equipment. Scope for entering into collaborative arrangements to develop new added-value products needs to be investigated.

The shellfish farmer's own financial situation and his capabilities to take advantage of the financial support available under this Directive will be a major consideration.

Council Regulation No.3699193 Laying Down the Criteria and Arrangements Regarding Community Structural Assistance in the Fisheries and Aquaculture Sector and the Processing and Marketing of its Products

The main objective of this Regulation is the implementation of measures connected with the modification of the structures of this sector. This is to ensure that the Financial Instrument for Fisheries Guidance achieves the objectives assigned to the structural policy of the sector within the overall framework of Community structural assistance and the Common Fisheries Policy as a whole, which comes under the exclusive competence of the Community, and to ensure that each Member State is in a position to manage structural assistance in the sector.

In the shellfish sector of this Directive the main points considered are:

- the protection and development of marine resources in coastal waters, in particular by the installation of fixed or movable facilities to enclose protected underwater areas
- fishing port facilities
- processing and marketing of fishery and aquaculture products

Member States may also take measures to encourage the devising and implementation of systems for the improvement and control of quality, hygiene conditions, statistical instruments and environmental impact, as well as research and training initiatives in enterprises. The relevant expenditure, with the exception of the farmer's enterprise operating costs, may be funded from this FIFG programme provided that it is directly linked to the investments referred to in the Directive.

Impact of this Directive on the Shellfish Farmer

The main feature of this Directive for the shellfish farmer is that funding may be made available in order that he may undertake the task of promoting new market outlets for shellfish products. Areas where funding would be granted are as follows:

- operations associated with quality certification and product labelling
- promotion campaigns, including those highlighting qualities issues
- consumer surveys
- projects to test consumer reactions
- organisation of and participation in trade fairs and exhibitions
- organisation of study and sales visits .
- market studies, including those relating to the prospects for marketing Community products in third countries
- campaigns improving marketing conditions
- sales advice and aids, services provided to wholesalers and retailers.

The above measures must not be based on commercial brands or make reference to particular countries or regions.

The shellfish farmer will have to be able to identify the principal markets and target customers for their products. They will have to segment their market by activities and geographical zones. A customer base will have to be established where key accounts can be established. Methods to encourage customer loyalty will have to be established as well as an understanding of present customer attitudes and preferences. The suitability of the current channel of distribution will need to be assessed. The characteristics of the competition for the shellfish farmer will need to be identified and possible ways to react established. The establishment of a sales force will have to be considered and co-operation with other sections in the shellfish farm such as production and finance will need to be created. Campaigns to promote the sale of the farmer's product will need to be organised and funded. The whole question of the capacity and capability of the shellfish farmer to engage in such activities and participate in the schemes funded by this Directive will be a major task for the shellfish farmer.

Impact of the Single European Market on the Shellfish Farmer Enterprise

Most of the shellfish farmers interviewed held the belief that the Single European Market would allow for opportunities to sell and market their products, providing they complied with the general legislative requirements set for the industry. It will be necessary however, that the farmer takes the appropriate steps to meet the health and hygiene regulations, and to obtain approval from the Department of the Marine and Natural Resources for such an operation. The farmer will also have to produce documentary evidence to show that such regulatory requirements were met. Should he fail to do this it would be illegal to sell his product and would be subject to penalties and fines for not meeting these compulsory regulations.

There is also the opportunity to adapt the shellfish product or develop new products for new markets. This will require the shellfish farmer to investigate customer tastes in these new markets and what new products could be developed. Failure to take this action could result in the shellfish farmer losing out on potential new markets to competitors. While the Single Market will present an expanded market for the Irish shellfish farmer, it will be important for him to identify markets for his products, price the products for these markets and understand what the competition is doing. There is always the danger that competitors will break into the farmer's existing markets and adapt their products more closely to customer needs. The new regime in the Single Market would make it easier to sell products to existing customers and to new customers in this market. In order to take advantage of this it will be necessary for the shellfish farmer to investigate ways of reaching his customer directly through channels of distribution. Methods of promoting his product will also have to be researched. The transport system and physical distribution system will become easier with less paperwork and the abolition of border custom controls. This will present a challenge for the shellfish farmer as customers will expect quicker delivery times and just-in-time deliveries.

There are also a number of Directives concerning the health and safety of shellfish farm workers and operatives. The purpose of these Directives is to establish a set of common principles regarding health and safety at the farm. The shellfish farmer will need to assess any risks to his workers and implement suitable preventive measures and to take responsibility for their health and safety on the farm. The equipment used on the farm must also comply with minimum safety requirements regarding installation and structure. Directives on hours worked on the farm and the provision of personal protective equipment will also have an impact on the operation of the shellfish farm.

Many Irish shellfish farmers were concerned about the financial impact the compliance with the Directives and competing in the Single European would have on their enterprise. Financial considerations as to the operating costs of successfully running a shellfish farm enterprise had to be considered. Issues such as working capital, cash flow problems, price adjustments, and upgrading their financial systems to deal with additional currencies and foreign transactions had to be taken into account.

Impact of Conservation and Environmental Directives

Most of the coastal peripheral regions around Ireland are rich in natural habitats. There are a number of new Directives now being introduced which are designed to provide a means of preventing environmental damage to, and to protect the environment and quality of life in these regions. Many of these regions would be suitable for shellfish farming and cultivation. The implementation of the Directives will ensure in the broader context that any shellfish farming carried out in these regions is not alone environmentally acceptable but will, relative to other options, be in accord with the broader public interest and will be environmentally suitable and sustainable.

The implementation of these Directives will therefore have a moderating influence on the selection of any new sites for shellfish farm operations and time will have to be allowed for a qualified inspection of the region and an environmental impact assessment made to monitor the effects of shellfish farming on the marine environment in that region.

For example, the requirements of the Directive on Environmental Impact Assessment from the shellfish farmer's point of view are stringent, and require the preparation and submission of lengthy and costly documents. The gathering and presentation of the necessary information will be time consuming. It is felt that these requirements, while necessary to ensure an adequate level of environmental protection, will make it more difficult for the small shellfish operator to secure a licence. The introduction of these environmental Directives however, will have the effect of increasing the awareness of environmental issues among the peripheral coastal communities, the local authorities and the shellfish farming industry and can result in the abandonment of potentially damaging shellfish farm developments at an early stage. With more understanding among the coastal communities and environmental organisations of the interaction between different uses of the shore-line and coastal waters, this may lead to strategies for better management of these resources and a more positive interaction between shellfish farming and other natural resource interests.

The Directives on Water Quality and Treatment are mostly concerned with controlling the quality of water in areas where shellfish farming takes place. If an area is designated under this Directive the State is obliged to reduce pollution so that waters will conform with the standards needed for direct human consumption and these areas will receive environmental protection.

The Directives on Wild Birds and Natural Habitat are concerned with protecting coastal regions and bays which are documented as habitats of major international importance for migratory waterfowl populations and for the conservation of natural habitats of wild fauna and flora.

As most Irish shellfish farm enterprises are small scale, if managed properly they are unlikely to have significant negative impacts on local wildfowl populations. However, as the size and number of shellfish farm operations in a bay increases over larger areas of the inter-tidal zone a greater amount of habitat loss and disturbance is inevitable and will therefore be detrimental to wildfowl. The extent of the disruption to habitat and wildfowl would depend on a number of factors including the nature of the shellfish farm and the size and shape of the bay.

The main purpose of these environmental Directives is to identify and predict any impacts of consequence, to interpret and communicate information about impacts, and to provide an input to the decision - making and planning process.

Some of these Directives aimed at the protection of the environment are as follows..

- Council Directive (85/337/EEC) on Environmental Impact Assessment
- Council Directive (EC/91/271) Covering Urban Waste Water Treatment
- Council Directive ((EC/79/923) Covering Water Quality Required for Shellfish Farming
- Council Directive (EC/79/409) on the Conservation of Wild Birds
- Council Directive (92/43/EEC) on the Conservation of Natural Habitats and Wild Fauna and Flora.

Summary

For the orderly development of shellfish farming within the European Community, a suitable regulatory framework is required. One of the major problems for shellfish farmers is establishing the right to operate a shellfish farm enterprise in a suitable area. Apart from national and local legislation and administration, the European Community is now imposing many Directives which will impact on the further development of these farms. In many cases the shellfish farmer states that the greatest disincentives to growth and development are the inadequate and inappropriate licensing regulations. With the added requirements of the regulatory framework imposed by the Single Market Directives, many farmers feel that the whole system may become cumbersome, expensive and overly politicised. This situation does not provide for a climate of security conducive to stimulating a peripheral natural resource enterprise such as shellfish farming. The Department of the Marine and Natural Resources is the regulatory body charged with the administration of these Directives. This Department however, does partly delegate this responsibility to other State agencies and various local authorities. In many cases, these authorities lack specific aquaculture scientific and environmental skills in decision making marine policy formulation, which may inhibit the development of these enterprises. Closer integration and consultation by the Department of the Marine and Natural Resources with these local authorities is needed in the task of implementing these regulations. For example, although considerable time and effort may be spent in acquiring a licence to operate a shellfish farm enterprise, planning permission may not be granted for the necessary onshore facilities needed to meet the relevant requirements.

Conversely, the lack of specific regulations governing the use of these coastal regions for shellfish farming or the interpretation and application of regulations promulgated for other purposes without any reference to shellfish farming e.g., the conservation of wild birds, may become a major impediment to the further development of shellfish farming in these regions. In order to facilitate the development of shellfish farm enterprises, the procedures for implementing these EU Directives may have to be streamlined and simplified. As yet the full impact of most of these Directives is still unclear. This uncertainty is most frustrating for the shellfish farmer and can also be very expensive and time consuming. Furthermore, the diverse nature of the shellfish farms will not help in the administration of these Directives. In order to harmonise the compliance with these Directives it may be appropriate to concentrate on the development of more concise and controllable shellfish farm zones. The development of a unified approach to ensure the administration of these regulations would also help in the speedy and effective implementation of the requirements. The risk to the survival and further development of these enterprises will be greatest during this transition period. The Directives dealing with farm management and operations are many and varied and will have an impact directly or indirectly on the profitability of the shellfish farm. Directives dealing with safeguarding the operation of the shellfish farm in order to prevent the introduction and spread of infectious diseases are of major concern of the farmers. The cost of up-grading the shellfish farm operation may prove prohibitive. The Directives dealing with the marketing and distribution of shellfish products are designed for the benefit of the consumer and are in essence welcomed by the shellfish farmer as they instil confidence in the shellfish product. The requirements of the conservation and environmental Directives will result in the establishment of shellfish farm projects which are not alone environmentally acceptable but will accord with social interest.

While it may be in the interests of the E.U and the Government to have constructive legislation to control the industry, they will also have to have the support and commitment of the shellfish industry. Most shellfish farm operations are high risk enterprises because of the number of hazards which are beyond the control of the shellfish farmer, such as changes in the quality of water, weather conditions, and epidemics of mortality due to communicable diseases.

It is therefore necessary, in order to implement this framework of legislation for the shellfish industry, that it be undertaken in consultation with and earn the support of the shellfish farmers. The purpose of the EU Directives is to create a unified approach to control the operation and monitoring of these shellfish farm enterprises. With the establishment of the Single European Market and the associated higher degrees of international interactions in the industry it is necessary that legislation is established both at national and international level. The Irish shellfish farmers should as far as possible ensure that the implementation of this legislation is appropriate to their needs since they and their customers should be the ultimate beneficiaries of the Directives imposed. It is important therefore, that better communication between the administrators of the Directives and the shellfish farmers themselves be created, particularly at the implementation stage in order that criteria can be established by which the shellfish industry can be developed satisfactorily.

DEFINING THE BUSINESS STATUS OF THE SHELLFISH FARMER

Introduction

Defining the business status of the shellfish farmer and shellfish farming in Ireland is difficult. This is because of the fact that in the literature there are so many terms and definitions for business owners and founders, business enterprises and self-employment. Also, these definitions are often used as synonymous with entrepreneurship and enterprise. **Curren and Burrows (1987)** for example, maintain that although both self-employed own-account workers and the self-employed with employees may be described as "small business owners" there is an immediate distinction made between them, which is reflected in their work situation as well as their personal characteristics. Also, there are three important dimensions along which the self-employed may be distinguished from employees. These are sociological, legal, and statistical. The sociological characteristics usually used to distinguish the self-employed are ownership of the means of production, autonomy at work and, for the employers, expropriation of the labour power of others. **(Bechhofer and Elliott: 1981; Goldthorpe et al: 1987, and Wright: 1985)**. Legal definitions of the self-employed centre on whether the business is incorporated or unincorporated and the statistical definition of the self-employed can be determined by taxation status. Further, **Stanworth and Curren (1976)** delineate the artisan, who seeks intrinsic satisfaction, from the manager, who seeks recognition for managerial excellence, from the classic entrepreneur, who is profit-orientated.

Carland et al.: (1984, 354-9) further focused upon the essential factors for any forms of business growth in distinguishing the small business venture from the entrepreneurial venture, and the "small business owner" from the "entrepreneur". These were identified as follows:

- A Small Business Venture is any business that is independently owned and operated, not dominated in its field, and does not engage in any new marketing or innovative practices
- An Entrepreneurial Venture is one that engages in at least one of Schumpeter's four categories of behaviour: that is, the principle goals of an entrepreneurial venture are profitability and growth and the business is characterized by innovative strategic practices
- A Small Business Owner is an individual who establishes and manages a business for the principle purpose of furthering personal gains. The business must be the primary source of income and will consume the majority of one's time and resources. The owner perceives the business as an extension of his or her personality, intricately bound with family needs and desires
- An Entrepreneur is an individual who establishes and manages a business for the principle purpose of growth and profit. The entrepreneur is characterized principally by innovative behaviour and will employ strategic management practices in the business

The nature of the entrepreneur and entrepreneurship itself is a continuing theme in the literature. **Liles (1981, 31-33)** uses the term "entrepreneurship" to define a wide range of activities such as initiating, founding, adapting and managing an enterprise. A comprehensive definition found is by **Hisrich and Peters, (1992, 56)** as:

> Entrepreneurship is the process of creating something different with value, by devoting the necessary time and effort, assuming the accompanying financial, psychological, and social risks, and receiving the resulting rewards of monetary and personal satisfaction.

However, in almost all of the theoretical definitions of the entrepreneur, there is a consensus that it involves behaviour that includes: 1) initiative taking, 2) the organizing and reorganizing of social/economic mechanisms to turn resources and situations to practical account and 3) the acceptance of risk or failure **(Hisrich and Peters: 1992)**.

In this study of the shellfish farm enterprises and the people who own and manage them, it will be necessary first to look at what theorists believe entrepreneurs and managers do, and to examine why it is that certain human actions performed by the individual farmer may be defined as being entrepreneurial. Also this study may require the use of broader and wider definitions of actions taken by the shellfish farmer. For example research undertaken by **Scott and Anderson (1994)** on the role of "rural entrepreneurs", shows how both the changing image of the countryside in the way it is becoming "commodified" presents both challenges and opportunities for a different type of entrepreneurial action. This process of commodification is important because the extraction of value often depends on the creation of a commodity which can be sold. They defined this action of the creation and extraction of value from the environment as "entreprenology".

THE ROLE OF THE SHELLFISH FARMER

Shellfish farming is a high risk business, not only because of its dependence on the survival of large numbers of living organisms in captivity, but also because of its reliance on the skills of the shellfish farmer in dealing with the many problems imposed by the marine environment. As the purpose of shellfish operations is to produce shellfish products at a profit, all the operational processes and management decisions should be directed to that objective. Should there be disruptions in production, through accidents, poor management decisions, or for any other reasons, then the future and profitability of the shellfish farm enterprise will be in jeopardy. While the welfare of marketable shellfish products is the most important activity of all shellfish farm enterprises and the focal point of the farmer, its profitability is also very much influenced by other activities on the farm. Shellfish farmers also have to recognize two additional processes, which will influence the profitability of the enterprise. These are 1) post-harvesting handling and marketing activities, and 2) the preparation of the shellfish product for the ultimate consumer. Therefore, in addition to their major responsibility for growing and producing marketable shellfish products on the farm, shellfish farmers have to develop a continuing vested interest in many environmental factors, which can be vulnerable to risks and therefore prevent the final objectives of the farmer being achieved.

Shellfish farming on a commercial basis is a relatively new venture in Ireland. While research into shellfish biology and development of shellfish farming techniques provided the tools for the farming of shellfish on a commercial basis under more or less controllable conditions, the industry has to date been preoccupied with science and technology, and little in the way of farm management skills or techniques have been developed. The industry is now becoming more stabilized and the production of the shellfish products has focused on a number of set practices. The future and sustainability of the industry will depend however, on increasing shellfish farm efficiency through the application of management skills and techniques. The term "management" can be used to convey different concepts to different people in different circumstances. In the farming of shellfish it is often considered as the overall technical operation of the farm and the supervision of day-to-day activities. Farm management expertise was considered to be the same as practical experience in the application of shellfish technologies on the farm. While research to develop shellfish farm technologies can be conducted in laboratories and experimental farms, farm management research can only be undertaken in the field by collecting and analysing information from individual farms, to discover or verify successful farm practices under specified circumstances. In the absence of such relevant data and appropriate research, the applicability of these principles practised on Irish shellfish farms has not been explicitly tested. The nature of shellfish farm research promoted to date does not include the type of applied research considered necessary for the developing farm management procedures. A reliance on the "green thumb" approach to shellfish farm management was considered adequate. So far it was not possible to carry out farm management analysis, as records and accounts of operations were not available. Reliable farm data was very scarce and this was a major handicap in the development of shellfish farm procedures and practices.

Research undertaken for this dissertation identified the business of managing a shellfish farm as:

1) organizing the farm, 2) planning and directing its operation from day to day, 3) planning and conducting the buying and selling and 4) arranging finance and credit. This planning and organizing of the farm operation is not a once only task, and at least some of it has to be done

on a continuing basis at the beginning of each rearing and harvesting season. Most of the shellfish farms surveyed were too small to afford a manager who could devote his time entirely to managing. Most were farms where the owner was also the manager, and along with his family members and hired labour, undertook all the work involved. Larger farms were likely to present more varied management problems than owner farms, but most tasks of management were the same for both enterprises.

However, shellfish farm management, which is a relatively new discipline, should be based on the concept of the farm as a business and consist of the application of scientific laws and principles as well as involving a continuous process of economics to the conduct of the shellfish farm activities. Originating in the production of agricultural economics **Yang (1965, 27)** defined this type of management as follows:

> A science which deals with the proper combination and operation of production factors, including land, labour and capital, and the choice of crop and livestock enterprises to bring a maximum and continuous return to the most elementary units of farming.

Proper and timely maintenance of the shellfish farm and its installations, successful methods of stock manipulation, seed production, stocking, disease and pest control, maintenance of water quality, protection of the stock, harvesting and marketing should all be elements of this concept of proper farm management. Whether or not these shellfish farmers, mostly operating on a part - time basis, on small farms located in peripheral coastal regions, can be identified as acting in an entrepreneurial way, has now to be considered.

Is the Shellfish Farmer an Entrepreneur?

One of the most perplexing aspects of any study of entrepreneurship is to define who and what is an entrepreneur, a concept that is frequently shrouded in semantic confusion. Most studies of the entrepreneur make an attempt at a definition relying upon a stereotype which, if one should conform to it loosely, could be classified as an entrepreneur. This reliance upon the stereotype of the entrepreneur as a business adventurer who knows "how to make a fast buck", has impeded the economic analysis of the phenomenon **(Casson: 1982,6; de Toit 1980, 54)** identifies the entrepreneur as: "A man who starts his own business because he is a difficult employee." According to **Barrow (1986)** the entrepreneur must have innovative skills, be result-orientated, a professional risk taker, and be totally committed to his task and goal. Economic circumstances as much as personal characteristics are viewed as being just as important in stimulating entrepreneurial activities as is the world of uncertainty which provided an opportunity for the entrepreneur **(Binks and Coyne: 1983)**. While this stereotyping has some utility in that it yields hypotheses regarding the family background, education, personality characteristics and the business of the entrepreneur, all attempts at producing a single acceptable definition of what constitutes "entrepreneurship" can be argued as inadequate. For example, **Gartner (1990, 101)** concludes:

> A definition of entrepreneurship has yet to emerge . . .if no definition can be agreed upon by most researchers and practitioners, then it is important to say what we mean. If many different meanings for entrepreneurship exist, then it behoves us to make sure that others know what we are talking about. The various themes of entrepreneurship. . . seem to reflect different parts of the same phenomenon.

Likewise, a case has been made by **Van der Werf and Bush (1989)**, that it is not even necessary to agree to a single definition. The entrepreneur can also show many faces. **Vesper (1980, 93)** states that:

> To an economist, an entrepreneur is one who brings resources, labour, materials, and other assets into combinations that make their value greater than before, and also who introduces changes, innovations and new order. To the psychologist, such a person is typically driven by certain forces - a need to obtain or attain something, to experiment, to accomplish, or perhaps escape the authority of others. To the businessman, an entrepreneur appears as a threat, an aggressive competitor, whereas to another businessman the same entrepreneur may be an alliance, a source of supply, a customer, or someone good to invest in. The same person is seen by the capitalist philosopher as one who creates wealth from others as well, who finds better ways to utilise resources, to reduce waste, and who produces jobs others are glad to get.

In this survey of the shellfish farms it was found that over 60 per cent claimed to be owner managed and the remainder were owned and managed by a fisheries co-operative. Of the number engaged in shellfish farming on a full-time basis, most had obtained a third level qualification in a scientific discipline and were aged in their middle to late thirties. In contrast, part-time farmers tended to come from a wide array of occupations and professions such as agricultural farming, pub owner, food factory worker, telephone technician etc. Regardless of the background and qualifications of these shellfish farmers, in the commencement of the business all had to follow a set procedure. Initially this started with the gathering of information from the various State agencies and Government departments regarding the establishment of the enterprise. This information was necessary for issues such as selection of an area, practical training required, initial trials, grant availability, and information on potential markets. The second stage involved the selection of the site for the farm and the acquiring of all the necessary operational licences. Approval of grant aid had to be determined as well as establishing a possible outlet for the shellfish products. This action initially led to the creation of a shellfish farm pilot scheme. If this scheme proved successful, the creation of a commercial production farm was developed. The final activity was the creation of a profit-making enterprise. This process could take a number of years and presented the potential shellfish farmer with a wide number of tasks to complete. Unfortunately, there is as yet no one underlying theory of the entrepreneurial behaviour of the shellfish farmer in undertaking these activities, even at a national level and thus no one body of economic theory that represents itself as being uniquely relevant to this type of activity. For example, is the function of the shellfish farmer primarily organizational in nature? Is uncertainty-bearing an essential activity of the shellfish farmer? Does the behaviour imply the introduction of innovations and technical improvements or is he involved in the process of simply profiting from imitating known farming techniques and proven product development? Central to **O'Farrell's (1986)** functional definition of the entrepreneur is the notion that he takes decisions under uncertainty about the co-ordination of scarce resources. This co-ordination of resources for shellfish farming may be seen as a dynamic concept - as opposed to the allocation of resources which can be static - and captures the reality of the shellfish farmer as an agent of change. The shellfish farmer may not be concerned with the perpetuation of the existing allocation of resources, such as the right to farm in an area of the sea, but with improving upon this resource. In this sense shellfish farming could be defined as an activity combining factors of production to introduce change in the cultivation of shellfish products, rather than in the organization of factors of production simply to cultivate them. Perhaps this differentiates entrepreneurship from management: the former involves initiating changes in the production of these shellfish commodity products under uncertainty, whereas the latter refers to combining resources to add to the on-going organization of the production process. **Wilken (1979, 60)** sees this type of process as an entrepreneurial act rather than management. Shellfish farming can be a discontinuous phenomenon, changing the manner in which factors are combined. For example, two basic types of change may be initiated in the production of shellfish products --- quantitative and qualitative. The former implies changes in the quantity of shellfish cultivated while the latter refers to innovation - the introduction of new processes or cultivation of the same shellfish products in the manner in which they have been produced before. **Wilkin (1979)** denotes such quantitive changes in the amount of goods produced as expansive entrepreneurship, while, conversely, innovation refers to qualitative changes. In shellfish farming this expansion may occur in one of two ways. A farmer who has not cultivated shellfish products before may start a farm and initiate cultivation techniques replicating existing shellfish products and techniques and selling into established markets; or a farmer who has already done so may increase the volume of shellfish products he is cultivating in the same manner in which they have been produced before. Many others including **Wilkin (1979)** regard both expansion activities and those who commence enterprise initiatives, as being within the concept of entrepreneurship.

