Livestock and Aquaculture Insurance in Developing Countries

A Brief Overview

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ACRONYMS

APIF	Agricultural Products Insurance Fund (Iran)
BSE	Bovine spongiform encephalopathy
CRMG	Commodity Risk Management Group, implementing agency in the World Bank for the International Task Force on Commodity Risk Management
EU	European Union
FMD	Foot and mouth disease
FAO	Food and Agriculture Organization of the United Nations
FIRI	Inland Water Resources and Aquaculture Service, Fisheries Division, Food and Agriculture Organization
GDP	Gross Domestic Product
GIC	General Insurance Corporation (India)
ICAR	International Committee for Animal Recording
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
L/R	Loss ratio – see entry in Glossary
NOAA	National Oceanic and Atmospheric Administration (USA)
NDVI	Normalized difference vegetative index (see also entry in Glossary)
OIE	Office international des épizooties (World Organization for Animal Health)
TAD	Transboundary animal disease
TSI	Total sum insured
UN	United Nations

Chapter 1: INTRODUCTION

1.1 Purpose of this publication

Livestock farmers and fish farmers in developing countries face many uncertainties and risks in the pursuit of reproductive and growth operations. Diseases, adverse weather, theft, predation, fire and other perils can cause sickness, loss of stock or of performance, or death. Losses to farmers can be substantial.

The losses can similarly affect those entities in the economy, namely processors and marketers, who depend for their livelihoods on a supply of livestock, livestock products, fish and other products of aquaculture operations. The losses can also affect financiers and other investors who are dependent on the profitability of the farming operations with which they are associated.

Consumers too may well face increased costs as a result of losses to livestock and aquaculture enterprises, and can also be affected by an interruption to supplies of needed foodstuffs, especially if perils are such that sources of supply are cut for more than a short time, for example, through business failures among the producers.

Again, outbreaks of transboundary animal diseases (TADs) can result in serious losses to entire national economies. In recent years, outbreaks of diseases such as bovine spongiform encephalopathy (BSE) and foot and mouth disease (FMD) have been expensive for the countries affected. At the time of writing (November 2005), the effects of Avian 'flu are beginning to be felt, with the destruction of poultry flocks in some regions of some countries being mandated as a necessary control measure.

The purpose of this publication is to meet the demand for a brief, accessible introduction to the role of insurance as a risk management mechanism in livestock and aquaculture enterprises. With the focus of the book being on enterprises in developing countries, most attention is given to livestock (especially cattle, sheep, goats, poultry) kept for food and/or fibre, and transport/motive power, rather than bloodstock used for sporting and recreational purposes.

This book does not purport to be a guide on to how to design an insurance product for these types of farming. Rather it aims at setting the scene, and exploring with the reader some of the complexities involved in this financial mechanism for risk sharing. In doing so, it starts by stressing the importance of risk management practices other than insurance. Before taking this broader perspective, it is worth stressing that insurance does not increase a farmer's income; rather it helps manage risks to this income.

"Risk management practices" embrace a wide range of mechanisms, which are the foundation of sound farm management. These include policy issues e.g. site licensing, regulations relating to such matters as quarantine and compulsory veterinary procedures. They also include on-farm physical measures such as attention to structural maintenance of fences, cages, racks and housing, as well as daily monitoring for disease conditions, and both preventive and curative veterinary procedures.

Risk management can also involve financially-based mechanisms such as share-farming, farming partnerships and Islamic-type borrowing where the lender shares the potential profit and

the potential loss. Another form of risk management is the forward sale of output and other types of contractual farming arrangements, especially where an element of risk-sharing is involved.

All of these will be briefly described in order to identify the potential role for insurance. This role, in brief, is confined to those situations where there is no other suitable risk management technique, or where insurance products can be designed to be advantageously cost-effective. The guide will then cover the more usual areas of insurance, such as: the roles of public and private sectors; the overall design of policies, including the basis for valuation; marketing policies; methods of collecting premiums and paying indemnities; loss adjustment; insurance product monitoring and modification.

It is worth noting that livestock, and especially aquaculture insurance, has received less attention than crop insurance in development efforts in the last few decades. This publication is intended as a contribution to redressing the current imbalance. It discusses the applicability of insurance to managing those risks which are beyond the immediate control of the farm manager, and which result in animal and fish mortality. The book is a companion volume to the 2005 FAO publication, Roberts, R.A.J. *Insurance of Crops in Developing Countries*[1] . As with the companion volume, a newly revised glossary of terms commonly used in connection with the insurance of agriculture and aquaculture is included. This is found in Annex V.

Whereas the focus of the publication is on developing country situations and circumstances, developed country examples are often used to illustrate particular points.

1.2 Target readership

While some of the example material is taken from developed country livestock and aquaculture experience, the basic target group of readers is expected to be those concerned with these enterprises in developing parts of the world. As such, the booklet may provide useful reading for:

Farmer unions, officials and members of farming and aquaculture associations
Producer/commodity groups
Processors, marketing firms and others contracting with producers
Officials of Ministries of Agriculture, Planning, Fisheries, Commerce and Health
Bankers with livestock and fish farming clients
Insurers with livestock and fish farming clients
Officials and veterinarians whose responsibilities include TADs

[1] Other FAO publications relevant to insurance as a risk management mechanism for primary sector enterprises include Roberts and Dick (1991) *Strategies for Crop Insurance Planning*; *A Compendium of Crop Insurance Programmes* FAO (1991); *Loss Adjustment Training Modules, Vols 1 & 2*

1.3 Importance of livestock and aquaculture products

a) Demand

The demand for livestock products in developing regions has risen greatly over the last two decades, a trend that is likely to continue, since this is a generally observed phenomenon, across virtually all nations and cultures, as incomes increase.

The magnitude of this demand trend in developing countries is illustrated in Table 1 below. This contrasts the growth in consumption of some major livestock products in developed and developing countries respectively, over a recent 20-year span.

Table 1: Trends in annual per capita consumption of selected livestock food products (kg)

Commodity	Developed countries			Developing countries		
	1973	**1993**	**% change**	**1973**	**1993**	**% change**
Milk & milk products	188	195	**+4**	29	40	**+40**
Eggs	13	13	**0**	2	5	**+150**
Beef/Pork/ Sheep Meat/Goat/Chicken	67	78	**+16**	11	21	**+91**

Source: Adapted from IFPRI/FAO/ILRI (1999), p.9

The demand for fish and fish products shows a similar upward trend as set out in Table 2 below. In this table the growing importance of aquaculture (as opposed to capture) as a source of fish and related products for human consumption is particularly striking. In this publication, the focus is on commercial aquaculture as opposed to "rural aquaculture" in which the produce is mainly consumed by the farm family and where little attempt is made to regularly produce saleable surpluses of fish[2], though of course sales are made as and when a surplus exists. An example of rural aquaculture is the centuries-old Asian practice of raising fish in flooded paddy fields.

[2] **Rural aquaculture** is defined by FAO as "The farming of aquatic organisms by small-scale farming households or communities, usually by extensive or semi-intensive, low-cost production technology appropriate to their resource base. Term sometimes erroneously used interchangeably with subsistence aquaculture". On the other hand, **commercial aquaculture** is defined, again by FAO, as "The farming of aquatic organisms with the goal of maximizing profits; it is practised by small to large-scale producers who are active participants in the market, purchasing inputs (including capital and labour) and engaging in off-farm sales of their production."

Table 2: Annual global per capita consumption of fish from capture fisheries compared with aquaculture products (kg)

Commodity	1970	2002	% change
Capture fish	10.3	.7	**-6**
Aquaculture	0.7	6.4	**+ 814**
Total	11.0	16.1	**+46**

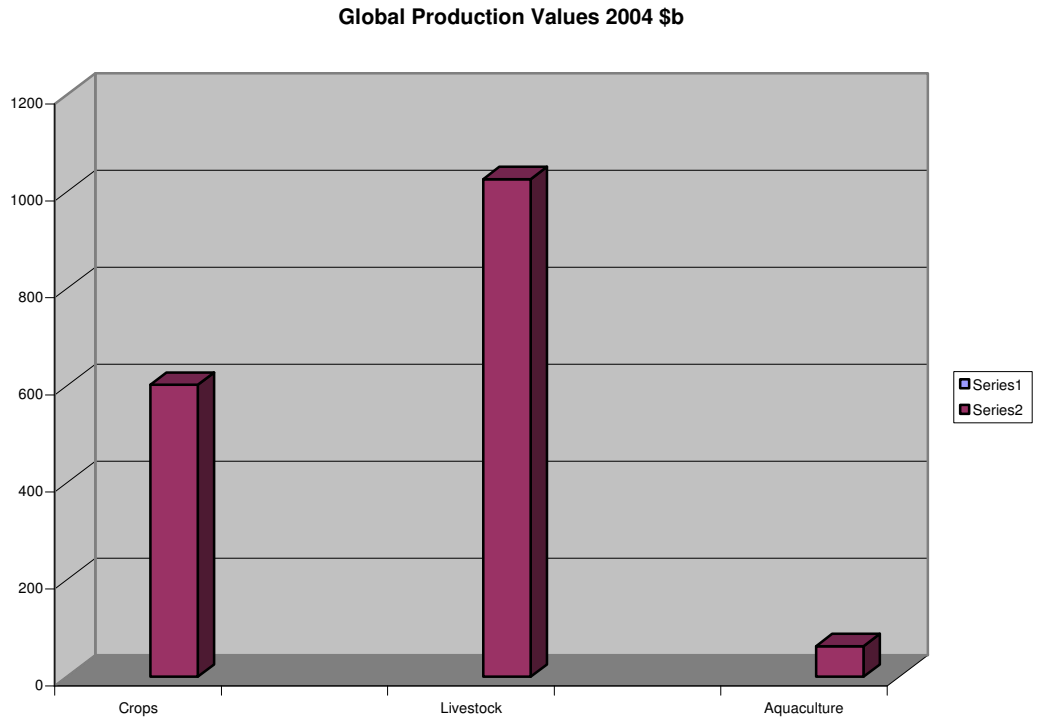
Source: Personal communication from Dr. Jiansan Jia, Chief FIRI, Fisheries Division. FAO Rome August 2004