Schumpeter (1934, 78) however, was more restrictive, arguing that an individual was "an entrepreneur only when he 'carries out new combinations' and loses that character as soon as he built up his business." However, it has now become commonplace for the owner-manager of any business to be classified as an entrepreneur. This association has become so entrenched in the literature and culture that it hinders rational analysis of the phenomenon that creates an alternative entrepreneur. Some authors have even wondered whether scholars should not discard the term entrepreneur on the grounds that so many different meanings have been assigned to it **(Livesay: 1982, 11)**. Suffice it to state unequivocally that the shellfish farmer who operates a small shellfish enterprise may seldom behave in an innovative way and "carry out new combinations", in the Schumpeterian sense. Moreover, since innovation varies on a continuum without clear-cut partitions, the classification of a shellfish farm as entrepreneurial or not will be partly subjective. If academics and policy makers persist in conceptualizing both expansion in the production of existing goods and all owner-manager activity of small firms as entrepreneurial, then they should be explicitly recognized as qualitatively distinct and lower level forms of entrepreneurial rather than innovating behaviour. The whole process of the creation, development and the management of these shellfish farm enterprises will have to be understood so as to obtain a consensus as to the entrepreneurial status of this type of "commodity from the environment" venture. For example, if the definition of the self-employed entrepreneur or small enterprise owner as used in the key sociological literature is applied to the shellfish farmer, he would widely be assumed to occupy a sufficiently distinctive class position to be allocated a separate class location distinct from either employees, the professional self-employed or large business owners. Thus **Goldthorpe et al. (1987)** assign small properties, self-employed artisans and "own account workers" apart from professionals, to class IV of their schema and stress their vulnerability to market fluctuations. Should such an alternative interpretation of entrepreneurship be defined for the shellfish farmer, it is necessary to examine the various entrepreneurial type activities undertaken in the different peripheral coastal shellfish farming zones.

Shellfish Farming - An Entrepreneurial or a Managerial Act?

In recent years the development of shellfish farming in coastal peripheral regions has expanded rapidly. This "commodification" of these regions presented both challenges and opportunities for some kind of entrepreneurial action. **Scott and Anderson (1994)** highlighted the fact that entrepreneurship arises out of the interaction of individuals and their environment. However, most of the literature on entrepreneurship tends to address the former rather than the latter and concentrates on the entrepreneur rather than on entrepreneurship. The entrepreneur is defined mostly as one who establishes a new venture while entrepreneurship is far more widely practised - in old businesses as well as new ones, and in big businesses as well as small ones. **Siropolis (1980, 37)** defines entrepreneurship as "the capacity for innovation, investment, and expansion in new markets, products, and techniques". Undertaking an examination of the relationship between the shellfish farmer and the environment in which he operates may lead to an understanding of the likely entrepreneurial process involved in these type of operations. It is necessary to understand the process by which these shellfish farms developed in these peripheral regions and to discover were there any considerable entrepreneurial consequences of these developments.

Stevenson and Williams (1986, 1-26) define the difference between the managerial venture and the entrepreneurial venture in the case of five key business dimensions - strategic orientation, commitment to opportunity, commitment of resources, control of resources, and management structure. The first job of the manager is to make the venture perform well. The manager takes given resources - people and money, machines and materials - and orchestrates them into production. In contrast, the first job of the entrepreneur is to bring about change on purpose.

Whether the shellfish farmer is engaged in managerial type activity or managing a resource could be tested against these criteria. It is important however, to outline the work duties and responsibilities of the shellfish farm operation. The following represents a typical work schedule for a four man shellfish farm producing 200 tonne of product per annum with varying one year and two year production cycles. It was difficult to quantify the time needed in the early development stage leading up to this fairly full-time operation, as the finance and manpower required for other types of operations varied greatly.

Month	Activity
April	Gear construction/maintenance Setting out moorings/checking Setting out spat collectors on temporary rig or raft
May	Checking collectors Fouling control (if necessary)
June / July	Predator and fouling control
August / September	Stripping spat collectors Filling tubes and attaching tubes to ropes
October	Little activity
November	Commence harvesting existing crop Grading of crop
December / March	As above
April	Gear and boat maintenance
May / July	Miscellaneous jobs, e.g. checking/fouling control as necessary
August	Sale of seed. Scaling of encrustrations on mussel shells (tubing) for following year's crop
September / October	As above
November / Mid January	Harvest rigs with larger mussels

Mid January / March Continue the harvest from settlement / thinning etc.

The majority of this work can be carried out on a part-time basis. The biggest element of full-time work on the farm is during the harvesting season. Apart from these activities, the farmer will also be engaged in the selling and distribution of the shellfish product. Time is also needed to attend training programmes and meet with agencies and Government officials.

In order to understand what kind and level of shellfish farm development activity was being conducted on a regional basis, an analysis of the grant aid application forms received from shellfish farm promoters over a two year period, 1993-95, was conducted. The following examples are from a selection of the grant aid proposals as received from shellfish farm promoters in the different peripheral coastal regions.

Donegal Regional Coastal Zone

Only about 5 per cent of applications for grant aid were received from this region. The aid sought was mostly for the development of bottom culture mussels and native oysters. There is little processing or depuration activity in this region and most operations are quite small.

Examples of applications from this zone:

An application for grant aid was received from a group about to form a co-operative. This group comprised thirty-five mostly active sea fishermen. The aim of this co-operative was to allocate a plot of water to each individual member who then would have the responsibility for the bottom mussel-seeding programme for that plot. When the mussels were ready for harvesting they came into the ownership of the individual member. The dredging of the mussels and the marketing of the produce would be undertaken by the co-operative. However, members had the right to sell their produce on the open market if so desired and in that case for every tonne of mussel harvested and sold directly, a levy would be paid to the co-operative. The co-operative was seeking grant aid to finance the dredging operations.

A second type of enterprise in this region involved a local coastal community group working closely with a regional Employment Enterprise Board. The enterprise organization provided training for this community group and they identified oyster farming as a possible commercial project. A shellfish farm consultant was engaged by the Enterprise Board as team leader for this project. The intention was that once the farm cultivated this shellfish, it would be sold to a co-operative or shellfish broker. Grant aid was sought to finance the initial seeding operation.

A third type of enterprise concerned an individual dairy farmer and land-owner who had access to a shellfish growing site and intended to operate this shellfish farm on a part-time individual basis. The intention was to have a small type operation and sell the produce locally. The application in this case was to purchase shellfish farm equipment.

The projected turnover in most of the applications for grant aid was rather limited and therefore grant applications rarely exceeded £20,000. Regardless of the structure of the organization most applications for aid were approved. The employment projections for the projects were also very limited even though the promoter always projected the most optimistic outlook.

Sligo, Mayo, Galway and Clare Regional Coastal Zone

This region accounted for almost 40 per cent of the grant aid applications and was the second most active region for shellfish development. While there was great variety in the extent and nature of applications, few enterprises had the potential to employ more than six people on a part-time or full-time basis. The grant application was also below £20,000. In this region there are a number of shellfish processing and marketing operations and a substantial amount of the shellfish produced on the farms is sold on to a third party who takes on the responsibility for finding a market for the product.

Examples of applications from this zone:

An inactive oyster fisheries society had access to a large expanse of a natural oyster bed in the area. This area is leased by the society but very little exploitation of this natural resource was undertaken. A newly established society was formed comprising mostly local businessmen. They had little or no experience of shellfish farming. They engaged the services of a marine consultant to advise on the best commercial plan to utilize this resource. The recommendations were that investment be made into the growing and harvesting of oysters and to introduce technology for this purpose. Labour engaged on this project would be on a part-time contractual basis and the shellfish produced would be sold to a shellfish broker. This operation would entail additional expense for the society. An application was made for grant aid in supplying equipment required for this operation.

An unemployed electrician started to grow oyster from seed in a small bay in County Mayo. He harvested this shellfish for the local market. However, his production rate had increased to such an extent that his target market outlets dried up. His only way to survive in the shellfish business was to seek grant aid to develop export markets for his produce.

A marine biologist with a Ph.D. degree in Zoology commenced operations by developing a small oyster seed nursery and hatchery. This evolved into an operation producing a substantial amount of fully-grown oysters from the hatchery. The application for grant aid was to fund the transition from turning this scientific operation into a possible commercial shellfish production concern.

Kerry and Cork Regional Coastal Zone

This region had the highest demand for grant aid and accounted for 50 per cent of the applications. The vast majority of applications were received from very small type operators. The main activity in the area was rope mussel cultivation and the bulk of the applications were for the purchase of long-lines and working platforms and barges. The area is well served for the further processing of mussels and there are also a number of depuration and grading operations in the region. There is also a very brisk trade in exports as international hauliers are constantly in this region transporting fresh fish from the ports and factories to be delivered to the continent. The presence of these operators allows for the opportunity for sales contacts and possibilities.

Examples of applications from this zone:

An application came from a public house owner in the region who also had access to the foreshore. He acted as a sales agent for local mussel growers and had built up a number of sales contacts. He realized the potential to supply some of these orders from a farm of his own and saw the opportunity for this development. The grant aid application was for rope culture mussel development equipment.

A local dairy hand and part-time farmer also had access to the shoreline. He did not have any technical or business skills to commence this operation. His grant application was to finance a training programme in shellfish cultivation and develop these skills in a part-time shellfish farm activity.

A small shellfish farm limited company wished to expand their operations and sought grant aid approval for the purchase of a custom built work boat/platform in order to create added value to their operations. Aid was also sought for a conveyer and hopper which would have the capacity to harvest, grade and land up to 15 tonne of bagged mussels per day. This investment was sought to increase productivity and safety standards which were seen as vital to the sustained operation of this mussel farm.

Waterford Regional Coastal Zone

It is only in recent years that any development of gigas oysters has taken place in this region. The rate of applications from this region was 10 per cent and there is a belief that the level of grant aid requests will expand to a greater degree in the coming years.

The financial standing and business experience of the grant applicants in this region was also much higher than in the other regions. There was also a greater level of co-operation and involvement in the industry within this region, and of all the regions this one demonstrated a much more optimistic attitude to the future development of the industry. The applicants from this region were much more professional in their submissions and their plans for the industry in the region. There was also the tendency to form limited companies rather than the more traditional methods of working alone or developing co-operatives. This may be due to the fact that potential shellfish farmers in this region are rather late in developing the farms and perhaps had the opportunity to learn from other farmers' mistakes.

Examples of applications from this zone:

A group of local businessmen applied for a grant to conduct a research programme on the commercial possibilities of oyster cultivation in the region. This involved conducting trials on the suitability of water temperature, salinity, freedom from pollution and excessive silting of the farm. Growth rates of the oysters were evaluated as were mortalities, option stocking densities, natural predators and fouling organisms. The growth rates proved excellent and the mortality rates were very low. Further aid was sought to commence the commercial operation of this site.

Also in the region a number of sea fishermen formed a co-operative and each contributed financially to the initial development of the enterprise. This was a bottom mussel farm. The harvest was sold directly to the co-operative which in turn found a buyer for the product. The only real involvement of these co-operative members was to make a financial contribution to the enterprise and they did not concern themselves with the day-to-day running of the enterprise. The success of such an undertaking was therefore dependent to a great extent on the skills and commitment of the co-operative executives. Grant aid was sought to establish the administrative operation of the co-operative.

An alternative operation in this region was the undertaking of an individual shellfish farmer who purchased a large quantity of oyster seed and grew this to its mature stage. The promoter of this project then made joint arrangements with a French buying agent where the agent would supply the oyster seed and the promoter would grow it to the mature stage and then sell it back to the agent. The promoter applied for grant aid to purchase a refrigerated van to transport the oyster seed and the mature oysters.

Dublin Regional Coastal Zone

By comparison with other regions, the grant application from this region was very small and amounted to less than 5 per cent of all the applicants. In this region the area for development and available resources are very limited and therefore attract only a small number of promoters. In spite of this situation the most costly of all the grant aid applications came from this region.

A limited company operating in Carlingford first sought assistance for the development of a shellfish hatchery. The company was experiencing difficulties in sourcing supplies of quality oyster seed and the proposed hatchery was aimed at reducing the dependency on overseas suppliers. The company sought aid to build a nursery operation for the purpose of ongrowing seed to make it ready for eventual transfer to the shore. It was also proposed that the seed grown in this operation would be sold to other shellfish farmers as well as possible exports. Grant aid of £0.5 million was sought.

In Mornington Bay a tradition of bottom culture mussel farming has been carried out for over thirty years. New EU Health and Hygiene Regulations were introduced which meant that the shellfish farmers in this region had no option but to send all their production on to a processing facility before it could be sold on the market. Grant aid was sought by this group to provide funds for the establishment of a water treatment plant in the area so as to counteract the contamination of the seashore where the mussels were being farmed.

A small business exporting periwinkles was established in this region for over twenty years in Carlingford Bay. When the owner died, his only son, who was a motor mechanic by trade, returned to Ireland to carry on the business. As the product was fairly unique it had established a market niche in France, Holland and in Belgium. As a result of this established marketing link into the export markets the promoter sought to expand his product range and develop a mussel farming facility. Because the promoter had basic inshore facilities, he also wished to develop processing facilities such as depuration and grading facilities.

The above examples of regional development in shellfish farming demonstrate the wide and diverse methods of creating shellfish farm operations. According to **Hisrich and Peters (1992)** identifying and evaluating a good opportunity is a most difficult task for the potential entrepreneur. Most good business opportunities do not suddenly appear but rather are the result of an entrepreneur being alert to possibilities or, in some cases, by establishing mechanisms to identify potential opportunities. In most of the grant aid driven examples of shellfish farm enterprise development there was a move from a passive interest in the project to an active one. **Birley (1989, 8-31)** suggests that the current economic climate is also an important factor in influencing the number of people who finally decide to move from either unemployment or employment to self-employment.

Also **Hisrich and Peters' (1992, 34-35)** study on entrepreneurial and managerial decision making styles, views strategic orientation, commitment to opportunity, commitment of resources, control of resources and management structure as essential. They maintain that the entrepreneur's strategic orientation depends on his or her perception of the opportunity. This orientation is important when other opportunities have diminishing returns. When the use of planning systems and measuring performance to control current resources is the strategic orientation, then the managerial decision domain will exist. In terms of commitment to opportunity, the entrepreneurial decision making will be characterized by a need for action, short decision windows and a willingness to assume risk. The managerial decision making domain is slow to react to opportunity but once taken it is for a long time span.

The entrepreneur is accustomed to having resources committed at periodic intervals, often based on certain tasks or objectives to be reached. These resources, often acquired from others, are usually difficult to obtain. The commitment of these resources for the managerial venture is usually for the total needed for the venture and managers receive personal rewards by **effectively** managing the resources under their control. The control of resources follows a similar pattern. The pressure of power, status, and financial rewards cause the manager to avoid other periodic use of the resource. The opposite is true for the entrepreneur who, under pressure of limited resources and the risks involved, strives to achieve periodic use of the resources on an "as-needed" basis.

The final key business dimension, management structure, also diverges significantly between the two domains. In the managerial domain, the organizational structure is formalized and hierarchical in nature because of the need for clearly defined lines of authority and responsibility based on management theory and the reward system. The entrepreneur, true to his or her desire for independence, employs a flat organizational structure with informal networks throughout.

Defining where the shellfish farmer fits into these entrepreneurial and decision-making domains, with the exception of the managerial structure, remains unclear. There are too many contrasting and diverse approaches taken in the establishment of shellfish farm activities throughout the coast. Research by **Scott and Anderson (1992)** in rural Scotland, attempted to make sense of the diverse experiences of entrepreneurs in this region. They searched for a common theme to explain this diversity and concluded that entrepreneurship is a socially defined phenomenon whose key characteristic is the extraction of value from an environment. The basis of their study was the environment for rural entrepreneurship and the commodification of the countryside. They defined this type of enterprise as "entreprenology". As the basis of their research concentrated on enterprises situated in peripheral rural areas and the extraction of value from the environment was the objective of the enterprise, perhaps there may be some similarities between shellfish farming in peripheral coastal regions of Ireland and their definition of entreprenology.

Shellfish Farm Entrepreneurship and Management - the Peripheral Region Dimension

In the literature there appears to be considerable variation in the understanding of the capacity of different regions to generate entrepreneurial behaviour. **Swales (1979, 236)** argues that regional differences in entrepreneurship might be a correct partial or complete explanation of difference in economic performance. If the rate of new firm formation is used as being indicative of entrepreneurial expression, then the evidence suggests that there are substantial spatial differences in formation rates in the UK **(Lloyd and Mason: 1984: Keeble and Wever: 1986, and Whittington: 1986)**. Research has also demonstrated that the formation rates are higher in rural than in urban environment **(Gudgin and Fothergill: 1984: O'Farrell and Crouchley: 1984)**. There is as yet, no complete explanation as to why less successful regions cannot allocate resources as efficiently as successful ones. Research into the performance of rural entrepreneurs in England **(PA Cambridge Consultants: 1992)** found that most rural entrepreneurs were migrants into the region and were significantly more influenced in their migration decision by the attractive residential environment of rural areas. A corollary of this is that in regions where indigenous entrepreneurship is deficient, entrepreneurs from more successful regions may enter and improve the allocation of resources. Moreover, economic factors are necessary but not sufficient conditions for the expression of entrepreneurship; social, institutional and cultural influences may either stimulate or constrain entrepreneurial behaviour. **Scott and Anderson (1992)** maintain that entrepreneurship arises out of the interaction of individuals and their environment, but most research tends to address the former rather than the latter.

These peripheral coastal regions where shellfish farming is carried out, are much more than a geographic location: they are in fact a social construction with many implications for entrepreneurial type action, both in terms of barriers and opportunities. The barriers arise from the traditional concept of ownership of the shore and the traditional values that this represented to the community. Conversely, opportunities have opened up, providing new ways both to add value to, and extract value from the marine environment. This can be achieved by new shellfish farming techniques and methods, new product requirements, new markets and product diversification.

However, **Schell (1983, 497)** argues that the socio-economic climate "is the major moderating variable affecting the level of entrepreneurial activity in the community". He highlights two factors of particular importance. First, does the "power elite" in the community have entrepreneurial characteristics? **Schell** suggests that in regions in which the community leaders have a high entrepreneurial orientation and in communities where entrepreneurs are members of the power elite, there will be high levels of entrepreneurial activity. In such communities the attitude of the community leadership will be reflected in actions which favour entrepreneurship. Second, is the nature of the community decision making process dominated by the elite or characterised by a pluralistic approach? These notions have yet to be tested as regards the establishment of shellfish farm operations in these regions. While there is some evidence that local community groups did take the initiative in founding shellfish farm operations in some regions, there is no empirical research available to substantiate this fact.

An interpretation of the effects of local communities and local culture on entrepreneurial activity is provided by **Illeris (1986)** who drew upon work by Danish ethnologists. He suggests that at least three contrasting "life modes" can be identified: "self-employment", "career" and "wage-earner". These life modes which are culturally and socially determined, influence the propensity of individuals within a local community to create a new business. In the "self-employment" life mode the dominant job-related motivation is to own the means of production and control the production process. For the individual concerned, what they produce is less important than the fact of self-employment, thus they may move from one sector to another, perhaps interspersed with periods of paid employment. However, they rarely wish the enterprise to grow so large that they lose control over it. This local cultural tradition is carried over from one generation to the next.

Keeble and Weever (1986) found that the areas where the self-employment mode is dominant are characterized by a large number of small enterprises. This type of mode was frequently found in rural areas characterized by independent and self-reliant small-scale farmers or under the "metayage" or share-cropping farming systems common in Mediterranean countries. In such areas the family took all the fundamental business decisions regarding the management of the farm. Also, opportunities provided by the agricultural systems for part-time farming by individuals or the diversification of household income through the gender division of labour served to minimize the risk of new firm formation by providing a financial safety net **(Brusco: 1986)**. Again, there are cases in shellfish farming where these type of decisions are made in the reasoning for developing the farm. An analysis of the social construction of the shellfish farm regions can be used as a tool to reach a fuller understanding of peripheral region entrepreneurship. The prevailing impression of the peripheral coastal region's environment as one of distance, remoteness, sparse population and lacking in supportive economic activity imposing a wide range of entrepreneurial constraints on shellfish enterprise development, has yet to be tested.

SUMMARY

There is a great deal of mythology surrounding the concept of the entrepreneur and entrepreneurship with many studies relying upon a stereotype which hinders a rational analysis for defining the shellfish farmer and shellfish farming. For example, one group stresses uncertainty as the chief burden of the entrepreneur; another group of theories emphasizes the key role of innovation; a third category of theories treats entrepreneurship as a combination of uncertainty-bearing and either innovation or "special ability"; and a fourth group stresses the perception of and adjustment to disequilibrium, with uncertainty and innovation receiving minor attention or none at all **(O'Farrell: 1986a, 21-22)**. **Schumpeter (1934)** also maintains that entrepreneurship is an activity which involves combining factors of production of goods under uncertainty. This distinguishes it from management which is concerned with the ongoing organization of the product process. He emphasized the key connection between the entrepreneur and innovation, and he distinguished between entrepreneurial and management functions arguing that the entrepreneurial function only shows up within the innovation process. It is also unclear whether a shellfish farmer, who may carry out an "entrepreneurial act", can be described as an entrepreneur. In this study of the entrepreneurial status of the shellfish farmer, it was difficult linking most of these theories with the activities and motives of the farmer. For example, because the shellfish farmer comes from such a diverse and disparate background it is difficult to establish a common trend in the social influences affecting the life cycle of the shellfish farmer or traits which distinguish the farmer from members of other groups. In searching for a common theme to explain this diversity it has to be concluded that the shellfish farmer is a socially defined phenomenon whose key characteristic is extracting value from the environment. There are several different approaches by which this activity is conducted and this activity is not limited to purely financial advantage. This extraction of value from the environment by the development of shellfish farm enterprises may well involve some sort of entrepreneurial activity, but it is also embedded in the social sphere and its direction may well be influenced or determined by these social constraints or opportunities. Also, shellfish farming is not limited in all cases to the individual shellfish farmer, although it appears that even in community and co-operative run shellfish farms, the initiator will be an individual. There are as yet no clear directions as to what causes these shellfish farmers to initiate, promote, modify or exploit their position, or indeed if any of these apply at all. Any attempt to conceptionalise the entrepreneurship of these shellfish farmers may require a model which encapsulates, in general terms, appropriate variables and take into account the variability in behaviour due to the differences in the character of the shellfish farmer and the influence of the social structure of the peripheral coastal regions. The concept of the entrepreneur who does not engage in risk taking or innovation being recognised as a qualitatively lower form of entrepreneurship, could perhaps be examined in the context of to what extent the shellfish farmer is engaged in these activities.

THE SHELLFISH FARM ENTERPRISE RISK

Introduction

Empirical research carried out by **Colton and Udell (1976)** on the issue of risk taking and the entrepreneur suggests that it is the individual's risk taking propensity which distinguishes them from the general population. **Cantillon (1775)** first outlined the importance of the entrepreneur as a bearer of risk. **Knight (1971, 38)** indicates that entrepreneurs were, "takers of non-quantifiable uncertainties" and noted that, with the division of ownership and management, an entrepreneur may not be exposed to financial risk but rather to social and psychological risk. **Liles (1974)** confirms this view. He argues that risk covers a number of areas - the critical ones being financial risk, career risk, family and social risk, and psychological risk. More recently, research focusing on general risk-taking propensity, such as carried out by **Martin (1982, 16)** declares that:

> A person who assumes the risk of his or her capital is not necessarily an entrepreneur but only an investor. However, one who risks his or her reputation or a position in a large corporate organisation, as a result of innovation with which he or she is closely identified, fulfils some of the preconditions of entrepreneurship.

Numerous textbooks refer to entrepreneurs as "moderate risk-takers". For example, **Ray (1993)** argues that the phase may be largely the creation of academic invention, unrelated to how entrepreneurs actually think about risk or cope with risk in their decisions. Risk in entrepreneurship is better understood as a contextual and strategy variable, not a personality variable.

Researchers are, however, divided as to the risk-taking propensity of entrepreneurs. The findings appear to vary according to the entrepreneur's background, stage of business development, and the type of business owned. **Brockhaus (1987, 1-6)** found no statistical difference between a group of entrepreneurs and a group of managers on a number of personality characteristics and **Kirzner (1981)** further added that as well as the element of risk for the entrepreneur, uncertainty was an essential feature of the entrepreneurial activity and conversely, as a key condition of entrepreneurial behaviour, exists solely with respect to the future of the enterprise.

The shellfish farmer, in common with other food-producing operators, is required to perform a variety of roles, which involve some element of risk. These include policy formation, planning, implementing decisions, control, and communication. The economic strength and survival of the shellfish farm is dependent on and subordinate to the principle tasks of cultivating, growing and marketing quality shellfish products at a profit and with the minimum of risk. It is important therefore, to know and understand the likelihood of the many risks occurring in the development of these enterprises. It is the responsibility of the shellfish farmer to respond to the threats these risks impose and to select appropriate techniques so as to avoid or minimize these risks. Because of the very nature of shellfish farming there are potentially vast arrays of risks which can threaten the success of the shellfish farm. **Johnston and Bryden (1994, 37)** maintain that from individuals up to the largest enterprise it will not be possible to provide a complete counter to every risk nor will it be practical to completely counter any individual threat. In this study of shellfish farming it will be necessary to calculate the threat probability presented by each risk to the shellfish farmer and to understand to what extent the farmer manages these risks.

THE REALITY OF RISKS IN SHELLFISH FARMING

According to **Secretan and Nash (1989)**, any process, by definition, involves a change or a series of changes over time. This process may be either man-made or naturally occurring, and the degree of change from the beginning to the end of the process is dependent on many and varied factors. In the case of man made processes, such as those characteristics of manufacturing industries, the end is almost certainly predictable, but in the case of naturally occurring processes such as shellfish farming, there are many factors which make the end unpredictable.

Most natural physical and chemical processes take place slowly over extremely long periods and therefore have the appearance of stability and predictability; conversely, biological processes, which by definition deal with live creatures, occur over short periods of time and are highly susceptible to change or misdirection. It is not possible, with a high degree of statistical certainty, to expect that the simplest biological process will achieve its predicted end in its appropriate time. There are many risks or hazards and some of these are totally beyond the control of the process. It is estimated, for example, that in shellfish farming only one egg out of ten thousand survives to become a breeding adult **(Clarke: 1996, 26-27)**. The risks to any one biological process are therefore so numerous and varied that it is almost impossible to catalogue them, or to describe their magnitude, or to predict their frequency of occurrence.

Shellfish farming is an industry built on biological processes and it is entirely dependent on the welfare of aquatic animals, which have to be produced and sold to generate profit.

Consequently, by deduction, it is an industry which must be classified among the group of high-risk food producing industries. According to **Gordon (1992, 25)**, the business entrepreneur is the person responsible for the organisation of the other factors of production and therefore becomes the bearer of risks. This still applies to many small enterprises where ownership is concentrated on one or two persons, as is the case in most Irish shellfish farm enterprises. Yet the growth and expansion of shellfish farming in Ireland over the past twenty years would indicate that even though it can be deemed a risk industry, it is one that is not necessarily avoided by investors and promoters.

Because many biologically dependent activities occur between a farmer and his profits, shellfish farming may be deemed an industry with many risks. It is therefore important that the shellfish farmer is highly circumspect in his identification and management of the most likely risks to each process, and the commercial consequences. A grasp of the economic dimensions of the potential risks which threaten each process is critical. **Gordon (1992)** further stresses that the economic environment is of importance as the constraint of limited resources affects the risk environment of the enterprise. So an understanding of the fundamentals governing decisions about the allocation of scarce resources is therefore essential if the risk taker is to see his function in the wider context of the economic survival of the enterprise. As the business of shellfish farming in Ireland is part of the social and economic well-being of the community in these peripheral regions and of general national interest, it cannot be isolated from events on these levels. An overview and broad understanding of the issues involved and, consequently, the implications of decisions taken by others, such as the Department of the Marine and Fisheries or the EU Commission, will assist in the application of the constraints placed on the shellfish enterprise by these external factors and the risks which such constraints may pose to the enterprise.

In shellfish farming there are many legal requirements and rules which are devised to form a framework within which these enterprises are regulated. Because these rules reflect the conduct and operation of these enterprises they are subject to amendment, change and extension of their scope. The industry in Ireland is increasingly influenced by EU legislation and the shellfish farmer cannot ignore the effect of this legislation on the conduct of his enterprise.

The socio-political environment in which the shellfish farming industry operates will also pose risks to the shellfish farmer. For example, the shellfish farmer cannot afford to wait for society to respond to changes in patterns of behaviour because such changes may threaten the enterprise in its present format. A keen interest and appreciation of the forces which shape a community will place the shellfish farmer in an advantageous position when seeking to identify and respond quickly to risk. An awareness of the political climate will also enable the shellfish farmer to identify and respond to threats to his enterprise in a more timely way and therefore more effectively.

The skill of the farmer in placing a value on each risk influences its priority and therefore the attention paid to its control. This is invariably the determining factor in the success or failure of any farming venture. The "common sense" school of management recognizes that for every process there is a group of potential risks, which can be identified individually, and given priority. In many cases they can be avoided by careful attention, for example, fire is well known to be a major cause of death and injury, and the chances of escaping and saving property are greatly enhanced if early warning of fire is given. It is therefore sensible to have smoke detectors in the shellfish farm building.

There is another group of risks which also can be identified but which can be excluded from consideration, either because their incidence is beyond any reasonable human effort (or expense) to control, or because the chances of their occurrence are too statistically insignificant to consider. For example, it is not worth a shellfish farmer analysing every individual seed in a bag of shellfish seed before use on the theory that it may be contaminated. The chances are so small that the risks are outweighed by the cost of testing and the loss of seed tested. Therefore, to lesson the risk more cheaply the farmer makes certain that the seed is purchased from a reliable grower or hatchery. Equally, the statistical chance that the shellfish farm will be destroyed by fire is so insignificant that the risk can be discarded.

It is relatively easy, at both the personal and the commercial levels, to identify those risks which can either be beyond human control (and expense), or statistically insignificant. However, there remains a large grey area of potential risks. Some of them can be identified with care, and an attempt made to evaluate them. The shellfish farmer can then attempt to manage them for the benefit of himself and the enterprise. The process of managing risk on the shellfish farm is based on the individual analysis of three fundamental activities, which are taken in sequence, and subsequent synthesis of the results into a programme of management action. These three activities are:

- Identification of the farm enterprise risk, or discovering the source(s) from which the potential risk may arise
- Measuring the risk, or evaluating the impact on a farmer or his enterprise in the event of a potential risk occurring

- Managing and controlling the risk, or selecting the most effective method(s) to deal with a potential risk

These three components have, in turn, many sub-components. These all must be reviewed and analysed when a risk management exercise in the operation of a shellfish farm enterprise is taken.

Identification of Shellfish Farm Risks

Shellfish farming in Ireland is an industry of some diversity. This is because there are many different farming systems and practices used throughout the various peripheral regions. There are also many different sizes of shellfish farm enterprises. Consequently any attempt to produce a simple framework for the identification of the most common risks is not easy. In addition, the exposure to different types of risk can change during the life cycle of the shellfish product. These differences may be subtle if the mollusc has a simple life cycle, or they may be dramatic if the species has a complete life cycle with major metamorphoses. Despite all the complicating differences arising out of the peculiarities of species and their life histories, there are a substantial number of components in the cultivation process, which are common from one practice to another. For example, testing the classification of the water on the farm in a controlled way is a common denominator of status of the farm, so too is the treatment of water in hatcheries, such as heating, filtration, and sterilization. The engineering associated with the mooring of structures in the sea is a common element of several practices in the industry, for example floating rafts for long-line mussels. Equally common to all production systems and practices, and having no relationship to the species or life history, are the pure risks, such as the natural hazards of water contamination and pollution, abnormal temperature conditions, wind forces and climatic perils such as floods and drought.

However, the principle causes of loss of shellfish products in Irish shellfish farms by frequency and by value tend to be disease related. In a survey conducted by an insurance company on claims made over recent years, 44 per cent of value and 42 per cent by frequency of claims regarded disease-related problems. Failure of rearing systems (mooring systems, pumps, depuration systems etc.) was also significant (30 per cent and 28 per cent respectively). Plankton losses were fewer in number but higher in value (10 per cent and 3 per cent) respectively. Other losses in value and frequency were attributed to a greater range of causes, such as poor water quality, theft or vandalism, transport losses and handling stress **(Bell and Thompson: 1996, 24 -26)**. According to **Boyce (1993)**, the beginning of any risk identification phase is the crucial starting point from which a thorough and comprehensive search must be done to discover all sources (e.g. subcontractors) and areas (e.g. system design) of risk. At this qualitative stage some of the techniques for identifying risks to an enterprise would include 1) brainstorming, 2) interviewing and 3) drawing on an existing risk database. These three techniques are quite different in nature and as such provide a wide coverage in the search for risk. Risk identification in the shellfish industry to date depends very much on drawing on existing experience and to a great extent on insight. The nature of this technique may be described as "passive historic" **(Boyce: 1993, 34)** and viewing these risks with real events can be a good way of validating the magnitude of the risk.

Examples of this type of risk identification can be found in the case where fouling of equipment left in the sea for moderate to long time intervals can cause problems for the shellfish farmer. The additional labour for cleaning trays and nets, the extra gear required to replace the foul trays, the risks and mortalities that can be associated with the replacement of fouled trays and the wear that may have on the gear will all affect the profit risk of the shellfish farmer. This fouling affects shellfish cultivation in a number of ways. Apart from the cost of equipment replacement, there are the problems that result in poor quality product from the lack of water flow through the cages. This can influence water quality and the amount of food that the shellfish receives, and may also have an effect on survival. The use of paint applications, which in the past were recommended in other countries for shellfish trays and netting were TBT (tri-butyl-tin) based, which not only compromised the subsequent culture of the shellfish, but in some cases made oysters unmarketable due to thickened shells and poor meat yields **(Minchin et al.: 1987)**. There is also the natural occurrence of algal toxins in the seawater, which leads to the state called "Red Tide". These toxins are monitored by the Marine Institute's Fisheries Research Centre and once they occur in the sea, the shellfish farms in the area can be closed for long periods. In May 1994, Red Tide occurred in the Bantry area which led to the closure of the Bay from May 1994 to February 1995 and cost the industry up to 2,500 tonne in lost production. Poor growth, tubeworm fouling and prolonged closure for Red Tide has played havoc with the attempts by many growers to supply the market.

The climatic conditions caused by the effect of the warm summer months of 1995 also took their toll on the millions of seed in the Irish shellfish farms. During the first week of August reports of high mortality rates in seed were recorded. Unprecedented seed loss around the coast was compiled and it was indicated that a figure close to seventy million seed oysters had died. The areas worst hit included the Shannon region (on the Clare side), Dungarvan Harbour, Waterford Estuary, Sligo, and Mayo. The potential causes of this unprecedented level of mortalities have still not been associated with any one single factor. The most widely cited hypothesis from the industry is associated with not only the very warm temperatures but also the possibilities of oxygen depletion or algal bloom **(Barnett: 1995, 10-26)**.

Shellfish Disease and Health Risks on the Farm

The health management of the shellfish products on the farm should be an ongoing process and not a series of reactions to diseases. The degree of management required to control the risk of the introduction and the management of diseases varies with the magnitude of production, with the intensity of production, with the design of the farm and with risks due to known (and unknown) hazards. However most bi valve mulluscs grown on the shellfish farms are subject to the same pathogens, fungal infections, and parasites which, for farming purposes, may often require the same biological and chemical treatments.

Meade (1989, 63) says that with careful management and planning many of the farm diseases can be avoided by reducing stress and preventing contact between the disease agents and the cultured organisms. Some disease causing organisms can be imported while others can be found in the geographic area of the farm. Examples of imported disease risk can be those caused by what are known as "hitchhikers". Various organisms associated with the gigas oyster in mainland Europe were introduced to France with consignments dispatched by air transport from Japanese hatcheries. The Irish shellfish farms did not experience any of these "hitchhiker" species until the introduction of the EU Directive on the free movement of goods within the Single European Market in 1993. The value of quarantine, as recommended by the ICES Code of Practice has been bypassed and this has had shellfish product risk consequences for the Irish shellfish industry. As a result of this free trade movement policy, in 1993 a gut "worm" *(a copepod, Mytilicola orientalis)*, was introduced into Ireland by the importation of French half-grown oysters.

The local or geographic area disease risk is caused mostly by the DSP "Red Tide" phenomenon. Since May 1994 "DSP Red Tides" have seriously affected the rope mussel industry in Ireland, particularly in the South-West, the centre of the rope mussel industry in Ireland. In 1994 mussel farmers there lost an estimated 3,000 tonne of crop (over half the annual production) which was valued at approximately £1.3 million. Up to 500 shellfish farm workers were affected by the closure of these bays due to this problem.

This toxic algal bloom causes Diarrhetic Shellfish Poisoning (DSP) and is a naturally occurring phenomenon. Worldwide there are four types of poisoning associated with toxic algal blooms which can cause shellfish to be poisonous to humans. The first " Red Tide" in the South-West was discovered in 1984. In order to provide a timetable of risks caused by the environmental conditions, the Irish Aquaculture Association commissioned a report on the situation. This report recorded that in the period January/February 1994 there traditionally should be good sales of fresh mussels to French processing factories. However, during this period under research, the mussels were in spawning condition which was uncharacteristic (they normally spawn a month or so later). This meant very few export sales were made at this time. After mussels spawn it takes about eight weeks for them to recover before they can be sold. Unfortunately during March and April severe storms and gales disrupted this recovery period. It was estimated that up to 1,300 tonne of rope- cultured mussels were lost. In the early summer months of May and June when mussels are traditionally harvested, the bays were closed due to the occurrence of the "Red Tide". As a result of this closure large mussels were not harvested and a fouling organism, tube worm, settled on the mussels during June and July. Once this fouling occurs the value of the mussels is more than halved. It was estimated that over 1,200 tonne of prime mussels were lost due to fouling. From June until February 1995 high and protracted toxicity was present with the bays being opened only spasmodically. This resulted in further losses of over 500 tonne due to storms because the mussels could not be harvested in time. This resulted in the final production of only 3,000 tonne of prime mussels been harvested and sold during 1994/5.

Source: BIM

Shellfish Farm Marketing Risks

> In any commercial transaction it is inevitable that all the implicit risks will be borne by one party or the other. It may take a court of law after the event to determine on which side of the barrier the implied risk lay but surely enough all the risks lie somewhere. Perhaps in an ideal world the risk pendulum would lie perfectly balanced between the two sides.
>
> **(Boyce: 1993, 6)**

However, in reality the position of the pendulum largely depends upon the bargaining position of both sides in the commercial transaction. The situation in shellfish farm transactions would show that the swing of the pendulum on the basis of the bargaining power is on the side of the buyer. As the bulk of the production of shellfish on the farm is destined for the export market, the shellfish farmer is relatively remote from the buyer. The nature of the commercial transactions in the Irish shellfish industry is generally based on what can be described as "partnership sourcing". The characteristics of this type of marketing is that there are, 1) many potential suppliers, 2) many end users, 3) many supplier products and 4) off the shelf products **(Boyce: 1993, 13)**. There are over 300 shellfish farms around the coast cultivating bi valve molluscs so there are a variety of suppliers. Equally, there are many types of buyers for the product, ranging from wholesalers and middlemen, to retail buyers and commodity brokers.

The customer base is extensive and the shellfish products are well established on the market-place. In this type of business arrangement the shellfish farmer has a wide vision and understands that the supply and quality of his products will help the endeavours of the buyer to perform well and maintain a good reputation for the product. However, the shellfish farmer's main focus is to satisfy his order from the buyer. While this type of seller/buyer arrangement depends to a great extent on mutual trust, the risks involved arise when a clear definition of the partnership is not agreed and it becomes less than easy to establish liability and remedy when things go wrong. While this type of partnership contracting is generally used in the shellfish industry it involves a high level of mutual trust and commitment and demands important decisions of principle; nevertheless it is to a degree a productive approach for this type of high-risk industry. The shellfish farmer will also have to share risks with the marketing middleman, as the middleman depends on the customer paying for a quality product. It is important that the farmer works with a marketing middleman whom he can trust to handle his product correctly and also is dependable in his business transactions. The commercial side of the shellfish industry, however, did suffer financially by engaging in this type of contractual arrangement. A major French buyer/broker of shellfish products got into financial difficulty in the 1995 season and was unable to pay for the consignments he contracted to purchase. He had built up contacts with most of the shellfish producers over a number of years and this arrangement became convenient for all concerned. Because of his inability to pay for his purchases many shellfish farmers never recovered from this severe financial loss.

The identification of a market for the shellfish farm's products and for forecasting market trends also requires considerable knowledge and skill. The marketing risk associated with shellfish farming may be reduced by the acquisition of information on the many variables involved. **Chaston (1993)** suggests that in aquaculture marketing it is this acquisition of information that is the key objective in the minimization of error.

Production and Technological Risks on the Shellfish Farm

Production risks are the principle concern in the daily routine of the shellfish farmer, and this production process is his sole responsibility. There are many and varied risks in the production process which can reduce profitability compared with those which can occur in marketing and consumption. These risks can be operational or technological. A large number of shellfish farms failed to attain profitability **(Economic and Social Research Institute: 1992)** because of accidents or major disruptions in the production process. A principle cause of disruption in daily operations is often mechanical failure of plant or equipment.

As shellfish farming developed and progressed there is now a tendency to mechanize farm operations for intensification of production. This was brought about by the high cost and shortage of labour and the desire to mechanize as much of the operation as possible. Many categories of equipment have been tried on various shellfish farms without much success. The risk of this happening comes from the manufacturer's general lack of knowledge and expertise in the operation of shellfish farm enterprises and some of their equipment has very little likelihood of becoming economically viable. There are also a number of routine activities in the daily operation of any farm which may be described as "hazardous" to the stock, and create risk. Typical hazards are those which expose the stock to a new environment, albeit temporary, for example, all handling activities required for such tasks as turning the shellfish bags, counting, grading and measuring stock and the transferring of stock. Another potential breakdown in the smooth production operation of the farm is the danger of lack of the supply of healthy shellfish seed from reliable hatcheries.

As shellfish farming is a relatively new technology, select systems designed to manage risk and control losses are still only emerging. The industry as yet does not have the tradition or experience of the other more advanced and established enterprises, such as agriculture, horticulture, or wild fishing. For example, to compare the level of knowledge of the natural history and biology of shellfish species produced on the farm with those of certain domesticated land animals, cereals, or vegetables in relative terms, it is suggested that if only 75 per cent of the biology of the human is known, then probably about 50 per cent to 60 per cent of the biology of the major domestic land animals, poultry, and crops is known. But the biology of the aquatic animals and plants probably ranges from only 20 per cent (for such as salmon) down to 5 per cent for shellfish **(Pillay: 1994, 251)**. While this comparative qualification is only indicative of a relationship, it helps demonstrate the lack of information the shellfish farmer has about the products which are intended to sustain his enterprise. This lack of information is compounded further by the dimension of water in which he has to work, and all its physical, biological ramifications involved in the production equation.

The inadequacy of shellfish technology is a significant risk to the industry. While there are many technological systems designed to create solutions to risks, a great many fail to deliver promised results and are decommissioned having never been usefully put into service. **Kennedy (1994)**, an aquaculture risk consultant, visited hundreds of aquaculture operations, and invariably found on each farm a scrap heap consisting of redundant equipment. Shellfish farm systems technology can be expensive and should the system fail to deliver an expected return it becomes redundant sooner than planned or can in fact create a situation which gives rise to stock loss. This in turn affects the potential profitability of the enterprise. The systems technology used on Irish shellfish farms has been limited mainly to stock protection against predators and systems for maintaining stock control.

Shellfish farmers need information which will improve and guarantee farm production and this technological information is of prime importance to the future of the industry. It is the responsibility of the individual farmer to make certain that he is well informed about technical developments which will help him reduce his risk. Farm production risks are increased where a high level of bio-technical skill is required and systems technology does have a role to play in controlling these risks. While applications of systems technology vary with each farm, the shellfish farmer should carefully appraise both the system and its purpose before he incorporates it into his enterprise. Locally tried and tested systems would appear to be preferred by the Irish shellfish farmer. This is true with technology such as off shore installations and rafts where often-climatic conditions are hostile and which can increase the likelihood of production problems.

Shellfish Farm Financial Risks

Many types of financial risk are common to all business enterprises. However, in the business of shellfish farming there are some conditions which make them peculiar to this sector, and therefore they are considered by the farmer as factors which can influence the profitability of the enterprise.

Shellfish farmers, like agricultural farmers, invariably require repeated loans. In addition to loans for capital construction, the farmer usually requires initial operation loans. These may be followed by short-term loans for annual supplies of seed, new equipment, or expansion. Thus the Irish Government's monetary and grant aid policy is important for the shellfish industry. Because it is a new industry and is situated in the most peripheral regions of the coast the

Government also offers a number of non-fiscal incentives for the farmer in order to encourage employment and sustain enterprise in the region. These aids include grants for development and development infrastructure. In recent years the Government has had to introduce insurance grants and compensation schemes in an effort to support the industry. The financial risk to the shellfish farmer is in not determining the extent to which these non-fiscal and fiscal incentives are making the farm operations profitable as these Government incentives could easily be removed once the industry becomes established. The industry also relies to a great extent on the State sponsored development agencies for various services, such as marketing services (market information, intelligence, promotions etc.) and technical services (research and development, technical training schemes etc.). The EU also has committed financial resources through its various development programmes to support the industry. Again these are taken advantage of by the shellfish farmer. While the Government funding is used to encourage more liberal lending practices, the main vehicle for this lending is embodied in the operation of the Common Fisheries Policy. The financial instrument for the development of shellfish farming is the EU FIFG Programme **(European Commission: 1986)** and the aim of this aid package is to introduce socio-economic measures for the marine industries. But these services will not necessarily be there forever as a change of Government policy or redirection of funds from the EU present risks to the utilization of capital by the farmer. The shellfish farmer has also to be aware of changes in the industry which are peripheral to shellfish farming, and which will influence his profitability. For example, changes in the price of seed, increases in the price of transport costs, and energy costs are also considerations. The profitability of any farm is closely tied to the farmer's management of capital and cash flow, but also to the overall financial awareness of other changes going on about him which have a direct or indirect effect on the profitability of the enterprise. The farmer will continue to need short-term credit to maintain the operation, and the lending institutions must make certain that credit is always available. The lending institutions have made little attempt to understand the intricacies of farm operations and their capital cycles, and invariably offer credit terms they normally apply to land-based farmers, or fishermen.

According to **Meade (1989)**, another important principle in shellfish farm economics and management is taken from a biological phenomenon. It is the law of diminishing returns, and applies to all culture systems; by applying it, the manager can determine the most effective or profitable level of production. All farm culture systems have both fixed and variable inputs to this production process. For example, a fixed input might be the facility, such as a mooring platform or holding tanks. The common variable input could be labour. The law of diminishing returns states that as units of a variable input are added to one or more fixed inputs in a farm culture system, the output first increases at an increasing rate, then increases at a decreasing rate, and finally decreases absolutely. The shellfish farmer will have to have the economic skill to understand these principles otherwise he will risk not acquiring the most economical output from his farm.

While financial lending institutions can be criticized for being too conservative and too anxious to look for security for their loans and overdrafts to shellfish farmers, they still see this business as a high-risk venture. A telephone survey conducted with bank managers for this dissertation on the financial risk of supporting the shellfish industry indicated the following reasons for lack of support for the industry:

1. the shellfish farm enterprise scheme was viewed as unviable
2. insufficient information was available concerning the total enterprise

3. the shellfish farmer had inadequate capital resources

4. the security being offered by the farmer was unacceptable

Safety, Health and Welfare Risks on the Shellfish Farm

Many major accidents, whether mechanical failure or human error is the key, have no single cause but are due to an unforeseen combination of interacting factors **(Spent: 1988, 195).** Shellfish farming presents risks to the health and safety of those engaged in the diverse range of activities associated with it. The safety, health, and welfare of shellfish farm workers is protected by an important piece of legislation which places the responsibility for risks with the shellfish farmer. This act brings together under statute law, the common law concepts of safety and health which impose duties on the shellfish farm owner and his employees alike. The Health and Safety (1989) Act **(Government of Ireland: 1989),** covers all persons in employment, as well as self-employed persons and persons who may be affected by work activities (other workers or the public in the immediate area). The shellfish farmer must also have regard to seasonal workers on the shellfish farm, divers under contract to the farm, maintenance contractors as well as permanent employees. The shellfish farmer has primary responsibility for any likely occupational accidents and diseases, which create risks on the farm. This is a self-regulation approach and means not only self-regulation using standards imposed from outside but also involves the creation and maintenance of standards of safety, health and welfare in line with the risks created by activities on the farm. The shellfish farmer must therefore be aware of these potential risks. The regulation requires the shellfish farm owners and managers to have safe equipment, safe systems of work, to provide information and training and supervision where required. Furthermore, the farmer is required to have a safety statement and bring it to the attention of the employees. The simple fact is that accidents can have far-reaching consequences for both the person affected and the employer. Controlling safety, health and welfare issues in a formal manner by setting down responsibilities of individuals and identifying and minimizing risks can greatly reduce accidents and ill health. The shellfish farm also faces the risk of being closed down should there be evidence of risk to employees and other workers. It is the responsibility of the shellfish farmer to be able to identify the risks on the farm, to make an assessment of these risks and to prepare arrangements for securing the safety, health and welfare of all those associated with the shellfish farm operation.

For example, should there be an activity on the shellfish farm where it is required to use a particular chemical, the shellfish farmer must take measures to reduce the risk that may be exposed in this activity by ensuring that protective equipment is used. Also buoyancy aids and life jackets are to be of a required standard as there is a great danger of loss of life by drowning while engaged on work on the shellfish farm. Knowledge of rescue procedures and water safety is needed to avoid risks as well as first-aid training. The shellfish farmer will have to identify the risks associated with the enterprise at both land and sea sites, assess the risks arising from these hazards and be able to demonstrate arrangements for securing safety, health and welfare on the shellfish farm.

The Social Risks of Shellfish Farming

National goals for employment in shellfish farming and productivity have been set by the Government **(Bord Iascaigh Mhara: 1993)**. This projected expansion, when considered in its entirety, is making considerable demands on natural resources. As a result, many other industries, equally important to the economies of peripheral regions now compete openly and vigorously for the same resources. **Gordon (1992)** argues that in such situations, apart from government influence, the social stability of the region will also have an impact on the success of the enterprise. This stability will depend on the complex inter relationships between the economic, social and political environment and so it may be difficult to predict the exact nature of risks to the enterprise.

Social aspects to be considered in the shellfish farm regions include the following:

- The nature of the community i.e., the age distribution of the population, whether it is urban or rural etc.
- The nature of the local economic infrastructure i.e., whether the population is skilled, the extent of education provision, the degree of dependence of an economic activity in the area for the maintenance of its social life etc.
- The general economic situation and the position of the community relative to it.

Most of these aspects have been examined already in a previous chapter and the implications for the coastal peripheral shellfish farm enterprises considered. The main social issues, which create risks for the shellfish farmer, come from the ecological impact of the production process. The principal competitors of the shellfish industry are those enterprises which also require water and adjacent space (such as leisure, tourism etc.). Furthermore, all are subject to the increasing demands of the environmentalists who want no industrial enterprise development at all around the natural resources.