Now we look at production in the face of this demand shift.

b) Supply (Production)

In view of these demand statistics and the trends they demonstrate, it is not surprising that livestock products (including farmed fish and other aquatic species – collectively known as aquaculture) account for an increasing proportion of the total value of farmed products.

Figure 1:Global 2004 Production values for crop, livestock and aquaculture



Source: FAOSTAT

It is evident that the combined value of livestock production and aquaculture, totalling nearly $1100 billion, is almost double that of crop production, at $550 billion per annum.

In volume terms, data indicate that the global production of meat in 2002 was 216m tonnes, with an annual growth rate of 1.8 percent (developed countries growth rate 0.6 percent; developing countries growth rate 2.8 percent). Milk production totalled 512m tonnes in 1993, and the corresponding figure for 2002 is estimated as being 600m tonnes, based on an annual growth rate in production, in developing countries, of 3.7 percent. Indeed, one developing country, India, is now the world's biggest producer of milk.

Against this, the annual consumption of fish for the same year was 100m tonnes (excluding 33m tonnes for non-human food uses, e.g. as an ingredient in chicken feed). Within this total, the share of aquaculture had risen massively from 3.9 percent in 1970 to 29.9 percent in 2002.

The limitations on production from capture fisheries, due to over-fishing in many parts of the world's lakes, rivers, seas and oceans, are well known. Coupled with this is the continued development of techniques to farm successfully more and more fish species. For these reasons, the share of aquaculture is expected to continue to rise.

An additional demand factor is that fish is an important dietary item in one major developing region (Asia) where incomes are rising very substantially. This will drive the global trend still further.

Associated with these production and consumption increases is a substantial demand and opportunity for investment capital. For example, FAO estimates that the investment associated with the huge expansion in global aquaculture production over the last 30 years is of the order of US$60 billion. While accepting that an estimate of this sort must be subject to a certain degree of error, the figure is sufficient to indicate the order of magnitude of the investment flowing into aquacultural production[3].

It will also be evident that massive production increases over a short period of time, in the case of aquaculture, may mean that the growth of knowledge and experience in the industry does not automatically keep up, with deficiencies in both the planning and the execution of projects. This adds a new and serious dimension to the issue of risk, and the need to manage this risk, as will be discussed below.

Insurance is just one item in the toolbox of risk management techniques to address the perils faced in these two industries. Although the range of perils faced by livestock and aquaculture enterprises is similar, it is rather different from the range faced by crop farmers. Because of the differences, insurance product design and insurance operations for livestock and aquaculture are similarly distinct from those applying to cropping enterprises.

[3] Source: Dr. Jia Jiansan, Chief FIRI, FAO. Personal communication.

Chapter 2: PERILS/RISKS FACING LIVESTOCK AND AQUACULTURE FARMERS

2.1 The Discussion Focus

Risks facing livestock and aquaculture producers can be divided into market related risks, and non-market related risks. Since this publication has risk management through insurance as its focus, the insurable types of risks predominate in the discussion, and these are largely non-market related. However, the distinction is not complete, as some insurance products incorporate an element of coverage of price and/or revenue risk in the insurance product design.

The focus of the discussion will therefore be on identifying where and how insurance is worth consideration as a risk-management technique. Given this focus, the discussion of various perils and of risk management other than insurance is intended to be illustrative rather than comprehensive.