Bannister and Bawcutt (1992, 131) argue that social risks arise from changes which are beyond the direct control of the enterprise and to which the enterprise is to respond. Social change is relatively straightforward to document but difficult to define precisely. Part of this is undoubtedly due to the long-term nature of such change even in a modern world where change is more rapid than previously and part of the invisible nature of cultural influences. The development of the shellfish farming industry cannot exist in isolation from the socio-political environment and therefore it is important to identify the areas of conflict between the shellfish farming enterprises and the communities within these coastal regions. The shellfish farming industry cannot avoid these issues raised by these social factors because in many cases the development of these enterprises was responsible in part for this changing social environment and the necessity for public acceptability. Disorganized and ill-considered expansion often brings social resistance to any proposed development, as well as hostility from other economic competitors. For example, there is already evidence of social hostility towards the shellfish industry. Typical accusations are unsightliness and smell of farms, dangers to wildlife, and hazards to navigation. Social unacceptance is often exacerbated by the speed with which any new industry develops in its formative years, mainly because society does not readily embrace substantial short-term changes.

All land below high water lines belongs to the State, and the general public has full right of access - a right regarded as sacrosanct. Any impoundment of tidal and offshore areas of the sea or any restriction of the right of access to public coastal lands and inland water bodies, for the purposes of production of shellfish products is proving to be unacceptable and results in some local public disquiet. For the shellfish farmer social problems may result in the non-renewal of the lease (if he does not own the property), refusal of the granting of a shellfish farm licence, or in limiting important expansion plans. They may also lead to the loss of rights to take water for the farm, or to install costly water treatment to purify farm effluent. These are all risks to the shellfish farm enterprise. Social behaviour may also affect the individual farmer in other ways, for example, the risk of local sabotage of the enterprise by some group of activists. This may be only a small risk at present but none the less could be significant should there be an organized and concentrated effort against the farmer.

There are obvious risks to the future of the industry if farmers do not have reasonable access to the key natural resources of water and adjacent land. Once again these risks can be alleviated to some degree by better information. It is important that farmers as a group are well informed about other industries in the region, and their programme for development. However, it is also necessary for governments to be equally informed about the shellfish industry, and allocate resources appropriately. The EU also designated a number of coastal areas as Areas of Scientific Interest or Special Protection Areas which has further constrained the development of shellfish farming in these areas. There is very little opposition to the classification of these areas, which would appear to have the approval of the local communities in the regions, and has led to social opposition to the continuing development of shellfish farm enterprises.

Other social risks to the shellfish farmer would include theft, malicious damage, and fraud. These social risks would be of immediate concern to the shellfish farmer. While random malicious damage is of less concern to the shellfish farmer, unless it is motivated by special interest groups, it will still cause the farmer difficulties. There is also the ever-present possibility of fraud. This can be external, from individuals and suppliers to the farm, or internal, from employees.

Shellfish Farming Consumer Related Risks

In theory, once the production process has ended, and the healthy live shellfish has left the farm gate (or the shellfish farm depuration or processing plant), and payment has been made, the product is no longer the responsibility of the farmer. This, under normal circumstances would be the end of his risk. In practice, unfortunately, this is not the case. The farmer is still exposed to risks which may change the quality of his product until purchased by the customer. If the quality changes, then both the consumer and the marketing middleman will not make future purchases, and this obviously will have an influence on the profitability of the enterprise. These risks the farmer now shares with the distribution middleman, as the middleman is also dependent on a satisfied consumer. Therefore, to avoid the risks of loss of quality of his product, and the loss of future customers, it is important that the farmer works with the marketing system and distributor whom he can trust to handle his product correctly. Some farmers, of course, choose not to take this risk, and process and retail their product directly to the customer.

Identification of the market for the farm's product and forecasting of its growth trends by the farmer requires considerable knowledge and skill. Using that knowledge to programme farm production, or to invest in new facilities etc., is an individual decision. Furthermore, it is not always possible to know the plans of the farmer's competitors to increase their market share and attack the same markets. For the farmer to compete in the market-place it is important that he is well informed. In addition, his product must leave the farm for post-harvesting handling (processing, grading, packaging, transportation) in perfect condition and the quality must be maintained until the product is purchased by the consumer. This flexibility of shellfish farming to harvest the product at the time of peak demand and optimal market prices is one of the advantages which farming has over competing products supplied by captured species. However, the farmer often has to deal with problems which are not evident in wild fish, such as diseased fish, malformation or unbalanced growth, "muddy" taste, poor bone/shell to meat ratios.

An example of the risks incurred in selling shellfish product to the consumer can be illustrated by the occurrence of illness experienced by over 200 consumers of Irish grown oysters during the 1996 Christmas period. A shellfish grower in the south-east region sold three separate lots of oysters to a Dutch importer and processor. The total quantity was 40 tonne and valued at £40,000. The importer used another distributor to sell on these Irish oysters to the retail trade in Holland. These oysters were exported from Ireland from a farm designated having Class B waters. This water classification indicates that it registers between 3 and 60 faecal coliform per gram and so all shellfish products therefore must be purified in an approved premises or be subject to heat processing. The shellfish were washed by the exporter on his premises before shipment. However, the consignment did not carry documentation indicating that they had come from Class B waters and required further purification. It is unclear what happened the oysters when they reached Holland. The end result was that these contaminated oysters caused illness to quite a number of consumers. Some of these oysters had been distributed to buyers in Denmark and Norway and again these caused sickness to hundreds of consumers. The breakdown in the chain of communication between the exporter and the buyer regarding the treatment and handling of these shellfish consignments led to extensive adverse media coverage in Scandinavia **(Bord Iascaigh Mhara: 1997)**.

Again, in theory, once the consumer has purchased the product in the market-place, the responsibilities for the quality of the product of the farmer and the marketing middlemen have ended. This, under normal circumstances, should be the end of the exposure to risk. But in practice, this is not always the case. The farmer and the middleman are dependent on the individual profitabilities on repeat purchases by the customer. Consequently the risks continue until the product has been consumed, and a verdict of approval has been given. The risks are now shared by the farmer, the middleman, and the individual consumer.

The greatest risk, not only to the individual producer and his marketing middleman, but also to the industry as a whole, is if, as in the above case, the health of the consumer is endangered in any way. This may be the result of ignorance or the lack of attention by the farmer. This may be caused by his mollusc beds being directly affected by pollution, or if his shellfish accumulate the toxins which cause paralytic shellfish poisoning, or the fault of his middlemen with unhygienic processing of the product, or poor storage. Any risk to public health invariably causes closure of the producer's farm and stringent examination of all neighbouring farms. Immediately all consumer faith in the product is lost and, for all intents and purposes, the market is lost and may be irrecoverable.

Measuring the Risk to the Shellfish Farm

There is a need to quantify shellfish farm risks and it is important that the shellfish farmer can identify these potential risks, as they will affect the survival of his enterprise. This is a necessary activity as it assists in placing his enterprise risks in some order of priority and highlights the decisions that have to be made.

Basically there are two elements of each risk, which need to be quantified before any assessment can be made of the cost and economics of controlling reliably these risks.

These elements are:

- The frequency of the risk occurring
- The cost and economic consequences of it occurring

Webber and Riordan (1979, 27 -34) argue that in aquaculture operations, new problem areas are engendered and many of the old problems become more critically significant, as small-scale farms, owned and operated by family units initially for a small cash crop, evolve into larger operations conducted for economic profit. They maintain that the scale of risks in such operations also increases accordingly. The quantification of such problems and risks is fundamental to almost all the commercial decisions which may be taken about the shellfish farm enterprise. If necessary, such decisions may include the cancellation of the investment in the enterprise altogether if the risks are too great in relation to the expected financial return and viability of the farm. Should the decision be made to proceed with the venture, then the initial investment capital must be sufficient to start and operate the business and to cover the many risks it is exposed to or to divert the costs of the risks elsewhere, for example, to insurance. Unfortunately, not many shellfish farmers make this type of analysis, or have the right level of risk capital available at the start of their projects. According to **Huguenin and Colt (1986, 495 -516)** the ability to organize and implement an aquacultural enterprise which is a complex combination of technical, economic, marketing social and political elements towards some specific goal, is a management process and a feature of such management is the ability to measure risks.

Traditionally in the Irish shellfish farming industry the first risk in establishing a shellfish farm enterprise involves an assessment of the potential farm site, which is usually made by deciding on the availability of unutilized or under-utilized coastal areas for conversion to shellfish farming and the availability of culturable shellfish. Between the two an assessment of the potential of the site is probably the one that is made more casually, often from topographical maps or local knowledge of the coastal region and perhaps access to the shore. This is very true in deciding to develop rope-cultured mussel and gigas oyster farm enterprises. For bottom-cultured mussels the availability of culturable seed is a more important consideration. While these decisions serve the purpose of drawing the attention of the Government and Government agencies to the possibilities of developing a shellfish farm enterprise, in actual practice these assessments have often proved to be invalid. This is because the very concept of making available these areas for enterprise development is now being questioned, as most such areas, even when not directly utilized for cultivation, may have important roles in maintaining the environmental integrity of the region. Many of these areas may be communally owned or may have marginal uses for local communities who may not be amenable to being divested of their traditional rights. Furthermore, the quality of water on which the farm is situated may be unsuitable for cultivating shellfish.

Efforts have been made **(Kapetsky et al.: 1988, 241-9)** to determine the usefulness of computerized geographic or spatial information systems in identifying potential areas for aquaculture development on a local or country-wide basis. While studies have shown that data derived from remote sensing can be employed for making estimates of locations for on-site surveys, the real assessment of available sites for different types of aquaculture has to be made through detailed site investigations. Besides the technical requirements of the culture system, data on ownership, multiple use conflicts, seasonal hydrological characteristics of the sites, exposure to natural climatic conditions such as storms and tidal waves, infra-structural development, availability of skilled and unskilled workforces, access to information and technical support and the distance from markets is also required. The estimates of actual water areas that will contribute to production and therefore the magnitude of yields, also has to be measured. The increasing awareness of the needs of the local community for conservation of natural resources is also a very important consideration.

Thus, poor siting of farms can be one of the major reasons for the failure of shellfish farming enterprises. The ideal requirements of sites for different types of shellfish farming are more or less well defined **(Pillay 1990, 23-35)** but it is only in very few exceptional cases that all the requirements are met. Even when ideal sites exist, access to such sites can be severely restricted for a variety of reasons and the farmer often has to settle for the available sub-site, with the expectation that the deficiencies can be rectified and problems overcome at affordable cost and effort. Despite the obvious primary importance of water resources in any form of shellfish farming, there are many failures of enterprises due to problems related to water quality, quantity, or other hydrographic conditions.

Apart from quantifying risks arising from shellfish farm site selection, there are other principal decisions facing the shellfish farmer. These sub-divisions are namely:

- **Commercial Decisions.** These are the basic decisions about the business, and should be made by investigating the financial comparison of the likely return on their time and financial investment with the cost of any risk should it occur. Should it be decided that the risks and uncertainty of starting the development of the farm are too great, then a decision may be made to abort the project.
- **Control of the Enterprise Decisions.** These relate to the decisions specific for each risk which must be made if its impact is to be reduced or eliminated altogether. If the risk is only to be reduced, then it is important to decide to what acceptable level, and at what cost. For example, should there be the likely risk that the shellfish farm licence may be

evoked at a future date, and the decision is out of the control of the shellfish farmer, then the risk factor for this venture is high.

- **Financing Decisions.** These are the decisions which deal with ways of financing the risk (for example, by insurance), and their acceptability.

At the present time in the emergent status of the shellfish industry, the quantification of risks remains very individualistic for the farmer and his farm. The shellfish industry in Ireland has developed far within the past two decades. It is only in more recent years, however, that any attempt at introducing standards and codes of practice for the industry were made. There was a need to introduce standards and codes for buildings, installation and operation equipment as well as professional standards for producers.

As part of the process of the development of the European Single Market, the EU introduced a number of Directives which will have to be conformed to in order to operate in the shellfish industry. The aim of these Directives is to introduce national standards of shellfish farm practice for such activities as the construction of the major farm buildings and the installation of utilities. The construction of special rooms, the erection of tanks and units, the water distribution system, and the internal electrical and water systems are also catered for in these Directives. Consequently, there is little in the way of basic information which has been built up and recorded over the years which makes compliance with these conditions difficult. A special derogation period had to be granted to the Irish shellfish industry in order that it might acquire the necessary skills and expertise to meet these standards. The shellfish farmer had to learn the hard way, through research and analysis and this involved a great deal of risk. However, no matter how good this research was it was still very necessary to make the adjustments specific to the farm in question. As the risk to the farm operations are often site related, it is necessary that the qualification of those risks is also site related. It is essential that as much information as possible is assembled for each particular farming enterprise, and its local environment.

There is also a need for information which is not only site related. This information should include scientific data about species such as life history cycles, reproduction, physiology and pathology, as well as engineering data about materials. Very little data is available and what there is has not been processed in a way readily available so that shellfish farm risks can be quantified. Therefore measuring or qualifying risks will have to be estimated intelligently by the individual shellfish farmer. The areas on which the shellfish farmer will need to acquire information before the measurement of risk take place are as follows:

1. Environmental Data
   - Climatology - understanding of basic weather data, including incidence of extremes of weather.
   - Hydrology - basic physical data of waterbodies such as range of tides, wave direction, water chemistry, and all seasonal changes.
   - Geology - topography, soil composition, and chemistry.
2. Biological data
   - Shellfish species data - life history cycle, basic physiology, reproduction
   - Species pathology - specific diseases, incidence, treatment, efficiency of treatment, known epidemics, regulations regarding diseases.
   - Aquatic biology - plankton profile and seasonal blooms.
3. Production data
   - Farm capacity - stock densities, handling capabilities.
   - Harvest - size, methods, times.

4. Engineering data

- Site works - standards and codes of practice for facility construction (tanks, rafts) water systems, moorage.
- Operations - alarm systems and safety equipment.

5. Social data

- Employees - regulations for health and safety, working conditions.
- Community structure - local conditions, level of unemployment, interest groups.

6. Economic data.

- Costs of design services and construction, operating costs, marketing data, production profiles, internal rates of return

In his research on why aquaculture enterprises still go wrong **Mathiesen (1994)** observes that while agriculture is an ancient way of producing food for human consumption so too is aquaculture but it still is a poorly organized industry - both scientifically and practically. He observes that too many aquaculture enterprises still go wrong, which he claims is bad news for an industry which is expected to supply a fast increasing share of the world demand for fish and other aquatic products. Some of the suggestions made by him in identifying and measuring the risks in shellfish farm enterprises include carrying out a proper feasibility study and site investigation. A serious market survey should also be implemented as part of this feasibility study. The manager of the farm should have at least 10 per cent share holding and the local community should be involved with the project so that it works for the farm and not against it. As it usually takes at least three years before the farm is in full production, there is the need for liquid assets.

Managing and Controlling Risk on the Shellfish Farm

There are a number of techniques used by the shellfish farmers in managing and controlling risk on a shellfish farm. Some of the methods used are:

Absorbing the risk

Absorbing the risk is one shellfish farm management technique and is appropriate to certain types of risk. The financial investment behind the farming enterprise should therefore be sufficient to withstand the occurrence and financial consequences of most risks. Typical risks which fall into this category are the normal fluctuations in market prices of the shellfish products, changes in international currency rates, increases in farm labour costs, etc. There are also a number of operational risks, such as increases in the price of seed due to sudden shortages or unavailability, breakdown of farm machinery and equipment and possible temporary closure of the farm due to water pollution or disease.

However, absorbing these type of risks requires positive action on the part of the farmer and not simply acceptance that the farm enterprise can withstand any loss or disruption should it occur. This requires a certain level of financial liquidity by reserving a fixed percentage of the profits in an emergency fund. Shellfish farm entreprenologists, more by default than planned strategy, continue to absorb potential risks without maintaining the required liquidity, and many pay dearly for the consequences. Because of the relatively part-time nature of some of these farm enterprises the shellfish farmer is able to maintain a level of finance from his other activities so that he can survive this downturn in the viability of the farm due to these risks. Very few farmers have a business or management strategy plan which anticipates the adherence of certain risks.

Organizing the Shellfish Farm to Eliminate Risks.

Managing and controlling shellfish farm risks is the responsibility of the industry as a whole. This is brought about by individual shellfish farmers recognizing the specific responsibilities within their own farm, and by the development agencies and funding agencies working together to improve the industry and set appropriate standards and adopt codes of practice. The following examples illustrate some of the issues of concern to the industry which, if properly organized, can help alleviate some of the high risks to the industry.

1. Selection of the site

The basic organization of the farm and its subsequent operations begins with the selection of the site. Unfortunately, there are considerable misconceptions about the site selection process which are very important. With almost certain probability, no site in these peripheral coastal regions is perfect. **Pillay (1994)** maintains that even though considerable knowledge has been accumulated on site requirements for aquatic farming it is very seldom that a site can be found that conforms to all the ideal physical and logistic features that are needed. Each site has its own drawbacks, and the accumulated experience can be used to rectify or ameliorate them. The prospective Irish shellfish farmer is generally unable to select a site which meets all the criteria for a successful enterprise. He has to compromise on many issues and in practice, the site for the farm often appears to select itself.

The location of the majority of farms is determined by the principle factors which govern the availability of appropriate land and access to suitable water; or, alternatively, is the only location for which a sale or lease is possible. Consequently, the majority of farm sites are a compromise of factors and what those factors are introduces the first element of risk to the enterprise. For example, the land might be flat and less costly to develop, and provide an opportunity for expansion but it may not be as close to the shore as it should be. As a result, larger pumps have to be installed, the water delivery system is lengthier, and the water line crosses a road requiring substantial protection. Although the costs might compensate each other, the risk of mechanical failure is increased, including an added risk of fracture of the life support system as it crosses the road.

2. Pilot scale shellfish farm projects

Before any substantial grant aid is given to the farmer to develop a shellfish farm enterprise, a standard procedure at present is to develop a shellfish farm pilot project. According to **Klemetson and Rogers (1985, 1-19)** the development of an economically successful project requires both engineering and economic evaluations. Available resources, site requirements, construction and operation costs, and design requirements were all integrated in their study for the evaluation of the most feasible system in the area. Economic summaries were also prepared outlining total expected costs, and rates of return on production of shellfish products were also made. This pilot scale farm study helped present information on the likely costs associated with the development and operation of a proposed aquaculture enterprise. Such pilot study schemes in the shellfish industry in Ireland are designed to assist in the identification of unknown risks and to provide the real qualification of these potential risks particularly should there be little or no prior shellfish farm practice in the region. However, should there be some farming activity in the same area already then this pilot scheme would not be justified as a number of regional risks may already be known, reduced or eliminated. Expansion of any of these pilot-scheme projects is not generally encouraged until the risks are manageable and controlled economically, and farm operations are trouble free to the trained employees.

There is always a considerable element of risk inherent in the process of expansion, no matter how well prepared the process might be. However, there is a considerable difference between the well-researched calculated risk, and pure chance. The farm designed around a built-in risk management approach has a far better chance of achieving organized and profitable expansion than one which expands on the strength of good financial or marketing opportunities.

3. Engineering standards

Due to the small scale of the shellfish farm industry, Irish engineering firms have been slow in entering the business of shellfish farming and agricultural and marine engineers have not recognized the shellfish farming industry as one in which their backgrounds can readily be applied to the research and development needs of the industry. Research by **Lee (1994, 205-227)** shows that while agriculture in the US is the world leader in productivity through intensification, mechanization and automation, a similar history in automated control in the aquacultural industry has been brief. Most of these systems have been custom-designed for specific tasks in hand. The engineering industry in Ireland has been slow in producing the fundamental engineering information from which codes and standards are set.

A specific example is the marine engineering associated with the construction and moorage of floating cages and rafts, particularly in the open sea. The engineering principles and practices relevant to the construction of depuration stations in the marine environment are also not that well established. Consequently, the shellfish farmer has to call on experienced individuals in the maritime industry to give him specific guidance, or to advise where the appropriate data might be found. Typical individuals are those who are engaged in aquacultural research in the universities such as in Cork and Galway and in the State agencies such as BIM and the Marine Institute. As a last resort. the shellfish farmer has to undertake experimental engineering studies himself. Under these circumstances. the risk management task for much of the shellfish industry is one of trial. experiment and research.

The Aquacultural Engineering Society serves as a primary source of information on aquacultural engineering and provides engineering support to initiatives from the aquaculture sector. This is accomplished by providing technical information and opportunities where aquacultural engineering problems and potential solutions can be discussed with knowledgeable people with similar interests. This society is US based and therefore does not generally relate to Irish shellfish farm situations.

The suppliers of shellfish farm facilities. such as floating cages and rafts. take the initiative in providing this type of equipment. They supply services to analyse the proposed location and to recommend the appropriate configuration of the facilities and the moorage system recommended. In doing so they accept responsibility for the failure of the system. thus releasing the farmer from one small group of risks. It is therefore a valid risk management action on the part of the shellfish farmer to purchase his facilities from a supplier who provides these fundamental services. These suppliers are taking a risk. This risk they will have analysed and costed. and they will have decided that they can withstand the liability in the event of any occurrence. and indemnify the farmer for the loss of equipment or stock.

4. Professional standards

Because of the many complexities involved in shellfish farming enterprises. the farmer inevitably seeks professional assistance either to plan the farm operation or to supply support and information throughout its subsequent operations. These professional advisors also are a risk to the success and profitability of the enterprise. It is important therefore that this risk is managed like any more obvious one. The majority of advisors in the shellfish industry are scientists or technical experts and their experience has mainly been in Government agencies or research institutions. Very few will have experience of running a commercial operation and their knowledge and expertise is very limited. Often the shellfish farmer has no choice but to seek advice from these same experts in other areas such as production programming, harvesting schedules, marketing programmes and even financial planning. Unfortunately, many investments in the shellfish sector have been lost as a result of professional individuals greatly overstepping their ability to provide the service required. Investments are often made in projects which are ill-conceived, inadequately researched and planned, and poorly implemented. However, the investor in these projects, whether it is the Government or commercial concerns, must share the responsibility as much as the farmer's advisors.

Dissemination of technological information and increased opportunities for contacts between key personnel, however have played an important role in the development of professional standards in the sector in recent years. There are many international societies dealing with aquaculture issues such as the FAO and the ICLARM (International Centre for Living Aquatic Resource Management). In Ireland organizations such as the Marine Institute, the Department of the Marine and Fisheries and the Irish Shellfish Association deal with information on all aspects of aquaculture. **Hecht et al. (1992, 6-19)** published information on successful aquaculture programmes and this has been a major impetus for development in aquaculture.

Shellfish farming, however, is still very much an "emotional" industry with considerable pulling power both for the Government and the many development agencies. Many potential entrepreneurs are irrationally attracted to the industry, deceived by its apparent simplicity and availability.

5. The treatment of disease

Diseases of shellfish species caused by parasites and infectious pathogens have attracted the attention of scientists and marine biologists from the very early days of aquaculture investigations. Disease of the molluscs is one of the main risks to the profitability of the farm and is one of the least understood of the shellfish farm risks. For example, research by **Alan and Hepher (1979, 478-87)** showed that the high pH and oxygen in waste-water in aquaculture ponds could actually be producing quite disease free environmental conditions, in contrast to expectations that such systems encourage parasites, disease and pathologies.

Diseased shellfish is unsaleable and invariably requires costly treatment. These costs are not always recoverable once the disease is eliminated. Moreover, the stock may not be marketable until all residual chemicals have been cleaned from the body. In Ireland there are laws and regulations regarding the movement, handling, and marketing of diseased stock to reduce the risk of spreading disease **(European Commission: 1991a).** For some of the most common diseases, effective vaccines have been developed and are commercially available. This is the most prudent management option for the farmer to avoid or minimize all the risks associated with disease on the farm. However, in view of the incidence and frequency of disease in the industry, Government research remains equally important as part of its supporting services.

6. Workers, health and safety

Shellfish farming has attracted the participation of a large number of individuals, the majority of whom have never received any basic education or training in its systems or practices. Only in the last few years has there been a steady stream of trained individuals entering the industry to join those whose training was received "on the job". However, both groups are quite clearly dedicated to the emerging industry. The majority of the work force in the industry is comparatively young and this low average age is probably fortunate. Shellfish farming is a hard way of life, requiring attention seven days a week, fifty weeks a year. Compared with agriculture, working conditions in the industry are not good. The work is hard, at times boring, and always dangerous. For example, operating on floating platforms in isolated coastal areas in winter is not appealing. Fortunately the "frontier spirit" of the industry makes many of these hardships endurable. However, the benefit of the frontier spirit will not last for ever and in many regions there is evidence that the production and profitability of the farms have been reduced by social problems often associated with working in peripheral locations or on offshore sites. Lives have also been lost both through accidents at sea with heavy lifting equipment and gear, and through pure acts of nature.

Diverting the Risk in Shellfish Farming

Many of the risks identified and analysed by shellfish farmers can be reduced by varying degrees, yet few can be entirely eliminated. Thus they have the option to absorb these risks themselves or to divert them. An important option available to the farmer is to insure the welfare of his molluscs against the risks and this is one of the most well-used and practical techniques for handling risk. Insurance provides the best option for the shellfish farmer to divert his risk, or to share it with others. It should be a satisfactory and reliable means of managing risks for the farmer. There are many risks, and parts of certain risks, which are worth insuring against as these will inevitably and frequently occur. The insurance underwriters level their premiums to cover the cost of ordinary losses, allowing also for a profit, and an "uncertainty" margin to enable them to establish a reserve for disasters and catastrophes, which occur from time to time. The role of insurance, as the principle method of diverting or sharing the farmer's risk exposure, is an important one which merits examination and explanation. Insurance is already the established mechanism for managing the risks of many existing enterprises and the presence of an active insurance industry in the shellfish sector provides the lending institutions with the confidence to make loans to the farmer. However, because of the high risk of the industry and the lack of all the right technology, many underwriters are being extremely circumspect about providing insurance, or are severely restricting their cover. According to **Morris (1992, 20-21)** insurers of aquaculture business all over the world have been losing money on mortality insurance cover. The level of premium is likely to depend on the volume of business and the proportion of profitable policies. As long as the business remains comparatively small, and claims for losses high, there will be little chance of reducing premiums. Underwriters have become more selective, and on the whole the availability of insurance cover is shrinking. Unfortunately, this is coincidental with a time of great need for additional capital investment in the farms, particularly by private and financial lending institutions. The confidence in the industry displayed by the insurance companies is necessary, as their role is important in the overall success of the enterprises.

Insurers are skilled assessors and their attitude to the shellfish farming industry is therefore indicative of the inherent risk level in farming, which should be taken by the collective shellfish industry as a warning that many procedures in the industry are far from satisfactory.

SUMMARY

While it is still difficult to generate comparative figures, it is generally believed that the many risks associated with aquaculture are substantially greater than in any other form of animal husbandry (**Gerhardsen: 1979, 10 -22)** and this is mainly due to the fact that the production of the enterprise products takes place in water, which is not easily observed and controlled by the shellfish farmer. **Secretan (1979, 63 -70)** observes that there are very few other stock rearing enterprises that are so exposed to such potential and rapid loss of stock from so many varied risks. The risks identified include loss, or loss of value, from disease and pollution, equipment breakdown, extreme weather conditions, health and safety risks, social risks, marketing, consumer and financial risks. Of all these risks to the Irish shellfish farmer it is difficult to judge which one will cause maximum losses but work undertaken by **Gerhardsen (1979)** and by **Secretan (1986)**, would indicate that the risk of loss through disease is the major reason. This loss of stock through disease will also cause added enterprise business risks such as price risk and other sundry risks like claims on customers and advances to suppliers.

Being deemed a high-risk industry also seriously affects the availability of venture capital. In evaluating the investments in the industry, cash flows may be discounted at a high - risk rate and this may affect the attractiveness of the enterprise to the potential investor. The role the Government plays in the promotion of the aquaculture sector has a significant impact on the management and control of risks. Some of these impacts do not arise through actions directed towards the shellfish farming sector itself, but actions directed towards associated or competing sectors such as tourism and conservation. The industry is also very much managed and controlled

through EU legislation and this also imposes constraints on the ability of the shellfish farmer to control and manage risks.

As a means of limiting some of the effects of these risks, the shellfish farmer can for example protect his investments by forming a limited company **(Gerhardsen: 1979)** but less than ten per cent of shellfish farms in Ireland are limited companies. This protection offered by establishing a limited company will only have the effect of limiting individual risk and therefore does not offer the scope to cover the many industrial risks.

As a means of diverting risks on the shellfish farm, the farmer will use insurance where possible. This is a way of covering risks and in some way represents security of the interest of all those who are financially involved in the enterprise. The risks to the enterprise are not a homogeneous concept and are measured as either the probability of occurrence of the risk or as to the variability in outcomes. While many of the risks can be classified according to the cause of the risk, there is some doubt as to whether these can be divided into commercial or insurable risks. Insurance on the important insurable interests of the enterprise however, does make it somewhat easier for a small sized farm to obtain bank credits. Because shellfish farming is a new industry dealing with a high risk activity, both the underwriters and the farmers face problems in choosing the type of risk to be covered.

Another way of limiting or diverting the risk in shellfish farming is the compliance with standard codes of practice for the industry. Such a practice was introduced for Irish oyster farmers **(Bord Iascaigh Mhara: 1996b)**. Standards and codes of practice for the industry can be useful, not only to the economic strength of the industry as a whole, but also to the farmers and their suppliers to help reduce their individual risk. For example, the EU Regulation on shellfish marketing guarantees the safe handling of shellfish products and where this Regulation is adopted, the farmer has the opportunity to meet the desired product standard. Meeting strict standards will require increased facilities but also at the expense of profitability. However, meeting these standards will help eliminate some of the grey areas, such as quality control, where there is little clear division between acceptability and unacceptability.

Risk may also be reduced by the shellfish farmer making use of the Hazard Analysis Critical Control Point (HACCP) scheme. This is a system which identifies specific food safety hazards and the preventive measures for their control rather than relying on end-product testing. HACCP as a management system is primarily concerned with the contamination of food products and the implementation of procedures aimed at minimizing the potential for contamination. Unlike the requirements of Government and EU legislation, both the HACCP and the oyster code of practice standard are merely voluntary systems and are not mandatory for shellfish products.

The need for risk taking and decision-making by the shellfish farmer on various aspects of shellfish farm operations and organization is recognized. Regardless of all the data analysis and application of economic principles, in shellfish farming these cannot completely replace the farmer's task of risk taking and dealing with uncertainty.

To what extent the shellfish farmer can deal with these situations through innovation will be dealt with in the next chapter.

Chapter Eight

INNOVATION AND SHELLFISH FARMING

Introduction

Innovation and entrepreneurship have been inextricably linked in the literature since Schumpeter researched it in 1934. Recent studies exploring this area have included **Casson (1982)** and **Akhouri (1978)** who present an economic profile of the entrepreneur as someone who is prepared to take innovatory risks others would not contemplate. Innovation is generally conceptualized as technological innovation involving products or processes. **Casson (1982)**, however, makes the point that innovation is the technological aspect of the more general phenomenon of adaptiveness, which has always been recognized as being at the root of entrepreneurship, as well as of business and more general economic achievement.

A study by Utterback and Reitberger **(Whittington: 1986, 51-78)** identifies a number of relationships amongst entrepreneurial qualities, innovation, and commercial success at least in the medium term, including the importance of the technical and commercial abilities of the entrepreneur. This is especially so of their ability to produce technologically differentiated products of high market acceptance, and to finance such development both through acquired and borrowed funds and through the generation of gross margin of sales. **Adams and Walbank (1981)** found that there were plenty of ideas for innovation, the problem being selection. The small firms they studied had no organizational arrangement for selection which was an internal subjective process, conditioned by an unwillingness to consider future risks and the underestimation of the efforts and resources needed to succeed. Technologically innovative development strategies were only one of a number of possible types. Other successful strategies involved the domination of scarce resources such as skills or materials, or the creation of local monopolies in location sensitive operations such as retailing and service industries.

Schumpeter (1939, 87), who ascribed a key role to the entrepreneur in the process of economic development in contrast to many earlier theories, stressed the unique connection between the entrepreneur and innovation. He then defined innovation by means of the production function. He considered the entrepreneur as the prime mover in economic development and his function is to innovate or to "carry out new combinations". The "new combinations" comprised the qualitative economic changes which he visualized as central to economic development. Also Schumpeter clearly distinguished between entrepreneurial and management functions and he emphasised that the nature of the entrepreneurial function "only shows up within the process of innovation" **(Schumpeter: 1971, 35)**. He recognized that the entrepreneur may at different times carry out both innovative and managerial functions, but not all individuals who carry out managerial functions are able to carry out entrepreneurial ones **(Thomas: 1984, 4)**. Schumpeter believed that only the entrepreneur was capable of the innate unlearned "acts of insight" necessary to innovate, whereas the behaviour of managers was manifested only in "acts of skill" **(Thomas: 1984, 7 -8)**.

Becket (1986) further argues that innovation is not just about new ideas, but is about minor improvements to products; product range extensions; slight differences which can make considerable differences; and also unsuspected spin-offs. The whole concept of innovation in fact would appear to take many forms and the search for new, or existing needs, could apply to all the functions of any enterprise.

THE NEED FOR SHELLFISH FARM INNOVATION

Shellfish farming is only now beginning to emerge as a mature enterprise activity. The industry itself has grown steadily, markets for shellfish products are becoming increasingly international, the physical and social environment is becoming a major constraint and consumers in developed markets are demanding better and safer quality shellfish products. Shellfish farming is also increasingly being considered not only for its production potential but also in terms of its role in coastal land and water habitat protection. Shellfish farmers have a need, therefore, to maintain natural resources, improve their competitive position and assume an increasing responsibility for quality production and environmental care. From the business enterprise point of view, the shellfish farmer has to optimize farm production management so as to control production costs, minimize any environmental impact, and maintain stock management and quality control.

An important element in this concerns his ability to monitor the quality of the environment for his shellfish products, the need to reduce and manage all types of risk and to assess the quality of the farmed products at each stage from seed to post-harvest. The need for shellfish farm innovation and technology, and the ability to develop or adapt existing technologies to suit local conditions, are aspects to be taken into account in achieving these tasks. However, as problems in shellfish farming are very often site-related even well established innovations and technologies have to be adapted or modified for local and regional application and examined to determine their economic viability.

The extent of innovation undertaken in the shellfish enterprises in Ireland is mostly at the technological level. This innovation is an ecological process and spans a range of activities from the initial idea of developing the enterprise through to growth and production of marketable shellfish products. Certain exogenous elements such as the needs of the shellfish farmer, his social values, and the peripheral coastal region economic and environmental structure also affect the rate and nature of shellfish farm innovation. This process is a creative endeavour and as such arises from the interaction between the shellfish farmer and the socio-economic environment in which the enterprises operate. However, in the shellfish farm industry, innovation is traditionally carried out in research involving farm stock biology and production environments. Very little research is carried out on the much wider multi-disciplinary and technical aspects involved in the operation and management of shellfish farm enterprises.

In the case of peripherally located shellfish farming, this industry has progressed from being a rather restricted, insignificant, localized activity in the early 1970s to become a widely dispersed and relatively important enterprise at present. It could only be expected that this new and emerging enterprise should face many problems getting established. Accordingly, shellfish farming has faced many of these anticipated problems during the period of its development. But what was probably unforeseen in those pioneering days, was that during this short period, it had to encounter many situations and problems that are common to more highly innovative industries. Some of these considerations included sector competition, economic production levels, trade restrictions, financial problems, environmental concerns, as well as national and international regulations and controls.

The expectations in the early stages of the shellfish farm innovation cycle were that it would be relatively unproblematic in that there is a reasonable and growing pool of ideas in shellfish production which could be exploited. Rather, it was implied that the problem was to transfer these ideas from their source to where they could be developed and deployed successfully in commercial terms. Closer inspection of the technology process of shellfish farming however, indicated that the problem was more complex, as was in many cases the subsequent step of moving to volume production. Quite apart from the purely technological problems encountered in shellfish production there were many social and environmental restrictions to be considered. In their study of innovation, **Mole and Elliot (1987)** maintain that commercial considerations are not always appropriate in the early stage of any innovative process and certain aspects of what they described as the socially-directed innovation process had to be encountered.

As the shellfish industry grew and developed many new regulations and restrictions were put in place in an attempt to regulate and control the industry better. These regulations included proper site technology assessments and environmental impact studies. Subjecting shellfish farm development technologies to these forms of social control also created a number of difficulties for the shellfish farmer. For example, in the early days some shellfish farm innovations were introduced and established a momentum of their own. But due to a lack of information and communication, these led to social confrontations as more and more of the local communities in which these enterprises were established and which were previously unaware of the impact of these innovations, began to take sides as to the merit of these enterprises. An example of this was the introduction of a new long-line seabed anchoring system of mussel cultivation in an area traditionally used by inshore fishermen that eventually led to local opposition and the abandonment of the project. The question also has to be asked whether the majority of shellfish farmers are merely copying a successful strategy of shellfish farm management and therefore making no contribution to innovatory growth. Yet because of the many risks involved in operating a shellfish farm, this presents many difficulties which can only be overcome in an innovative way. For example, the shellfish farmer depends completely on the cultivation and health of his shellfish products and must be fully aware of the well-being of the entire stock and therefore initiate necessary remedial measures when this is required to safeguard his stock. Risk factors such as stock mortality for instance, caused by disease, are capable of being controlled by applying suitable shellfish farm innovative procedures.

In the situation where location may have an impact on the innovation process, studies undertaken by **Malecki (1981, 312-334)** on science, technology and regional development indicated that there are three types of region and each of these regions demonstrated a different phase of innovational development. Some regions have an innovatory potential, other regions have an entrepreneurial potential and yet other regions being these together to give self-generated prosperity. He described these regions as: core central regions, intermediate regions, and peripheral regions. He described the peripheral regions as technically isolated regions in which agriculture tends to be the largest sector in employment or those formerly dependent on the extractive industries which are the largest group in the labour market. The overall technical culture in these regions is heavily influenced by the low technology, efficiency, and quality of the agricultural sector. Indigenous industrial employment is largely in more traditional industries but at a lower level of technical practice and quality. These regions are isolated from the best technical practice and have not within themselves the technical progressiveness to search for the best practice and new knowledge and to adopt it speedily. They are cut off from nutrient information flows. Malecki did, however, find strong entrepreneurial potential in that their populations had a large proportion of independent or self-employed people in farming, small industry and local services. Skills in these regions were generally not transferable to other industries and they tended to be introverted regions. Therefore, for these reasons, they lacked progressiveness, innovation, and entrepreneurial potential.

The profile made of the shellfish farming regions did show that most of these regions had in fact a structure similar to that described by Malecki.

Shellfish Farm Innovation and the Peripheral Region Dimension

Many of the peripheral coastal regions where shellfish farming is practised have the characteristics which have been described in an earlier chapter. **Malecki (1981, 312-334)** saw that the essential problems of these types of regions stemmed from being technically isolated. This meant the following:

- the stock of knowledge and technical culture is low
- there are virtually no large local customers strongly linked to other and progressive regions; nutrient information flow is weak, with a lower level of awareness and opportunity and little technology
- the logistic information cycle time tends to be long which with the lower levels of skills to implement new activity reduces such potential as exists
- the indigenous industrial sector is very largely in small firms and a strong entrepreneurial potential exists in the agricultural regions but this potential is frustrated by the low innovative potential
- networks in these agricultural regions between entrepreneurs tend to be good but are not linked effectively to sources of information which are very largely located outside the region

Fothergill and Gudgin (1982) and **Lloyd and Mason (1984)** provide evidence that there is a tendency for most new enterprises to be located in regional areas where the innovator was a local resident or had worked in the region immediately before setting up a business. This was generally the case with Irish shellfish farmers. Knowledge of the local competition for the resources in the region as well as available labour were other considerations for the development of the enterprise in the region. The reduction in uncertainties also appeared to be a strong motivator in commencing the shellfish enterprise in the region.

In terms of the shellfish farm innovation process not all innovation may be desirable in social terms within these regions. However, innovation in shellfish farming is now a part of social as well as purely technological and commercial policy. The existence of specific know-how of shellfish farming is an important element in the establishment of the enterprises in peripheral coastal regions. This is particularly true in cases where the technology of shellfish farming can be updated and adapted to any new technologies or methods of shellfish farming. The establishment and development of these enterprises in these regions is in large part determined by the shellfish farmer's skills at farming and their potential ability to adapt these skills to new technologies. This ability may determine to what extent a region is likely or not to generate innovative shellfish farm enterprises. For example, a survey carried out by Boulianne (**Maillat: 1988, 71-83**), which asked regional enterprise owners to assess the importance and identify the origin of skills, generated three types of answers. The first group of owners considered that skills know how depended on the environment; a second group that the only source of skills know-how was the enterprise itself; and a third group that skills know how did not exist. A comparison of the answers with the characteristics of the enterprises considered skills know-how to be environment-related. For these enterprises, the skills know-how rested on the professional conscientiousness, experience and sense of responsibilities of the enterprise owners.

Because of the dynamic nature of shellfish farming, the know-how skills are obviously not acquired once and for all. They are accumulated through learning and experience, and have to be maintained and developed. It is not easily transferred owing to its relation to time and experience. They also depend on the availability, circulation, and use of shellfish farm instructions and information and the work atmosphere. Moreover, these shellfish farm skills may be a mixed blessing in the sense that some acquired habits can only be overcome with respect to new technologies and practices. This shellfish farming know-how can be an essential environmental factor resulting from a multitude of interactions between shellfish farm enterprise and the peripheral regions. In many cases it constitutes the distinctive trait of a region, for example in the Bantry Bay region, and undoubtedly represents a comparative advantage. However, the location peripherality of these shellfish farms rarely provides the specialized service for innovation. These regions may constitute a real impasse for shellfish farm innovation as well as in practical terms. For example, it is difficult to determine whether a certain degree of proximity should exist between shellfish farming innovation and specialized services. Research carried out so far has not provided a unique and definitive answer. Some research has concluded that a lack of proximity presents no real handicap for innovation, while other research has implied that service activities are essential to the smooth operation of territorial production systems **(Maillat: 1988, 71-83)**.

To break this impasse, it may be necessary to look at the shellfish farm production system as a whole, rather than at the individual regional needs in isolation. Despite the fact that shellfish cultivation has existed for almost 4,000 years, the present technology of shellfish farming has largely been developed by trial and error rather than by scientific research. This accounts for the empirical nature of many of the shellfish farm practices and the generally low level of technology and innovation. When compared to agriculture, which has benefited by over 100 years of research, experimentation, and field trials, shellfish farming in Ireland as a science can be said to be only in its very infancy. Any research conducted on shellfish farm technology therefore, tends to be carried out by the universities and the State agencies. A review of shellfish farm research so far would show that efforts to innovate and solve individual problems in isolation have not led to any appreciable improvements in production. For example, the development of an innovative technique for the controlled reproduction of shellfish in itself is not likely to lead to any major improvements in production technology unless suitable methods of hatching, larval rearing, nursery practices etc. are also developed in the region. The new innovative system must encompass a certain number of backward and forward linkages. Recognition of the connection between this innovative production system and the need to update and maintain regional know-how leads to the hypothesis that these activities call for a certain proximity if regional know-how is to be implemented

Shellfish Farm Innovations

Shellfish farmers who replicate existing methods of shellfish farm development and imitate shellfish cultivation techniques may seldom need to initiate change in their method of production. There are however, some shellfish farmers who do initiate and introduce some new processes of shellfish cultivation and management. **Schumpeter (1939, 2-5)** regarded innovation as the discovery of a new technique as the initial event and the implementation of this new technique as the final event. Innovation research by **Susskind and Zybkow (1978, 4)** implied that there were three major points concerning the innovation process: 1) it is a response to either a need or an opportunity: that is it is context dependent: 2) it depends on creative effort, and, if successful, results in the introduction of novelty; and 3) it brings about or induces the need for further change.

While shellfish farm innovations can be technical or commercial, steps needed to implement new shellfish cultivation processes or to eliminate of shellfish farm risk, involve the introduction, adoption or modifications of existing shellfish farm operations. These innovations are undertaken in order to extend the viable life, health, and growth of the shellfish products and to adapt to new social and environmental circumstances. In **Schumpeter's (1934, 66)** definition of the concept of innovation as the "carrying out new combinations" he suggests that this should cover the following five situations:

- the introduction of a new product (or improvement of existing ones)
- the introduction of a new process
- the opening of a new market (exporting)
- the identification of a new source of supply of raw materials
- the creation of a new type of organization

This list is not exhaustive and other types of quantitative change may be initiated by entrepreneurs. The farming of shellfish may well include some elements of the Schumpeterean definition of the innovative act.

Sweeney (1987, 102) further adds to the definition of innovation by stating that:

> Great or small, a long leap or a small increment, innovation is what entrepreneurs invest in. They feel that they have something through which they can create wealth even if it is only at the mundane level of earning a living. Creation of a new

economic activity through the foundation of new firms occurs through the union of entrepreneurial and innovative potential. Innovative potential is complex. Its presence, like entrepreneurial potential, does not guarantee the creation of new economic activities and therefore growth. It is the essence of the stock of knowledge of a locality. The conversion of this into innovation is dependent on characteristics associated with technical progressiveness - the willingness to give and to receive information, buy rather than make policies and decentralisation of decision-making.

The following are examples of some of the different types of shellfish farm operation innovations as undertaken by shellfish farmers in the peripheral coastal regions. These cases were discussed at the Bord Iascaigh Mhara Resource Development Unit meetings which the author attended during the period from 1993 to 1996.

Case One

One of the first commercial shellfish farms commenced operation in the Wexford Bay area. This 25 square mile bay was an ideal site for Dutch-style bottom cultivation of mussels and was favoured by the natural environment of the shallow bay. There was also a good and abundant supply of local (Wicklow) seed, proximity to export markets through the Rosslare ferry service, local co-operation and an absence of competing water users in the bay. The principle of this extensive mussel culture enterprise was to remove seed mussels from rocks offshore and carry them inshore where growth could be accelerated. The mussels were then relaid in numbered "parcs" which were dredged at a later stage for export. The advantage of this type of Dutch system was that the mussels were submerged most of the time and a high degree of mechanism could be employed in recovering the grown mussels. In adopting this Dutch method of shellfish cultivation, a number of difficulties arose for the Wexford operators. These included: 1) high mortality of seed level, 2) predation, 3) silting over of mussels and 4) a low meat yield which was also gritty. Since the initiation of the laying programme it was later found that the seed quality and availability deteriorated. This falling quality also led to a decrease in the survival rates of the seed. From an average of 1 tonne of seed laid to produce 3 tonne of mussel in the early stages of development, 1 tonne of seed now only produced one tonne of mussel. This deterioration was also accounted for by the increase in predator numbers due to the mounting mussel numbers. New ways of increasing the tonnage of mussels cultivated had to be introduced. Greater emphasis on better management of the "parcs" was introduced. This was based on a system of controlling and monitoring areas for dredging the seabed. Traps were also laid for mussel predators such as the Carcinus and Liocarcinus crab. So many of these predators were captured that eventually an export market was developed for this crab.

Case Two

The mortality rate of the shellfish products was a constant uncertainty for the farmer and new methods and ways of limiting and controlling this situation had to be found. The development of rope-cultured mussel as practised in France was a relatively new phenomenon in Ireland. The first experimental work was based on the Spanish raft system and a pilot scheme was launched by Gaelterra Eireann in Killary in 1975. These improvised first rafts varied in cost and design and were constructed of sawn timber as the framework, forestry poles as hanging beams and scrap plastic drums as flotation. The industry experimented with the development of a more sophisticated system of production. Ferro-cement welded steel or fibreglass platforms capable of supporting up to 100 tonne of mussels were developed. These rafts had advantages in the fact that not only could they bear the weight of the mussels but also provided a working platform for the shellfish farmer.

Case Three

A further development in mussel cultivation was the long-line process, which was a cheaper and easier system to construct. More importantly, however, this system produced better growth rates of mussel. The flotation of long-lines consisted of scrap plastic barrels frequently imported containing detergent and fruit concentrate. This led to the development of purpose-built polythene floats. The suspension of mussels in this three dimensional environment also maximized the use of available space. Other innovative advantages of suspended mussel culture were: 1) 100 per cent submersion, 2) mussels were removed from bottom living predators, 3) faster growth rates were achieved (four times faster than wild bottom mussels), 4) the condition of the flesh was improved and 5) mechanization was made possible.

Case Four

Spat that had settled naturally on mussel long-lines was removed and the seed ongrown in pergolari netting at a stocking density of some 4,000 - 6,000 mussels per metre. The density in which these mussels were repacked was crucial to the growth rate of the mussel. Local environmental conditions also caused differing growth rates. Thinning of the mussel seed was introduced at a later time of the year when the occurrence of fouling organisms was reduced. A new technique was introduced by the industry where mussels were grown on submerged vertical lines from just below the surface at 60 feet. Fouling was reduced and the system led to the growth to maturity of the mussels at a much faster rate.

Case Five

Native oyster beds were unmanaged in the past in Ireland and this led to the drying out of these beds. This was basically caused by over-fishing and exploitation of the beds. Action taken to revitalize the production of this oyster involved a number of initiatives such as the creation of ponds to produce seed, the use of spat collection on small self-reproducing populations, laying of cultch for more settlement and the setting up of hatcheries.

Case Six

On a shellfish farm in Cork, seawater was pumped into an artificial pond lined with butyl rubber. After a week approximately 1,000 broad oysters were placed in racks in the centre of the ponds. By mid July the water was warm enough to induce the oysters to spawn. Eggs were fertilized in the mantle cavity of the female and were brooded for two weeks. The larvae were released and swam and fed in the plankton for two weeks. At that stage washed and aged mussel shell was introduced to collect the oyster spat. Over three days the larvae metamorphosed into young oysters. After one month the mussel shell was scattered on the seabed and after three to four years the oysters were harvested for dredging. At harvest time the mussel shell had virtually disintegrated leaving individual oysters.

Case Seven

Some 99 per cent of mature larvae fail to settle successfully in nature and the absence of a suitable settling surface was the prime cause of this mortality. Providing mussel cultch as a settlement media was introduced by some shellfish farmers in the Kilkieran Bay and Tralee Bay. This experiment failed to work, however, in the farms in the Clew Bay area. It was suspected that local hydrography may be a cause of this failure. To overcome problems of high mortality rates, hatchery rearing of oysters having a free swimming larvae stage increased survival rates as it reduced some of the causes of mortality such as predation, inadequate diet and physical extremes.

Case Eight

Hatchery rearing was necessary for the development of the Pacific oyster on Irish shellfish farms. This oyster was introduced to the shellfish farming industry so that it could lead to continuity of supply of oysters. The Pacific oyster can be harvested during the summer months (May - August) when the native or flat oyster is in a spawning condition. It was discovered that the ambient temperatures of the water on Irish shellfish farms were too cold for the Pacific oyster to spawn.

The Pacific oyster also has a faster growing rate than the native oyster. It will grow to market size within three years while the native oysters will only reach this stage after five years. The farming of these two distinct oysters also was different. The Pacific oyster is an internal species and so can withstand a certain amount of exposure to the atmosphere. It can also withstand muddier water conditions because of the existence of its promyal chamber. The native oyster is a deep water species and so must be submerged at all times.

Case Nine

With the initial introduction of the Pacific oyster into Ireland, new forms of growing techniques had to be developed. Being an intertidal species the Pacific oyster could withstand larger extremes of environmental variations than could the native oyster. Off bottom or trestle culture was designed. Oyster spat was stocked in bags at a density of approximately 1 kilogram per square metre and these were placed on trestles as close to low spring water as possible in order to maintain growth rates. This growing system is very labour intensive as the oysters must be serviced, graded, and thinned at regular intervals. Fouling of the bags is controlled by scrubbing and using a high-pressure hose. The bags also have to be rotated on a regular basis.

Case Ten

The native oyster is a deep water species and results in poor growth when exposed at low tides. Trestle culture is therefore not suitable for this oyster. The shellfish farmer is experimenting with different ways of growing this oyster which involves long-lines and raft culture. Initial results of this type of suspension culture showed good survival and growth rates but fouling of the oysters was intense. This method of shellfish farming produced frilly, thin-shelled oysters which had to be hardened up by laying them on the bottom.

Case Eleven

Sea fishermen in the Waterford region were under-employed due to the decline in traditional herring fishing in the area. They formed a shellfish farm co-operative in order to develop a bottom culture mussel enterprise. They transplanted over 4,000 tonne of seed in Waterford Harbour. Within two years this resulted in the harvesting of over 1,000 tonne of bottom mussel. This harvesting was carried out by the members of the co-operative using inshore fishing boats. A levy of 30 per cent was paid from landings to fund the management and running of the co-operative. The enterprise now owns ten dredgers and has purchased its own sea-going mussel dredger so that it can source its own seed for laying.

Case Twelve

A rural development partnership body was established in the Northwest with the aim of improving the lives of the people in the region involving social community, cultural, environmental and physical aspects. This body was founded by the EU's Poverty 3 Programme and the Combat Poverty Agency.

Shellfish development programmes for local bays with major input from the fisheries development agency and from the fishing co-operatives in the area were introduced. One co-operative had sixteen members involved in long-line mussel cultivation, the other co-operative had ninety members and was engaged in the cultivation of native and Pacific oyster cultivation. The rural development body, Forum, provided administrative support and the State agency and the co-operatives provided technical and financial assistance. A Shellfish Development Partnership Project was established comprising the agencies and the co-operatives. The key elements of the Project were financial and technical support delivered and integrated with Forum's other community and personal development programmes. This involved participation of over 150 people part-time (half were traditional fishermen and others were shellfish farmers and under-employed members of the local community). The aim of this shellfish project was to support new organizational structures and to provide necessary managerial, technical and other training support for the expansion of shellfish farming in the region and to provide the basis for viable and sustainable shellfish farming activities in the region.

Case Thirteen

A road haulier operated the transportation of shellfish products to France and Holland for more than ten years. Over this time he built up a business relationship between the shellfish farmer and the shellfish importer. He identified the problems both the farmer and the buyer had in the case of "just-in-time" deliveries of product. He sold off his transport business and invested in a chilled temperature warehouse where he could store shellfish products. Also having seen a gap in the market-place for periwinkles he invested in a small periwinkle farm operation to supply these products to the contacts he had established whilst in the transport business.

Shellfish Farm Innovation Culture

The innovative potential of a region, like entrepreneurial vitality, is determined by whether it is a central core region or a remote region, whether it has autonomy in information or receives information, eventually, as a transplant from the centre. It depends on the flow of nutrient information, and on the cycle time for logistic information. A region needs a mix of sectors and technologies and occupations so that there is awareness of new technologies. Less-favoured peripheral regions tend to have an even heavier concentration of small firms in the traditional sectors and agricultural resource-based sectors. But here the quality tends to be lower. There is a very slow uptake of the best practice and they are usually a long way down the innovation chain **(Sweeney: 1987, 102)**.

The importance of having a sectoral mix of enterprise activities in these regions lies not only in the creation of awareness through the diversity of information in the information flows but also in the creativity spurred by this diversity. Many shellfish farmers would appear to have initiated the creation of the shellfish enterprise or introduced a new way of conducting their operations as a result of a mix of diverse and disorderly bits and pieces of information flowing in casual and business conversations. The creativity needed for shellfish farm innovation in the early days of its development sometimes appeared to happen when two concepts, bits of information previously un-associated, struck one another and sparked off an action which did not exist before in that way in that location. However, the industry has moved into a new era of regulation and control and the "green thumb" approach to shellfish farming is under threat. The industry in these regions depends to a great extent on the Government and State agencies, extension services, which is the main channel for technology transfer and guidance to shellfish farmers and entrepreneurs. Shellfish farm innovation and technology transfer increasingly comes from State and university laboratories, to field technicians and advisors and through them directly to the shellfish farmers. The dissemination of this technological information has to a limited extent been carried out by the establishment of shellfish farm associations and societies. In recent years shellfish farm conferences and workshops have become frequent features and provide opportunities for the shellfish farmer to disseminate information on new innovations in equipment and production technologies. However, research shows that a certain degree of economic liberalism is necessary to stimulate both innovation and the creation of enterprises and there must be certain operational margins. **Martin (1986)** suggests that a too regulated environment inhibits the development of innovative enterprises. To enhance an innovative culture in such a region he suggests cost reductions in areas as follows:

- Government regulations interfering in the function of markets in which small enterprises operate
- Dissemination of information concerning the economic situation, technological advances, etc.
- Expensive legal transactions required to conclude and carry out the terms of a contract
- Transactions with Government services which force small enterprises to resort to costly consultants

However, with the advent of the Single European Market it is estimated that there are as many as twenty-five different EU Directives and Regulations with which these small periphery located shellfish farm enterprises will have to conform **(European Commission: 1993)**. These range from issues such as health and hygiene on the farm to storage and transport arrangements. As the majority of these Directives and Regulations have as yet not come into force and have a certain derogation period, it is unclear what the impact they will have on the innovative scope of shellfish farming. It appears essential, however, that in order to conform with these requirements the shellfish farmer would have to devote a considerable amount of his time and resources to comply within this framework. A study carried out in Switzerland (**Maillat: 1988, 81**) identified a total of Thirty-five federal laws and regulations having a considerable impact on small enterprises. These ranged from business accounting regulations to laws on environmental protection. The enterprises had to devote an average of nine weeks to the processing of such administrative matters at a mean cost of 23,400 Swiss francs. As yet no such measurement has been made of the cost to the Irish shellfish farmer of complying with these new EU Directives and Regulations. Perhaps it may be only by reducing the onus on the shellfish farmer to comply with these regulations that a more conducive climate will be developed for shellfish farm innovation culture. Naturally, any deregulation would have to go hand-in-glove with a reorientation of the policy for the future development of shellfish farming in these peripheral regions.

The establishment and role of small shellfish enterprises in creating enterprise in these peripheral regions is recognized by the Government. But few measures recognize how local a phenomenon is the innovator or entrepreneur and how local is the environment which appears necessary for this vitality. A study of Gaudin's Six Countries Programme (**Sweeney: 1987,** 14-15) on the creation of an innovative cultural environment states three principles on which technological innovative policy and programmes should be founded and which permeate other policy formation. These are:

- Creation of a technical culture, a cultural environment and a cultural awareness within each individual, of traditional skills and an aesthetic appreciation wedded to an understanding of technology; that is, provision of an environment favourable to innovation of the skills and creativity to generate innovation.
- Direct support to the entrepreneur. Studies of the innovative process have demonstrated that innovation measures should be aimed to provide direct support to entrepreneurs and innovative firms rather than indirect measures or support of projects. The support system in information, advice and services, technical, managerial and financial, should be sympathetic and responsive to the needs of the entrepreneur/innovator and must be easy to approach and therefore local. The orientation of the support system must be the success of the entrepreneur and not job maintenance, job creation, high technology, or other objectives which might in fact inhibit the entrepreneur and his innovation.
- Removal of obstacles to the entrepreneur and the innovator. Innovative entrepreneurial endeavour can only thrive in a climate of optimism and opportunity - the removal of regulatory, procedural, fiscal and other obstacles to entrepreneurial innovation should be taken hand-in- hand with development of policies and attitudes within the administration which cross administrative divisions.

It is recognized by some that tight legislative frameworks for an industry are inappropriate for the needs of the innovative process. For example, **Piatier (1981, 13)** maintains that it is the transfer of ideas and concepts between sectors that is probably one of the forms of innovation that can have a rapid and significant effect on economic growth rates. **Shapero (1977, 13)** also states that "where variety and diversity abound, there is a higher likelihood for achieving meaningful associations of items not previously associated, one definition of creativity".

Socially-Directed Innovation of Shellfish Farming

With the worsening economic and employment climate prevailing in Ireland in the 1970s, technology assessment and environmental impact analysis of the potential for shellfish farming, quite apart from the public participation in the technological decision-making, was seen more as a luxury that could not be afforded. Any assessment made at that time on the potential of shellfish farming in a region was more concerned with employment creation and potential commercial success. Very little reference was made to both environmental and social considerations. In these early days of shellfish farming the emphasis was on enterprise stimulation rather than on enterprise regulation in creating ways to encourage shellfish farming and the introduction of farmed products.

With the advent of the Single European Market general legislation covering food hygiene was introduced to establish standards to protect public health and inspire confidence in the quality of food products. The most important area for harmonization for the Irish shellfish industry, was to allow the free, hygienic movement of shellfish products throughout the Community. In the absence of customs border control the necessary basic standards and control measures were established throughout the shellfish farming industry of each Member State, for all shellfish products from farming and cultivation to retail sale. Because of the many Directives and Regulations introduced by the EU and the Government to control the establishment and social impact of shellfish farm technology, it can now be argued that undesirable technologies emerging from this industry should be avoided and should be engaged only in the early stages of the shellfish farm innovative process. While the development of new technologies for the shellfish industry may be strategically important, any new innovation will be to a great degree influenced by the State and EU intervention. Rather than trying to assess proposed new projects from within the industry, social control of these innovations is now being introduced effectively as part of the funding support by the Government and the State agencies operating at the early stage of the shellfish farm innovation process.

The reluctance of investors to support financially a high-risk business such as shellfish farming in the early development stages necessitated the support of State agencies and local development bodies. This meant that these bodies could, at least in principle, apply non-commercial criteria in selecting many of theses enterprises to support. This system of State financial support was practised for other industries besides the shellfish-farming sector; it has led to the situation where the requirements for the further development of the industry are now greatly influenced by Government policy. This intervention has effectively imposed ways of introducing a wide range of social, environmental and political criteria into the innovation process of the shellfish farmer. For example Community measures designed to improve and adapt structures in the shellfish-farming sector are outlined in Council Regulation No. EC 4028/86 (**European Commission: 1986**). This states that structural measures must as far as possible be implemented within the framework of multi-annual programmes which ensure that Community measures are compatible with national measures and with the objective of regional policy. This programme sets out the objectives and means necessary to develop technically viable and profitable facilities for the farming of shellfish. These industry support programmes must have the following information made available before any support is sanctioned:

1. An assessment of the importance of shellfish farming in the various regions concerned
2. Initial situation on type of shellfish being farmed and species being produced
3. Estimated potential of shellfish production in the region concerned
4. Impact on the shellfish industry at the present situation and the foreseeable trends in the market for shellfish products
5. Description of the strengths and weaknesses of the shellfish industry requirements covered by the programme
6. Investment needs during the period covered by their programme to obtain the objectives pursued
7. Prospects and investments envisaged for the establishment or development of protected marine areas
8. Measures planned for the protection of the environment

This policy and legislative action taken by the Government to control the shellfish industry has significant impacts on the management, control, risks and indeed innovation in the industry. **Idyll (1986)** in an international survey of aquaculture regulations states that governments have a tendency to over regulate the industry. He maintains that unnecessary regulations which form a significant barrier to desirable and necessary innovations in the industry should be eliminated, others made more flexible and new legislation introduced. However, he also acknowledged that there will always be an ambivalence towards aquaculture legislation and regulation - the views of those in the industry, those outside the industry and the government and those views not always in agreement. **Neiland and Mennillo (1990, 2)** further add that the broad objectives of control relevant to shellfish farming should include: the protection of the physical environment, the protection of the consumer and the encouragement and sustainability of the industry. The **Irish Shellfish Association (1991)** emphasize the point that the individual shellfish farmer has to operate within a complex web of legal instruments which inhibits the innovation process. In a study on the operation of Customary Tenure Management (CTM) in the fisheries industry, **Tillay (1994)** advocates that the promotion and control of fisheries activities be delegated to local and regional control. His study shows that in innovative matters such as stock enhancement, management and environment control is much better organized at regional and voluntary level with less interference from the State. On the other side of the argument is the thesis put forward by **Keary (1991)** that the sea as a resource has unknown potential and any privatization would have unpredictable consequences.

SUMMARY

Defining innovation in shellfish farming, like defining shellfish farm entrepreneurship is an extremely varied phenomenon and it is difficult to determine to what extent shellfish farm practices can be deemed to be innovative. However the combination of initiatives required to cultivate shellfish products would suggest that there was a certain level of innovation in shellfish farming. The shellfish farmer by developing the farm, for example, introduced a change into the market for seafood products, and action such as this led **Shapero (1977, 13)** to the conclusion that the real innovation was the founding of the enterprise. He maintained that the means by which the enterprise creates new wealth and replaces declining economic activities is secondary. Creating new wealth by meeting a market need through imitation of an innovation elsewhere is the essence of economic growth. Earlier studies on technological innovation and natural resources identified innovation and technological change - in economic terms if not in geological terms - as making continuous additions to the resource base of a region. While the Irish shellfish farmers may have imitated shellfish practices as used in other countries such as France and Holland, a great deal of adjustments in these practices had to be introduced so as to comply with both the environmental and economic conditions under which the Irish shellfish farmer had to operate.

Shellfish farm enterprise founders who replicate existing modes of production and imitate shellfish cultivation techniques seldom need to initiate change in their method of production. There are some shellfish farmers who do however, initiate and introduce some new process of shellfish cultivation and management. While these shellfish product innovations may be the technical and commercial steps which result in the implementation of a new technical process or the development of a new market for the shellfish product, these developments involve the

introduction, adaptation, change or modification of existing shellfish products. These innovations are undertaken in order to extend the viable life, health and growth of the shellfish, to adapt to new social and environmental circumstances and to introduce new customers or markets for the product. In the framework of a Schumpeteeian analysis much attention has been given to the role of small enterprises in innovations. Yet an analysis of the effect of the size and location of the enterprise upon innovations and on the transformation of research and information input into output has as yet not yielded any entirely conclusive answers. There are suggestions however, that in order to stimulate indigenous regional development by means of small enterprise policy, access to higher education and scientific and technological research institutions should be improved, venture capital and other innovative structure-improving infrastructure should be provided, and the establishment of regional technology networks should be promoted.

FINDINGS OF THE STUDY

The main findings of this study are summarized under the four broad objectives set for the development of the shellfish farming industry.

1. **Does Shellfish Farm Production Fill A Growing Gap Between Demand And Supply For Fish And Fishery Products?**

Shellfish production in Ireland is generated mainly by over 300 small-scale independently owned and operated shellfish farms situated in the most peripheral coastal regions of Ireland. The vast majority of these farms produce less than 20 tonne of product per year. The development of these enterprises was brought about by a number of factors, the potential availability of suitable sites for shellfish farming and the generous grants and support systems available to establish these shellfish farm operations. Also the desire to fulfil market demand for shellfish products both on the export and domestic market were further influences. The availability of potentially suitable sites for shellfish farming was probably the most important factor in determining the feasibility of viable shellfish farm production units.

The contribution shellfish farm production made to the overall marine seafood industry supply increased from 4 per cent of volume in 1980 to 10 per cent of volume in 1996. During this period the total shellfish farm production increased from 5,000 tonne to 18,900 tonne. This was made up of 7,000 tonne of rope mussel, 7,500 tonne of bottom mussel, 4,000 tonne of gigas oysters and 400 tonne of native oyster. The biggest contributor to this increase in production came from rope mussel cultivation and in the production of gigas oysters. The production of bottom mussels and native oysters during this period remained static. This shift in production can be attributed to several general causative factors and influences as follows:

- Higher value and better quality produce from intensive shellfish farm systems: e.g. rope-grown mussels attract higher market prices than bottom, extensive product
- Facilities allowing the dissemination, uptake and adaptation of intensive farming technologies within Europe and elsewhere from the State development and support agencies
- Provision of grant-aid from State development agencies for pilot and commercial intensive rearing technologies
- Development agencies, institutions stimulating the dissemination of expertise through support services, extension services, technical advice, marketing initiatives and training programmes

The production targets for shellfish farm products were originally estimated only by projecting the likely current and future demand both for home and export markets, for shellfish products. This was considered only in general terms and was based on what was likely to be absorbed in the market and assessed largely on consumer preferences and anticipated production and supply in other shellfish producing countries. Also most of the shellfish farmers relied on past experiences in sales and anticipated a short- fall in export markets such as France and Spain in order to achieve their sales and production objectives.

There were, however, many other factors to be considered in respect to the feasibility of achieving desired shellfish production targets. These included climatic conditions affecting the farm, access to markets, suitable communications and infrastructure, availability of skilled and unskilled labour, legal and environment conditions and funding and financing arrangements. The legal and environmental right to establish and operate a shellfish farm in certain regions in the future will also likely limit the number of sites available for development.

Shellfish farming is still only a small-scale activity. Culture technologies in these farms are far from perfect and efforts to develop and improve production technologies are still in the early stages. Being a relatively new industry, the gestation period, in comparison to fishing and other forms of food production, is long. Even when farm technologies are adapted, the build up of a productivity system and the attainment of skills by the owners and workers can take considerable time. The lack of allowances for such time lags often resulted in premature termination of many enterprises. The type of statistics that are needed for an appraisal of this situation were unfortunately not available.

In shellfish farming in Ireland the emphasis was on the development of small-scale operations rather than on larger production units. The belief was that small-scale farming was generally more relevant when one of the main objectives was the socio-economic development of peripheral coastal regions. By encouraging the establishment of these small-scale operations it was believed that they would form an integral part of rural development and employment.

There are many biology-dependent activities occurring between the shellfish farmer and his production objectives and many of these are high risk. As there are different practices and environments in which the shellfish farmer operates, any attempt to produce a simple framework for the identification of the most common risks on any one farm is not easy.

In addition, the exposure to different types of risk can change during the life cycle of the shellfish product. There are few other stock-rearing enterprises that are exposed to such rapid and extensive loss of stock from so many varied causes. These loses in production can be caused by disease, water quality, breakdown of machinery and equipment, predation, extreme weather conditions and pure negligence. As many shellfish diseases and causes have as yet no known cure, infected and contaminated shellfish cannot be harvested and the magnitude of the production risks involved becomes evident. The Achilles' heel of shellfish production is still deemed to be the naturally occurring phenomenon of a toxic algal bloom known as the "Red Tide".

For the future development of shellfish farm production units it will be necessary to define specific objectives, policies and strategies that are most suitable for achieving selected production goals and targets in this changing environment. The original objective of shellfish farm development to "fill a growing gap between demand and supply for fish and fishery products" may no longer suffice. The need for more clearly defined policies and plans for shellfish farm production will have to be recognized. These goals should be based on macro-plans, specific development projects, or plans that can be formulated by both the public and the private sector. Feasibility studies on the technical and economic viability of select shellfish farming zones should be undertaken. However, a number of situations will evolve in the immediate future which may well have a profound impact on the future production capabilities of these small-scale operations and on the future viability of these shellfish farms.

2. Will Shellfish Farming Develop Into A Healthy And Viable Industry?

A major barrier to the future development of the shellfish farm industry will be the fact that EU financial support for the industry is anticipated to be greatly reduced by the year 2001 **(White: 1997, 10-11).** The application for grants for the development of shellfish farms under the FIFG Agreement is due to expire in October 1998. The shellfish farmer depends to a large degree on grant aid from the Exchequer and the EU to establish his shellfish farm operation. Having to source his own funds or seek private investment for development could prove prohibitive. Further funding for shellfish farm operations will also be more closely monitored so as to:

- fix maximum EU grant cost per job
- limit support to projects with output/employment commitments
- proof projects for dead-weight impact

Already indications of the lack of enthusiasm for the future development of shellfish farming are beginning to appear. A recent financial scheme devised by the EU (PESCA) was introduced in order to help the fishing sector succeed in adapting and diversify the socio-economic fabric of these coastal regions. The aid programme also focused on the retraining of fishermen to diversify into other activities such as shellfish farming **(Bord Iascaigh Mhara: 1994)**. In the Fourth Round of this Programme only 13 per cent of this fund was taken up for shellfish farm development **(Bord Iascaigh Mhara: 1998, 4-5)**.

Secondly a new system of legislation for the shellfish farm industry may also inhibit the growth in production of farmed shellfish products. The Minister for the Marine announced in 1996 that he was eager to bring forward new legislative proposals for the industry as quickly as possible. He declared that:

> It is essential to strike the right balance between quick delivery of licences and adequate consultation, on the one hand the industry wants a system that deliver licences in accordance with agreed criteria in a reasonable time-frame, on the

other hand, third parties, or potential objectors want a meaningful say in the licensing process and to have their views taken into account fully. The new legislation process will seek to achieve the optimum solution to both these requirements. This will include a specific appeal mechanism which will be outside the Court system.

Gilmore (1996, 10-11)

The aim of this proposed new legislation is to introduce better control and management of the number of farm enterprises being licensed and to better control the development of the industry. At present only 4 per cent of shellfish farms have a complete licence to operate. Apart from the unacceptability of this situation from a legal point of view, it created difficulties for the shellfish farmer in obtaining loan finance and in dealing with possible local conflicts. Shellfish farmers at present operate within a complex web of legal instruments granted under a succession of Government legislation. Whether this new system of licensing proves to be successful has yet to be judged.

A third aspect to be considered in the further expansion of the industry is the implementation of the many EU Directives and Regulation coming into force. Each Member State of the European Community has its own legal framework which influences the way their shellfish farming industry is developed. With the creation of the Single European Market in 1992 it was recognized that there was a need for a greater degree of co-operation between States and the general unification of relevant regulations governing such issues as home market protection, shellfish product transfers and the potential for disease transfer, hygiene and environmental impact effects. The EU is now seen as having an important role to play in co-ordinating these activities. With the added requirements of the regulatory framework imposed by the Single Market Directives, many shellfish farmers feel that the whole system imposed by these Directives will make the industry cumbersome and expensive. This situation may not provide a climate of security conducive to stimulating an enterprise such as peripheral shellfish farming. The Department of the Marine is the regulatory body for the administration of these Directives but it also does have the power to partly delegate this responsibility to other State agencies such as local authorities. However, in many cases these authorities lack specific enterprise and environmental skills in decision-making marine policy formation and could inhibit the development of the industry.

In order to facilitate the future development of the shellfish industry, the procedures for implementing these Directives will have to be streamlined and simplified. As yet the full implication of most of these Directives for shellfish farming is still unclear. This uncertainty is most frustrating for the shellfish farmer and may also prove very expensive and time consuming. Also the small size of these enterprises and the diverse and spational nature of the shellfish farming does not help in the administration of these Directives. In order to harmonize the compliance of these Directives it may be appropriate to concentrate on the development of more concise and controllable shellfish farming zones. The development of a unified approach to ensure the administration of these Directives would help in the speedy and effective implementation of these requirements. The risk to the survival and future development of these enterprises may well be greatest during this period of transition. For example, the Directives dealing with shellfish farm operations and management are many and varied and will have an impact either directly or indirectly on the profitability of the shellfish farm. Other Directives dealing with safeguarding the operation of the shellfish farm in order to prevent the introduction and spread of infectious diseases are of major concern to the farmer. The Directives dealing with the marketing and distribution of shellfish products are designed for the benefit of the consumer and are in essence welcomed by the shellfish farmer as this instils confidence in the farm products. The requirements of the conservation and environmental Directives result in the establishment of shellfish farms which are not alone environmentally acceptable but must be in accord with broad public interest. Present fishery laws such as restrictions and quotas do not apply to shellfish farming, nor is it brought under the existing regulations relating to agriculture and animal husbandry. The specific Government regulations and EU Directives now being established are deemed necessary to meet the specific needs of shellfish farming. While shellfish farming can in many ways be closely associated with agriculture and animal husbandry in integrated rural development programmes, shellfish farming should continue to be part of fisheries and legally come under it because of its closeness to or identity in the secondary and tertiary phases of the industry (harvesting, handling, processing and marketing). The need and potential for harmonizing shellfish farming with fisheries on a national or regional basis are arguments in favour of this decision.

The final important issue that may impede the further development of the industry is the fact that the classification system for water quality designated to certain areas may be altered. Because of the concern regarding the health of food products arriving on the market-place, indications are that all of the waters around the coast will be re-categorized to designation B status. This will require the shellfish farmer to have his product purified by either using a depuration system or by relaying his product in classification A water for purification. This will be an expensive and time consuming operation and many shellfish farmers now operating in waters with an A classification may cease their operations due to this new constraint.

3. Does Shellfish Farming Help Sustain the Economy in Depressed Regions?

Shellfish farming is carried out in the most peripheral coastal regions of Ireland. Some of the characteristics of these coastal regions have been examined and have been found to be characterized by considerable diversity, both in natural terms and in the range and extent of local activity. For the needs of shellfish farming, however, these regions offered a definitive resource i.e., an abundance of good quality water and a clean, biologically attractive environment. Nevertheless, the physical location of the shellfish farms presented a barrier in some aspects of the development of the industry in such regions. For example, distance costs, which can be tangible, the physical costs relating to transport and distribution, and the non-tangible costs such as costs arising from information gathering and technical support, communications and management time devoted to overcoming these problems. In economic terms the value of shellfish produced in the regions increased from £1 million which represented 5 per cent of the total sum of the seafood supply in 1980 to £10 million which represented 6.9 per cent of the total seafood supply in 1996. It is estimated that the production cost for gigas oysters is between £650 and £750 per tonne. The capital expenditure on this type of shellfish farming is not very high but it is very labour intensive. The selling price of this product is roughly £1,000 per tonne ex. farm. On the other hand rope culture mussels cost approximately £200 per tonne to produce but in this case the capital costs can be high. The ex. farm price for these products is roughly £400 per tonne. Therefore the economic activity created by shellfish farm enterprises in these regions is not high. However, these shellfish regions benefited from generous grant aid support for shellfish farming in the regions. Between 1992 and 1996 over £5 million were allocated to shellfish farming. The zones benefiting mostly were the Cork/Kerry region which was granted over £2 million in aid and the Galway/Sligo/Mayo zone received over £1 million. The Waterford/Wexford Zone benefited by £825, 000, Louth Zone received £450,000 and the Donegal Zone received the least at £400,000.

The development of shellfish farm operations in these regions had both positive and negative economic interactions. Positive interactions included the need to maintain good water quality and a clean environment. The presence of these operations helped promote high quality treatment of existing or potential discharges to coastal waters in the region. The shellfish farms also provided a reliable source of supply of locally produced, quality shellfish products. A certain employment potential was also created in the region particularly for people with skills and training in some form of animal husbandry, redundant fishermen of groups of people with limited employment opportunities in the region. The negative economic interactions of having these shellfish farms in these regions included visual intrusion, particularly so in scenic areas, the use of water space in direct competition with other water users, including fishing and water sports, competition over limited on-shore development land, the potential conflict with other forms of wildlife, such as birds and dolphins, and the potential impact on natural vegetation.

The further development of shellfish farming in these peripheral coastal regions illustrates many of the difficulties of these coastal regions, with issues of co-ordination, consultation, local participation, and the balance between development and conservation very much to the fore. These coastal regions can be among the most dynamic and complex of all environments and economic or physical process can alter the shape and character of the region over relatively short periods of time. The many conservation and environmental protection regulations being introduced will have a profound impact on these regions and on the future location of shellfish farms. Many areas will be designated as nature reserves, wildfowl sanctuaries and special areas for conservation. The National Parks and Wildlife Service are compiling a list of special protection areas and this zonation will have an impact on intertidal regions. The main type of zones proposed are as follows:

Zone A This will be the "natural zone" where there will be little or no intervention by man

Zone B The "multiple use zone" will be an area where aquaculture and birds already co-exist but some restrictions beyond normal licensing requirements may be outlined

Zone C The "intensive use zone" can be an area of considerable conservation value which is already heavily used or an area of low conservation value where aquaculture can be practised without restrictions

(Ryan: 1997, 5-6)

While some evaluation of the economic performance of shellfish farming projects could be measured to a certain degree by using a cost-benefit analysis, the estimation of the other economic benefits are much more difficult to define. Many intangible and unquantifiable issues were involved. Also it was often impractical to separate out shellfish derived economic benefits in coastal communities which were already served by integrated rural development projects. For example, any improvements in employment and income were often combined with other economic development programmes in the region and it was extremely difficult to quantify with any degree of preciseness the contribution of shellfish farm activities to the combined benefits derived from community activities.

In these peripheral regions there are many Government sponsored programmes that have broad objectives and targets and therefore an analysis of such projects cannot be based on purely economic or business criteria.

The direct economic benefits of shellfish farming are understood to be through an increase in the value of shellfish production and in the creation of employment. Any increase in value of outputs generally takes place as a result of expansion of production, adoption of new technologies, improvement in handling, and in exporting. In many cases the main aim of the shellfish farmer is to generate income from exports, and the net benefits will be in the form of earnings of foreign exchange. Estimates of direct cost and benefits in this case are easy to make and are more readily available. The actual cost to the State of the shellfish farm project by way of grant-aid would also have to be considered and adjustments should be made in the project costs under analysis. Another example is the cost of labour employed on the shellfish farm. As most of the people employed on the shellfish farm either have or can find other employment on a part-time or seasonal basis, the training required for shellfish operations will have to be financed to some extent.

The treatment of costs in socio-economic orientated development projects such as shellfish farming differ in certain aspects from private and commercial projects. For example, the Government grant or subsidy is considered a cost to society, but is treated as a return in private projects. Interest paid on capital borrowed is a cost in private sector projects, but is not a cost to society as it forms a part of the capital returned, which becomes available to the society as a whole. Similarly, taxes and duties are costs to private projects, but these are incomes to society. Also estimation of indirect effects of shellfish farming should include benefits and costs to other segments of the peripheral region. If the spill over effects of these State-supported operations affect the output of private producers, this should be taken into account in the socio-economic analysis of the shellfish industry. Examples of these adverse effects of shellfish farm projects are the possible disadvantages to recreational and tourism facilities and restrictions to foreshore and seashore resources.

The beneficial effects are the improvement of supply of shellfish products, the creation of economic activity in the region and the employment potential in the region. There may also be certain "added value" benefits in the form of rents, wages, and the payment for services such as transport and the hire or purchase of machinery and equipment. The sum of these payments generated by shellfish farming could be useful in assessing the impact of the project on the local community. Should the spending and incomes be known, the total income generated within the region can be calculated by undertaking some form of income - impact multiplier system. However, as most of these types of analysis are complex, the small size and economic impact of the shellfish sector in any region may not justify the undertaking of an analysis of this nature.

The need for the participation of the local community in the planning and implementation of shellfish farms in the regions is a widely accepted ideal. Many of the basic needs of the community could be factored into individual or family needs and the activity that meets these needs, and leads to improvement in the standard of living in the aggregate, may constitute economic benefits to the community as a whole. However, the assumption that the success of receptive and progressive shellfish farmers will motivate the rest of the community to adopt productive activities does not always prove true in these regions. An alternative solution may be closer involvement of community development agencies, such as the Forum Group or the West Development Programme and Leader Programmes, in the development of shellfish farm projects which has the potential to reach the local community and its individuals more easily and motivate them to adopt development activities. However, the effectiveness of such agencies would depend largely on their organization, objectives and the motivation and dedication of their workers. In areas where no such agencies exist, it might be necessary to promote their formation. As participation by communities is rarely spontaneous, it may be necessary to involve the community through education, persuasion, and demonstration of the economic benefits of such shellfish development programmes in their area. Participation is needed not only at the initial decision making stage, but also during implementation, including decisions on benefit sharing.

4. Does Shellfish Farming Create Job Alternatives in these Coastal Sectors?

Any increase in employment generated by the development of shellfish farming in peripheral coastal regions has been in part-time and casual employment. Since 1990, full-time employment in shellfish farming has remained static at around 300 jobs. During this period the part-time and casual jobs increased from 1,200 to 1,700. Rope culture farms and gigas oyster farms support the highest number of workers. There were many definitions of what constituted full-time, part-time and casual time, and descriptions for this type of work were very much at the discretion of the shellfish farmer himself. A guide used in this research was that full-time represented work for forty weeks of the year; part-time was defined as work on the farm comprising between ten hours and thirty hours per week for between thirteen and thirty-nine weeks of the year and casual was less than ten hours per week for not more than thirteen working weeks per year.

Generally, these small-scale shellfish farm projects did create some employment opportunities and had the advantage of being more widely distributed geographically and locally owned, enabling improved income distribution across the region. One of the early objectives was to develop shellfish farming on small-scale farms in people orientated farms. However, the size and production of these farms has to be adequate for the targeted income to be earned by individuals or families and should conform to the minimum economic size of the particular type of farming. Very little initial research was conducted into what constituted an economical size of farm. It is now estimated that to produce 25 tonne of gigas oysters from a hectare farm would require one full-time person. For bottom culture mussels between twenty-five and fifty tonne of mussels could be cultivated from one hectare. One full-time person could produce 300 tonne of product. Employment and labour created by shellfish farming is also spasmodic and tends to have short seasonal peaks. Mostly, shellfish farming was developed as an additional or part-time activity and the farm system selected was compatible with, or complementary to, the normal vocation of the shellfish farmer. Crop and animal farmers, for example, found it comparatively more easy to integrate fish culture with their on-going farming activities and obtain increased production at minimum cost. These fishermen and agriculture farmers wanting to undertake shellfish farming on a part-time basis to supplement their income, normally established their shellfish farms close to their property. In these cases bottom culture of molluscs was easier to adopt, not only because of the technology but also the ease with which attitudes to such activities can be influenced. Since these systems of farming have a closer association with the capture fishery environments and practices, the fisherman, who is basically, a hunter found it easier to adapt to such farming approaches.

However, the gradual development of the shellfish farm industry in peripheral coastal regions owes some of its success not just to the shellfish farmer's knowledge of the technology and experience required for shellfish cultivation, but to his ability and efficiency in farm management. The farmer's ability to organize and implement shellfish farm technology, which is a complex combination of technical, economic, marketing, social and political elements towards some specific goals requires entrepreneurial type skills. In the early days of shellfish farm development there was a belief that the importance of entrepreneurial skills related only to large-scale operations and not to small, part-time activities such as are the case with many Irish shellfish farm operations. New problem areas became more critically significant as these small-scale farms owned and operated by single family units primarily for subsistence or as a small cash crop, evolved into larger-scale units incorporated and conducted for economic profit. While there may be differences in the management problems between these two types of farming, both had to comply with the same rules and regulations for shellfish farming. However, notable differences were observed between the performance of small-scale farms in the same region, operating under similar conditions, using the same technology. At least a part of this difference in performance was ascribed to differences in farm management practices. The ability of the shellfish farmer to manage his resources, including know-how, land, water, labour, capital and time, to the best advantage for achieving his goals to a large extent determined the performance of the farm. The role of an efficient farm entrepreneur has been well accepted in the allied fields of agriculture and animal husbandry, irrespective of whether they are large-scale or small-scale operations. Shellfish farmers come from a wide and diverse spectrum of education, background, and experience and with differing motives. Because of this it is difficult to establish a common trend in the social influences affecting the life cycle of the shellfish farmer or traits which distinguish the shellfish farmer from members of other groups. In searching for a common theme to explain this diversity it has to be concluded that the shellfish farmer is a socially defined phenomenon whose key characteristic is extracting value from a natural resource. There was evidence, however, that nearly all of these farmers operated on the "green thumb" approach to shellfish farming. This approach was very much influenced by two factors that are somewhat unique to farming animals and plants. One was the varying degree of uncertainty under which the shellfish farm operations had to be planned. This level of uncertainty was brought about by many factors such as prevailing climate, incidence of pests and diseases, the performance of new technologies to be adopted, the price and competition that had to be faced in the markets and the political, legal and social environment in which the farm operates. Decisions had to be made by the farmer under such uncertainties and therefore called for the exercise of personal judgement about the risks that he faced in the application of the various principles. The other important factor was the orientation of the farm: whether it was completely market orientated and operating commercially in the money economy or whether it was regarded as subsistence and part-time farming. However, any business where the risks are high and a certain amount of innovative skills are needed will require the operator and owner to have a certain amount of entrepreneurial flair.

Rather than seeking an answer to the question as to the number of jobs created by shellfish farming, perhaps it would be more important to define the type of jobs the phenomenon of shellfish farming creates? For example, how can we define someone who cultivates a natural resource product, on a part-time basis, on a stretch of water he does not own nor control, which involves many risks, is tightly controlled and creates little economic wealth or employment? The shellfish farmer of the future will be required to undertake an even greater number of tasks and responsibilities and will have to acquire a great many skills and techniques if he is to survive in the new shellfish farm environment being created.

CONCLUSIONS

Small-scale, part-time shellfish farm operations located in peripheral coastal regions may no longer meet the broad socio-economic objectives originally set out for this industry. The generous grant aid available for investment in the industry under the Operational Programme for Fisheries 1994-1999 is coming to an end. Availability of suitable sites for shellfish farming will be restricted as more environmental and conservation measures are introduced. These will impact on issues such as flora, aquatic fauna, water, air, the landscape, and the interaction of these with the natural environment. There will also be designated "Special Areas of Conservation" and "Special Protection Areas" which will restrict the availability of on-shore shellfish farm development activities.

Shellfish farming licences may be more difficult to obtain under the newly proposed legislation on aquaculture farming. In addition, the legislative requirements imposed by the EU's stringent Directives and Regulations will make it mandatory to monitor all stages of shellfish production to ensure the highest level of food safety. Complying with these new rules will increase the burden and responsibility of the management of these farms and will require a greater level of professionalism in shellfish farm operations. Part-time shellfish farm managers and owners may not have the time, structure or expertise to deal with these situations.

This new coastal resource management and seafood production environment will have a major impact on the future development and promotion of the industry. Adjustments will therefore be necessary in the future planning and policy stages for the industry and it may be appropriate to now consider a new national economic development plan for the industry. A suitable time period for this plan should be determined if the aim is to increase the supply of seafood production and create employment. Included in the plan should be projections aimed at achieving and maintaining production targets to meet projected export and home market demands. For this to be achieved, large-scale production units, based at the core of the shellfish farming zones, should be developed rather than the current emphasis on small-scale production units located in peripheral regions. The threat of the reclassification of the water quality around the coast from being "approved" areas to "conditional" areas will no longer give these peripheral coastal regions a production advantage. Also, the ability to produce regular supplies of shellfish products may prove expensive and difficult for small-scale operators. As well as economies of scale in production, economic arrangements for storage, transport and processing are inherent strengths of large operations. It also becomes possible to be more self-reliant in the supplies of inputs. These operations and the volume of production may allow the farmers to have their own depuration, processing and marketing arrangements. It will also be possible to introduce mechanization and so save labour and increase cost effectiveness.

The survival and viability of these shellfish operations will very much depend on the ability and skills of shellfish farm managers. Concentration should therefore be focused on supporting and developing the many skills required for such a complex industry. Full-time managers rather than part-time shellfish farmers should be targeted. The unique managerial type skills required for the establishment and managing of this industry have been identified and the rare characteristics of a shellfish farm entrepreneur or "green thumb entreprenologist" have evolved. These managers have developed the expertise to manage a natural resource under a great deal of uncertainty and are aware of the risks inherent in this unique type of enterprise.

A limited number of these large-scale farms should ideally be located in selected "core" areas within the shellfish farming zones. These marine product "core" centres would be in regions such as Bantry in County Cork, Dungarvan in County Waterford, Carlingford in County

Louth, Lough Swilly in County Donegal and Killary Harbour in County Galway. These marine product core areas should be fully licensed to facilitate the orderly development of all aspects of shellfish and marine culture. In these select regions, a marine and coastal management policy should be formulated and administrated by a Government agency representative of all coastal interests in the region including the interests of the local community. Diversification of seafood cultivation and maritime products in these core regions should be encouraged and viewed as a positive mechanism to provide variation, and to extend activities, within these core regions, which could provide the benefits of greater stability and security for the sector as a whole. For example, marine products such as periwinkles, clams, sea urchins, and abalone while still in early stages of development, could be pilot tested in these regions to investigate their commercial ability under Irish ambient conditions. The potential for the development and harvestability of algal biomass or seaweed could also be a compatible product to be located in these marine core regions.

Considerable changes in the technologies and in the management of these marine resources can be expected to occur in short periods of time. This is also true for market conditions, particularly in respect of export products, and this could necessitate changes in the technology and in the nature of the products. It is important that these marine core centres be close to universities or colleges where research into innovations in the industry may be carried out. An effective information network, which could be capable of communicating up-to-date information on all aspects of the marine industry, from product research to market information could be established.

Another aspect to be considered is the potential of these core regions to be promoted as a tourist attraction. Other food promoting industries have been successful in this type of activity. This would bring additional economic and social benefits to the community in these regions and supplement the income of these in the region by creating part-time jobs during the tourist season.

However, the capital outlay needed for the establishment and development of these types of projects, and the requirements of raising such capital on the open market, may bring a number of limitations. Besides the normal investment criteria such as expected rate return, payment period, degree of risk etc., the investor will have to compare financial benefits from marine products with those of alternative ventures. Therefore consideration should be given to moving from any subsidies on fixed capital to the subsidization of working capital. This could take the form of interest subsidies or deferred interest during the early years of the development of these marine core centres.

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APPENDIX A

QUESTIONNAIRE

ON

IMPACT OF 1992 ON THE IRISH FISHING INDUSTRY

1. Name of Firm: ____________________

____

2. Address: ____________________

____

____

____

3. Main Product(s): ____________________

____

____

____

____

____

4. Questionnaire completed by: ____________________

ACTION STRATEGY

1. How has to market for your fish products changed in the past four years?

2. In what ways will you become vulnerable to more competition in your present market?

3. Would you consider forming links, merger or acquire business to strengthen your market presence and broaden your range of products?

4. Is your organisation structure appropriate to exploit new opportunities or defend your market positions?

5. What training, in language and other skills, do you need to be ready for the single market?

6. Who in your firm is going to be responsible for deciding how to make the most of the single market?

MARKETING OF SEAFOOD PRODUCTS

1. What countries do you sell mostly to?

2. What countries represent limited sales?

3. What countries are you not selling to?

4. Who are your potential customers?

5. What markets should become more accessible?

6. Would you consider supplying as a sub-contractor of raw material?

7. Who supplies your information on markets?

8. Do you have information on strengths, weaknesses, product and price of your product in the market place?

9. Do you know who your major competitors in the seafood business are?

10. Do you know what your customers buying plans are?

11. What new competition will you expect to face for your products in the single market?

12. How do you identify potential customers at present?

13. Do you have a regular means of collecting and assessing market information?

14. Do you think you can compete on quality and price in the single market?

15. Do you know the tastes and preferences for your customers products?

SEAFOOD PRODUCT SALES

1. How do you currently reach your customer?

2. Do you know the distribution pattern and structure of the markets you are operating in?

3. What are the buying procedures of your customers? What are their trade terms and invoicing policies?

4. How far do you need to know the local language at present?

5. Do you export direct?

6. Do you use agents or distributors to reach your customers?

7. Have you considered using different selling approaches for the single market e.g. Export Trading Houses?

8. How is your selling organised?

9. Do you use any sales literature?

DISTRIBUTION OF SEAFOOD PRODUCTS

1. What changes do you consider necessary for future distribution requirements?

2. What volume of your business could be destined for new markets?

3. Are you happy with the frequency and size of loads for shipment at present?

4. What distribution arrangements are currently best for your customer?

5. What transport systems are you now using?

6. Which transport services should you be using in the future?

7. What impact would alternative transport systems have on the cost, frequency and reliability of your shipments?

8. Do you use the services of a forwarding agent for your transport arrangements?

PRODUCTION

1. Will you need to change your production and processing facilities to comply with the single market?

2. Do you plan any further plant expansion?

3. Can you assess the impact of any changes in the health standards of your products from the single market?

4. Will you be required to have certification and quality standards set for your products?

5. Do you consider your production performance competitive?

6. Have you evaluated the potential benefits of improving production standards?

7. Can you rationalise your production?

8. Can you asses the scope for rationalisation of production processes as standards are made common to all countries?

9. Can you relocate your production facilities as national boundries become less important?

SEAFOOD PRODUCT DEVELOPMENT

1. Can you identify the changes required by the market for fish in terms of quality and range of products?

2. What resources do you need for product development?

3. Assess the need for expertise, technology and equipment.

4. Assess the finance required.

5. What scope is there for entering into collaborative arrangements to develop new added-value products?

FISH PURCHASING

1. What sources of supply do you have at present?

2. Is there any significant change in volume by product?

3. Can you identify any new sources of supply?

4. Can you evaluate the suitability of supply?

5. Are you equipped to purchase in a wider market?

6. Do you have adequate means to collect and monitor information on supplies?

FINANCE

1. What will be the effects of competing in the internal market have on join profit and loss account?

2. Identify changes i.e. operating costs as a result of the single market on:-

   - Transport
   - Distribution
   - Rationalisation of product
   - Certification and inspection procedures

3. Identify higher costs arising from:-

   - New market initiatives
   - Sales promotion
   - Product development

4. How do you get paid?

   - Open account
   - Documentary collections
   - Letters of credit

5. What will be the effects on your cash flow?

6. Can you get local financing?

7. What are the VAT implications?

8. Will you existing financial management be adequate?

9. Have you a system to handle new financial demands, such as foreign transactions, currency dealings, debt collection?

TRAINING AND RECRUITMENT

1. What new or improved skills will you need for selling in the single market?

   - Language ability
   - Marketing experience in Europe
   - Export administration and procedures

2. Who in your firm needs improved language skills?

3. Do you have adequately trained staff?

4. What ares will you need recruitment for?

5. Will you buy specialist services?

6. How do you provide training for your staff?

7. For training staff would you use

   - in house/company courses
   - individual training or in groups
   - specialist courses

8. Will you need to recruit new staff?

A(A

	Knowledge of the question			Importance of the question in the light of 92		
	1 Vague	2 Fairly accurate	3 Very accurate	1 Minor	2 Medium	3 Major
The match "product/market"						
• The principal markets and target populations of your enterprise (Who buys? Why? How?)	—	20%	30%	—	20%	30%
	—	20%	30%	—	20%	30%
• The principal segments of each market. The rate of penetration of each different market segment.	20%	20%	60%	10%	20%	70%
• Your customer base: segmentation by activities, geographical zones.	10%	10%	80%	10%	10%	80%
• Your customer base: ratio to your potential clientele.	70%	20%	10%	10%	30%	60%
• Key accounts	—	10%	90%	—	—	100%
• Effect of prices and service on your customer base	—	10%	90%	—	—	100%
• Captive customers	10%	20%	70%	—	20%	80%
○ Methods used to encourage customer loyalty	10%	20%	70%	—	20%	80%
○ New markets within your reach	10%	40%	50%	—	10%	90%
○ New consumers	50%	30%	20%	10%	10%	80%
○ Countries in which you do not sell enough	10%	20%	70%	10%	20%	70%
○ Size - segments - attitude of customers in new accessible markets	10%	30%	60%	—	20%	80%

	Knowledge of the question			Importance of the question in the light of 92		
	1 Vague	2 Rather precise	3 Very accurate	1 Minor	2 Medium	3 Major
Competition						
• Your present competitors and their characteristics.	20%	20%	60%	—	20%	80%
• The strategy of your competitors. (Quality, products, pricing, marketing, networks, etc.).	70%	—	30%	10%	10%	80%
• New competitors in your present markets in 92.	10%	30%	60%	—	10%	90%
• Possible ways to react.	30%	10%	10%	—	70%	30%
• Your price position with respect to the competition.	—	20%	80%	—	10%	90%
Effect of a price change (up or down) on the consumer.	—	—	100%	—	—	100%
Products						
• Turnover per product in 1989.	—	—	100%	—	-	100%
o Loss-making products.	—	20%	80%	—	-	100%
o Product life cycle of each product.	—	20%	80%	—	10%	90%
Distribution						
o Suitability of your distribution channel to consumers' needs.	10%	20%	70%	—	10%	90%
o The future of your distribution channel without the Single Market.	60%	30%	10%	—	10%	90%
o Do. in the light of 1992.	70%	30%	—	—	—	100%
o Your promotion resources.	—	10%	40%	—	—	100%
o The expected development of these resources.	10%	30%	10%	—	60%	40%

	Knowledge of the question: 1 Vague	Knowledge of the question: 2 Rather accurate	Knowledge of the question: 3 Very accurate	Importance of the question in the light of 92: 1 Minor	Importance of the question in the light of 92: 2 Medium	Importance of the question in the light of 92: 3 Major
Sales force						
• Size with respect to the real needs.	–	30%	70%	–	10%	90%
• Training, information, leadership.	–	30%	70%	–	–	100%
• Preparation resources.	30%	40%	30%	–	–	100%
• Administrative support.	–	30%	70%	–	30%	70%
• Speed of response to orders.	–	20%	80%	–	10%	90%
• Delivery times and schedules.	20%	20%	60%	–	10%	90%
• Your sales analysis system. (Order book, financial terms, complaints, returns, etc.).	–	10%	90%	–	10%	90%
• Cooperation between heads of department in sales, production and financial matters.	–	10%	90%	–	10%	90%
• Sales involvement of the rest of the enterprise.	–	20%	80%	–	20%	80%
Marketing and communication						
• Organisation and campaigns.	10%	70%	20%	–	30%	70%
• Extent of your promotion resources.	–	20%	80%	–	–	100%
• Medium-term prospects.	–	50%	50%	–	10%	90%

Exports	Knowledge of the question: 1 Vague	2 Fairly accurate	3 Very accurate	Importance of the question in the light of 92: 1 Minor	2 Medium	3 Major
• Share of export figures in total turnover.	—	—	100%	—	10%	90%
• Profitability of exports.	—	20%	80%	—	20%	30%
• Network abroad.	60%	20%	20%	20%	30%	30%
• Export capacity of the enterprise. (Knowledge of languages, cultural, social and economic environment, etc.).	—	30%	70%	—	—	100%

The instructors can use the two following polls in this module.

- Poll 1: table 1

"What effect do you think the completion of the Internal Market will have on your sales?"

Check the change you expect for each type of market (one answer per column).

Type of market / Expected changes	1 Domestic sales	2 Exports to Member States	3 Exports to non-member States	4 Total sales, all markets
Large increase	....	✓	....	✓
Small increase	....	....	....	....
Unchanged	✓	....	....	....
Small reduction	....	....	....	....
Large reduction	....	....	....	....
Don't know	....	....	✓	....

- Poll 2: table 1

"Grade from 1 to 5 factors that might have a positive effect on your sales."

Suggested reasons	
Price reduction of products on markets	3
Capacity to penetrate new (regional) markets	2
Improvement of non-price competition (eg: change in range of products)	5
Withdrawal of competitors	4
Faster general growth of markets as a result of completion of Internal Market	1

Please Note: **All information will be treated in strict confidence and only aggregate figures will be used from the data collected.**

No. ________ Date: ________

1. Name and Address of Farm ______________________________
____
____

2. Location of farm (please circle):
   a. In Gaeltacht area
   b. Elsewhere in Ireland

3. Type of Organisation (please circle):
   a. Corporate
   b. Co-operative
   c. Other

4. When did you start production? ______________________________

5. Which of the following activities are you engaged in (please circle)?

a.	Finfish hatchery	f.	Shellfish ongrowing
b.	Shellfish Hatchery	g.	Remote Settlement
c.	Smolt production	h.	Primary Processing
d.	Shellfish nursery	i.	Secondary Processing
e.	Finfish ongrowing	j.	Other (Specify)________

6. Circle the type of structures/systems used.

a.	Tanks	f.	Rafts
b.	Cages	g.	Longlines
c.	Ponds/Raceways	h.	Extensive seabed
d.	Parc	i.	Marine ranching
e.	Trestles	j.	Other (Specify)________

7. For each species or stage produced, please complete the following:

1. Species/Stage ____________ Annual Tonnage ____________
2. Species/Stage ____________ Annual Tonnage ____________
3. Species/Stage ____________ Annual Tonnage ____________

8. Is the farm managed by the owner. ____ . __ Name of M.D. ____________

9. If no to question 8, who are the owners (in the case of Co-operatives, provide name of manager)? ____

____

____

10. Please provide employee details below:

Employees	Number Full-Time	Number Part-Time
Upper Management	________	________
Middle Management	________	________
Lower Management	________	________
Technical Staff	________	________
Clerical Staff	________	________
Operatives	________	________
Other (specify)	________	________
Total Staff:	________	________

In the case of Co-operatives: give number on Committee/Board: total number of members and outline any functional specialisations that exist within the Co-operative.

____

____

11. In the case of each employee level listed, briefly describe their main functions and responsibilities in the company.

(a) **Full-time**

Employee level	Functions and Responsibilities
Upper Management	________
Middle Management	________
Lower Management	________
Technical Staff	________
Clerical Staff	________
Operatives	________
Other (specify)	________

(b) **Part-time**

Employee level	Functions and Responsibilities
Upper Management	________
Middle Management	________
Lower Management	________
Technical Staff	________
Clerical Staff	________
Operatives	________
Other (specify)	________

12. Outline education levels of staff: List Par. time staff in brackets.

Educational level	Management	Technical	Operatives	Other
Primary only				
Primary & Secondary level only				
Third level				
Post Graduate (Specify)				
Professional (Specify)				

13. Average Age of Management ____________ Operatives ____________

14. What backgrounds do your employees come from, e.g. agricultural, fishing, industrial, etc.

	Part-time	Full-time
Management		
Technical		
Operatives		
Other		

15. When recruiting staff, do you require/prefer successful applicants to have any recognised qualifications and if so, name the required/preferred qualifications.

(a) Full-time Managerial/Technical recruits

Qualifications required ____________________

Qualifications preferred ____________________

Neither ____________

(b) Full-time Operative recruits

Qualifications required ____________________

Qualifications preferred ____________________

Neither ____________

(c) Part-time Staff

Qualifications required ____________________

Qualifications preferred ____________________

Neither ____________

16. Describe staff turnover below:

(a) Full-time Managerial/Technical: how many
(1) left during last year ________
(2) joined during last year ________

(b) Full-time Operatives: how many
(1) left during last year ________
(2) joined during last year ________

(c) Part-time Staff: how many
(1) left during last year ________
(2) joined during last year ________

17. (a) How many internal promotional appointments were made in the past two years?
____

(b) Give details (e.g. Part-time to Full-time, operative to health officer, etc.)
____
____
____
____

(c) Who is responsible for initial training of newly promoted staff.
____
____

18. Have staff members completed training courses during the past three years? ____

19. If yes to question 18, please give details below:

Employee level	Number trained	Nature & duration of course(s)	Venue(s)	Provided by whom
Upper Mgt.				
Middle Mgt.				
Lower Mgt.				
Tech.				
Clerical				
Operatives				
Other				

20. Were staff satisfied with these courses? ________________

21. If not, briefly outline the reasons for their dissatisfaction? ________________
____
____

22. If no to question 18, please give your reasons for not participating in any training courses (circle as many as apply):
    - a. too far from the farm
    - b. too expensive
    - c. could not spare staff
    - d. courses were not relevant
    - e. staff not interested
    - f. don't believe in training courses
    - g. other (specify) ______________________________

23. Do you consider that further training is necessary for (please circle as many as apply):
    - a. the development and growth of your business
    - b. growth of the Irish Aquaculture Industry
    - c. staff morale and motivation
    - d. other (specify) ______________________________

24. Are you aware of forth coming EC Directives and Regulations ______________
____

25. Please rank (1 -10) in order of priority the courses below you consider to be most vital for the development of your enterprise:

Finfish Biology
Finfish Health & Husbandry
Shellfish Biology
Shellfish Health & Husbandry
Hatchery techniques
Laboratory Methods
Environmental Monitoring
EIA's - what is involved
Site selection & assessment
New species
Public health
Waste Management
Fish Technology
By-product utilisation
European languages

Mechanics
Business Start up
Business Management & planning
Production Models (physical/economic)
Administration
Legal aspects(licences /regulations)
PR & community relations
Secretarial
Sales & Marketing
Personnel Management
Quality Control
EC Directives
Employee Health & Safety
Purchasing & Warehouse Mgt.
New technology
Value added processing

Other (specify) ______________________________

26. In the case of 5 of your preferred cou...es, please state briefly desired emphasis of study, practical skills required and any specific areas you consider critical to such a training course:

1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

27. In the case of the 5 courses outlined in question 26, which staff members (i.e. listed categories, Mgt./Operatives etc.) in your opinion would benefit from such courses?

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________

28. What training facilities are available locally, e.g. college, technical schools, etc.

____

29. Which of the following facilities do staff members have access to?

a. Office: How many? ________
b. Laboratory How many? ________
c. Board Room/Large Reception area: How many? ________
d. Telephone: How many? ________
e. Facsimile machine: How many? ________
f. Video player & T.V.: How many? ________
g. Computer: How many? ________

In the case of each computer, please supply the following details: Make, Model, Memory, Software Packages;

____

30. Are on-site/locally-based courses preferable to courses in colleges or other regional centres:

Yes ________ No ________ Give reasons ______________________________

31. Would staff be permitted to use the facilities listed in question 29 for limited periods (please circle):
(a) in company time (b) outside company time (c) not at all

32. How many of your staff are familiar with Personal Computers?
Management ____________ Technical ____________
Operatives ____________ Other ____________

33. We would welcome any further comments on training needs or courses.
____
____
____
____
____
____

34. Questionnaire completed by: ______________________________
Position: ____________________
Tel. No.: ____________________ Fax: ____________________

THANK YOU FOR YOUR CO-OPERATION AND TIME IN COMPLETING THIS QUESTIONNAIRE.

BACKGROUND INFORMATION

1. Name of company : ____________________

2. Name and position within the company : ____________________
____

3. Main shellfish products of the company : ____________________
____

4. Shellfish sales as a % of total sales in 1994 ____%

5. Shellfish exports as a % of total shellfish sales in 1994 ____%

6. Processed shellfish sales as a % of total shellfish sales in 1994 ____%

7. Number of full-time employees in 1994 _____

8. Number of part-time & seasonal employees in 1994 _____

9. How long has the company been in existence ? ____

Section A

1. How would you rate the following factors of the Irish shellfish industry in relation to the European shellfish industry ? Please circle the appropriate number for each factor

(5 indicating that the Irish shellfish has a superior advantage over Europe. 4 a slight advantage over Europe, 3 both are similar, 2 a slight disadvantage compared to Europe, 1 a serious disadvantage, 0 don't know)

Raw material						
1. Availability of raw material	5	4	3	2	1	0
2. Consistency of raw material	5	4	3	2	1	0
3. Quality of raw material	5	4	3	2	1	0
4. Cost of raw material	5	4	3	2	1	0
Skill levels of management						
5. Skill levels of management - marketing	5	4	3	2	1	0
6. Skill levels of management - financial	5	4	3	2	1	0
7. Skill levels of management - sales	5	4	3	2	1	0
8. Skill levels of management - language skills	5	4	3	2	1	0
Employees						
9. Skill levels of employees - production	5	4	3	2	1	0
10. Productivity of employees	5	4	3	2	1	0
11. Cost of labour	5	4	3	2	1	0
12. Available pool of skilled individuals	5	4	3	2	1	0
Technology						
13. Cost of technology	5	4	3	2	1	0
14. Level of technology	5	4	3	2	1	0
15. Research Institutes	5	4	3	2	1	0
Transport						
16. Cost of transport	5	4	3	2	1	0
17. Quality of transport	5	4	3	2	1	0
18. Educational Institutes	5	4	3	2	1	0
19. Scientific/Technical information available	5	4	3	2	1	0
20. Marketing information available	5	4	3	2	1	0
21. Access to capital	5	4	3	2	1	0
22. Communication system	5	4	3	2	1	0
23. Ability to develop new products	5	4	3	2	1	0
24. Other, please specify ______________	5	4	3	2	1	0

2. How would you rate the importance Irish shellfish processors place on the following factors: 6= top priority, 5= extremely important, 4= very important, 3= important, 2= slightly important, 1= no importance

1. cost reduction	6	5	4	3	2	1
2. new product development	6	5	4	3	2	1
3. product adaptation	6	5	4	3	2	1
4. packaging	6	5	4	3	2	1
5. technology	6	5	4	3	2	1
6. marketing	6	5	4	3	2	1
7. research and development	6	5	4	3	2	1
8. quality	6	5	4	3	2	1
9. meeting consumer needs	6	5	4	3	2	1
10. production processes	6	5	4	3	2	1
11. customer services	6	5	4	3	2	1
12. distribution network	6	5	4	3	2	1

13. innovation 6 5 4 3 2 1
14. other, please specify ____________ 6 5 4 3 2 1

3. Has your company been involved over the last year in training, either internally or externally, in the following areas ?

1. production management	Yes	No
2. operator skills	Yes	No
3. marketing skills	Yes	No
4. language skills	Yes	No
5. quality control	Yes	No
6. technology	Yes	No
7. R & D	Yes	No
8. financial skills	Yes	No
9. sales training	Yes	No
10. other, please specify ____________	Yes	No

4. Is your company involved in any of the following areas ?

1. gathering the latest marketing information and knowledge	Yes	No
2. gathering the latest technical and scientific knowledge	Yes	No
3. developing ties with research institutes	Yes	No
4. developing ties with educational institutes	Yes	No
5. working with trade association(s)	Yes	No
6. participating in apprenticeship programs	Yes	No
7. using graduate placement	Yes	No
8. carrying out research and development	Yes	No
9. other, please specify ____________	Yes	No

Section B - Demand Conditions

1. Do you sell

To the domestic market only ___
To the foreign market only ___
Both ___ If both, ___ % of sales to foreign market

2. Please indicate how long you have been exporting ___

3. In your opinion, what has been the main reason for the growth of shellfish demand in Ireland over the last five years?

____
____
____
____

4. Are Irish buyers needs identical to foreign buyers needs?

Yes No

5. If no, what are the main differences ?

____
____
____

6. **In your experience, are Irish shellfish buyers for the domestic market more sophisticated and demanding than buyers for the European shellfish market in relation to:**

	Retailers	Wholesalers	Caterers	Consumers
1. their quality requirements	Yes No	Yes No	Yes No	Yes No
2. value for money	Yes No	Yes No	Yes No	Yes No
3. varieties of shellfish types demanded	Yes No	Yes No	Yes No	Yes No
4. range of shellfish products demanded	Yes No	Yes No	Yes No	Yes No
5. convenience requirements	Yes No	Yes No	Yes No	Yes No
6. other, please specify _______________	Yes No	Yes No	Yes No	Yes No

If you do not sell any product on the domestic market, please go to question 11

7. **In your experience, have the following Irish shellfish buyers become more sophisticated and demanding in the last five years ?**

Irish retailers	Yes	No
Irish wholesalers	Yes	No
Irish caterers	Yes	No
Irish consumers	Yes	No

8. **If yes, in what respect have they become more sophisticated and demanding ?**

____

____

9. **Do you continuously track the needs of Irish shellfish buyers ?**

Yes ____
No ____
Occasionally ____

10. **If yes or occasionally, how do you track their needs ?**

Conduct market research- monitor sales figures	Yes	No
Commission external market research	Yes	No
Through the use of external databases	Yes	No
Through trade association data	Yes	No
Through sales teams	Yes	No
Government/Government agency data	Yes	No
Informal feedback from channels of distribution (retailers etc.)	Yes	No
Other, please specify _______________	Yes	No

11. **Do you continuously track the needs of foreign shellfish buyers ?**

Yes ____
No ____
Occasionally ____

12. **If yes or occasionally, how do you track their needs ?**

Conduct market research internally	Yes	No
Commission external market research	Yes	No
Through the use of external databases	Yes	No
Through trade association help	Yes	No
Through sales teams	Yes	No
Government/Government agency data	Yes	No
Informal feedback from channels of distribution	Yes	No
Other, please specify _______________	Yes	No

Other, please specify ______________________ _____ Yes No

13. Do you look primarily to foreign or domestic buyers for ideas on:

New products	Foreign [ ]	Domestic [ ]	Neither [ ]
Adaptations to existing products	Foreign [ ]	Domestic [ ]	Neither [ ]
Level of customer service desired	Foreign [ ]	Domestic [ ]	Neither [ ]
Other, please specify __________	Foreign [ ]	Domestic [ ]	Neither [ ]

14. Do you think foreign buyer needs follow Irish buyer needs?

Irish needs follow ___
Foreign needs follow ___

15. Have changing consumer needs forced the firm in the past five years to develop;

New products	Yes	No	Number
Adaptations to existing products	Yes	No	Number

16. Do you feel there is an adequate number of independent buyers available in the shellfish industry? Why?

____
____
____

Section C - Related and supporting industries

1. What percentage of your shellfish supplies are from aquaculture? ___ %

2. From what source of supply do you purchase your

1. raw materials	Domestic suppliers ___ %	Foreign suppliers ___ %
2. equipment	Domestic suppliers ___ %	Foreign suppliers ___ %
3. packaging	Domestic suppliers ___ %	Foreign suppliers ___ %
4. services	Domestic suppliers ___ %	Foreign suppliers ___ %

3(a). Are your Irish suppliers internationally successful/ have an international reputation?

1. raw material suppliers	Yes	No
2. equipment suppliers	Yes	No
3. packaging suppliers	Yes	No
4. services	Yes	No

3(b). If yes, please indicate the material they are supplying to your company

____

4. In relation to domestic suppliers in general, do you consider the following statements to be true or false

Quality of domestic supply is superior to foreign supply	T.	F.	Don't Know
Cost-effectiveness of domestic supply is superior to foreign supply	T.	F.	Don't Know
Service(s) of domestic suppliers are superior to foreign suppliers	T.	F.	Don't Know
Delivery times of domestic suppliers are superior to foreign suppliers	T.	F.	Don't Know
Domestic suppliers are more innovative than foreign suppliers	T.	F.	Don't Know

Domestic suppliers are more reliable than foreign suppliers	T.	F.	Don't Know
Domestic suppliers are more flexible than foreign suppliers	T.	F.	Don't Know
Domestic suppliers are more willing to co-ordinate activities	T.	F.	Don't Know
Domestic suppliers are more advanced than foreign suppliers	T.	F.	Don't Know
Dependence on current suppliers is a problem for the firm	T.	F.	Don't Know
Finding new sources of supply is a problem for the firm	T.	F.	Don't Know

5. Are you actively involved with your suppliers in any of the following activities

1. joint development of new technology	Domestic	Foreign
2. joint adoption of new technology	Domestic	Foreign
3. product adaptation	Domestic	Foreign
4. product development	Domestic	Foreign
5. advertising and promotion	Domestic	Foreign
6. quality	Domestic	Foreign
7. joint market research	Domestic	Foreign
8. sharing of technical knowledge	Domestic	Foreign
9. reduction of costs	Domestic	Foreign
10. identifying new opportunities	Domestic	Foreign
11. sharing of information	Domestic	Foreign
12. integrated logistics	Domestic	Foreign
13. informal communication	Domestic	Foreign
14. other, please specify ____________________	Domestic	Foreign

6. Is your company involved with a competitor, research institute, educational institute or government agency in the following activities ?
Please circle the appropriate letter
C = competitor, R = research institute, E = educational institute, G = government institute, N = none

1. joint development of new technology	C	R	E	G	N
2. joint adoption of new technology	C	R	E	G	N
3. manufacturing	C	R	E	G	N
4. product adaptation	C	R	E	G	N
5. product development	C	R	E	G	N
6. advertising and promotion	C	R	E	G	N
7. quality	C	R	E	G	N
8. joint market research	C	R	E	G	N
9. sharing of technical knowledge	C	R	E	G	N
10. pushing for innovativeness in suppliers	C	R	E	G	N
11. joint purchase of supplies	C	R	E	G	N
12. reduction of costs	C	R	E	G	N
13. identifying new opportunities	C	R	E	G	N
14. sharing of information	C	R	E	G	N
15. other, please specify ____________________	C	R	E	G	N

7. Does your company receive information from any other industry sectors on their;

1. their use of manufacturing technologies	Yes	No
2. their product quality and procedures	Yes	No
3. their processes in new product development	Yes	No
4. their customer service procedures	Yes	No
5. their use of marketing	Yes	No
6. their use of government agencies	Yes	No
7. their logistics	Yes	No
8. other, please specify ____________________	Yes	No

8(a). Are there other firms with which your company has a close working relationship (formal or informal)?

Domestic competitor(s)	Yes	No
Foreign competitors	Yes	No
Other Irish firm(s)	Yes	No
Other foreign firms	Yes	No

8(b). If yes, with who and in what relationship?

____

____

9. Have the following been of help, in terms of advice and assistance (excluding monetary assistance) in helping your company improve its competitive advantage over the last five years ?
0 = no involvement, 1 = no benefit, 2 = marginal benefit, 3 = some benefit, 4 = reasonably significant benefit, 5 = major benefit.

1. Industry association	5	4	3	2	1	0
2. Research Institutes	5	4	3	2	1	0
3. Universities	5	4	3	2	1	0
4. Technical colleges	5	4	3	2	1	0
5. V.E.C.'s	5	4	3	2	1	0
6. Udaras na Gaeltachta	5	4	3	2	1	0
7. B.I.M.	5	4	3	2	1	0
8. I.B.E.C	5	4	3	2	1	0
9. SFADCO	5	4	3	2	1	0
10. Department of the Marine	5	4	3	2	1	0
11. Other government departments ____________	5	4	3	2	1	0
12. IDA	5	4	3	2	1	0
13. Other, please specify ________________	5	4	3	2	1	0

Section D - Firm strategy, structure and rivalry

Domestic rivalry

1. Who are the main players you encounter?

____

____

____

2. Does your company <u>continuously</u> review the following information relating to competitors in the industry

Market share of competitors	Foreign	Yes	No	Occasionally
	Domestic	Yes	No	Occasionally
Competitors' use of manufacturing technologies	Foreign	Yes	No	Occasionally
	Domestic	Yes	No	Occasionally
Competitors product quality and procedures	Foreign	Yes	No	Occasionally
	Domestic	Yes	No	Occasionally
Competitors product range	Foreign	Yes	No	Occasionally
	Domestic	Yes	No	Occasionally
Competitors access to and cost of raw materials	Foreign	Yes	No	Occasionally
	Domestic	Yes	No	Occasionally
Competitors relative cost position	Foreign	Yes	No	Occasionally

	Domestic	Yes	No	Occasionally
Competitors processes in bringing new products to market	Foreign	Yes	No	Occasionally
	Domestic	Yes	No	Occasionally
Competitors customer service procedures	Foreign	Yes	No	Occasionally
	Domestic	Yes	No	Occasionally
Competitors marketing strategy	Foreign	Yes	No	Occasionally
	Domestic	Yes	No	Occasionally
Competitors market segments served	Foreign	Yes	No	Occasionally
	Domestic	Yes	No	Occasionally
Competitors channels of distribution used	Foreign	Yes	No	Occasionally
	Domestic	Yes	No	Occasionally
Other, please specify ______ ________________	Foreign	Yes	No	Occasionally
	Domestic	Yes	No	Occasionally

3.(a) Do you expect new entrants into the Irish shellfish processing industry in the future

Domestic entrants	Yes	No
Foreign entrants	Yes	No

3. (b). Why?

____
____
____

4. Would you view the competition in the Irish shellfish industry to be;
Please circle one only

a. Continuously intense competition
b. Frequently intense competition
c. Occasionally intense competition
d. Continuously moderate competition
g. Mild competition

5. If you export or are considering exporting, please rank the importance of the following in your decision to export
5 = the most important, 1 = the least important

increased competition on domestic market	___
increased scale opportunities	___
higher prices on foreign market	___
higher demand on foreign market	___
Government/government agency encouragement	___
other, please specify	___

Firm Strategy

1. The educational background of the MD of your company is:

scientific/technical	___
financial	___
marketing	___

other, please specify ______________________ ____

2. Which of the following statements best describes the company's strategic orientation
Please circle

a. The company strives to develop new products and new technology. Competitors actions are met by aggressive marketing to increase market share.

b. The company follows competitors actions and is seldom the first to develop new products or new technology. Competitors actions are met by defensive methods of competing to preserve market share.

3. In terms of your competitive strategy how much emphasis is placed on each of the following;
1= not considered, 6= extreme emphasis

1. production processes and new technology	6	5	4	3	2	1
2. continuing product development and innovation	6	5	4	3	2	1
3. breath of product range	6	5	4	3	2	1
4. competitive pricing	6	5	4	3	2	1
5. quality control	6	5	4	3	2	1
6. strong marketing and sales organisation	6	5	4	3	2	1
7. trade marketing	6	5	4	3	2	1
8. major effort to ensure availability of raw materials	6	5	4	3	2	1
9. continuing concern for lowest cost per unit	6	5	4	3	2	1
10. only serve special market segments	6	5	4	3	2	1
11. economics of scale due to mass production	6	5	4	3	2	1
12. control of channels of distribution	6	5	4	3	2	1
13. manufacture of retail brands	6	5	4	3	2	1
14. finance and operating efficiency	6	5	4	3	2	1
15. other, please specify ______________________	6	5	4	3	2	1

Section E - Future

1. Please indicate the extent to which the following factors pose/may pose a problem/threat for your company

	Serious	Moderate	No
1. ability to use new technology	___	___	___
2. raw material supply	___	___	___
3. firm's ability to innovate	___	___	___
4. changing consumer needs	___	___	___
5. increased competition in the domestic market	___	___	___
6. increased competition in the foreign market	___	___	___
7. E.U. legislation	___	___	___
8. government legislation & policy, please specify ______________________	___	___	___
9. ability to implement change	___	___	___
10. availability of finance	___	___	___
11. availability of skilled personnel	___	___	___
12. fluctuations in exchange rates	___	___	___
13. increased power of buyers	___	___	___
14. other, please specify ______________________	___	___	___

2. Please indicate the importance of the following factors in creating and sustaining a competitive advantage for your company in the future
1= not at all important
6= very important

1. developing new products	6	5	4	3	2	1
2. developing more processed products	6	5	4	3	2	1
3. continuous market research	6	5	4	3	2	1
4. investing more in marketing	6	5	4	3	2	1
5. developing brands	6	5	4	3	2	1
6. finding new export markets	6	5	4	3	2	1
7. investing in new technology	6	5	4	3	2	1
8. investing in new production	6	5	4	3	2	1
9. investing more in R&D	6	5	4	3	2	1
10. hiring and training staff	6	5	4	3	2	1
11. finding new raw material suppliers	6	5	4	3	2	1
12. developing alliances with firms	6	5	4	3	2	1
13. developing alliances with research institutes	6	5	4	3	2	1
14. developing alliances with educational institutes	6	5	4	3	2	1
15. cutting costs	6	5	4	3	2	1
16. staff	6	5	4	3	2	1
17. exchange rates	6	5	4	3	2	1
18. other, please specify ______________	6	5	4	3	2	1

3. Do you believe Irish shellfish processors will continue to be successful in the European market? Why?

____

____

____

4. Has and in what way has the government, its policy and its agencies forced the company to change in the last five years?

____

____

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Shellfish Farming in Ireland:

An Examination of the Criteria and Objectives for Development

This thesis was submitted in fulfilment of the requirements for the degree of Doctor of Philosophy in the National College of Ireland and the National Council for Educational Awards, 1999

Signed Brendan P. Mac Evoy

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