2.2 Market Related Risks

These risks relate directly to transactions in the economy. They include: availability of inputs, the prices of inputs, the price of farm products, the availability of markets for farm outputs, the gross margins of agricultural enterprises, and the revenue derived from farming operations. With regard to prices, it is particularly the short-term volatility in prices, for both inputs and outputs, which is of most concern to the average farmer, as he is rarely in a position to make quick changes to his farm enterprise mix or to his farming system.

Of significance to a discussion of risk with livestock and aquaculture is the possibility of market access for products being denied when there is evidence of a serious disease or contamination situation, leading to a health risk. This can apply both to domestic and to export markets. Clearly, for a correct application of marketing bans there has to be confidence that the information on which they are based is accurate, and that the conclusions drawn are not biased for reasons of personal gain or for the creation of a trade barrier for political reasons. International agreements are important here, with the specialist organization OIE (World Organization for Animal Health) responsible for maintaining a classification of those animal diseases that are notifiable by national authorities. The most serious category of these, Class A diseases, includes the major highly infectious diseases, such as FMD and BSE. Incidences of these diseases can lead to export bans between countries, and to bans on movements within countries. The reader will quickly appreciate that these measures imply both costs and loss of income.

Indeed, one of the major and long-lasting causes of loss following the outbreak of a serious livestock disease is the effect on exports. These may be blocked by importing countries, which are free of the disease in question, for what could become a lengthy period. In such a case, exports will only be possible to countries where the disease is endemic, and such exports are likely to realise a much lower price. Exports and movements of livestock and livestock products following disease outbreaks are not subject to arbitrary decisions but are prescribed by international agreements – to which authorities, financiers, insurers and those in the trade can refer for guidance.

Another type of price risk is that caused by over supply. Salmon harvest volumes from aquaculture farms have risen rapidly in recent years. This has led to what might be described as a slump in prices. For example, in early 1998 salmon prices in a major import market, Japan, were some 30 percent lower than the levels ruling just one year earlier.

2.3 Non-market Related Risks

These risks relate to a variety of events, some involving human intervention, directly or indirectly. The risks include: climate events, geological events, pollution, predation, theft, disease. A more detailed breakdown of these risks reveals the following individual, non-market perils for livestock and aquaculture farmers:

Group 1 Health factors

These risks are associated with diseases/epidemics[4] (local, national, transboundary) with the risk of consequences including:

- Mortality,
- Diminished production through disease,
- Ban on sale of animals or animal products due to quarantine or health rulings,
- Government slaughter order,
- Increased on-farm costs occasioned by quarantine, curative or preventive measures.

Group 2 Climate and seismic events

- Drought,
- Flood,
- Windstorm,
- Freeze,
- Lightning,
- Earthquake,
- Tsunami.

Group 3 Accidents

- Fire,
- Accident,
- Poisoning,
- Explosion.

Group 4 Infrastructure & environmental problems

- Machinery/electrical breakdown and power outages,
- Malicious damage, riot, strike,
- Pollution of water supply or water environment,

[4] See http://www.oie.int/eng/maladies/en_fiches.htm, from the website of the OIE (World Organization for Animal Health) for a listing of major animal diseases, together with useful summaries of key information concerning each entry.

Group 5 Management issues

- Infertility, loss of normal biological function,
- Cannibalism / overcrowding losses,
- Malnutrition due to unexpected feed deficiencies,
- Mysterious disappearance, rustling, theft, predation, escape.

Group 6 Consequential losses

- Consequential loss and legal liability due to livestock losses and/or food safety considerations.

A listing of risks for aquaculture farmers[5] would include many of those listed above, to which can be added the following, which are clearly spread across the Groups classified above:

- Predation by birds, seals, sharks
- Presence in massive numbers of harmful organisms, e.g. jellyfish, algae (see below)
    - Water quality problems
    - oxygen depletion
    - pollution
    - algal toxins – from harmful algal blooms
- Risks to structures (tanks, cages, sluices) from collision, seismic or storm events, e.g. tsunami)

All of the above apply principally to individual farmers. Some perils can also have significant consequences for national economies, for example, outbreaks of a contagious disease.

Indeed the risks associated with transboundary diseases have grown as human travel and trade (including livestock movements) across borders has increased rapidly in recent decades. This has placed considerable burdens, scientific, organizational and financial, on countries as they attempt to protect their national livestock and fish stocks against exotic disease threats (see Section 3.1 below, where quarantine policy, among other policy-based risk management approaches, is discussed).

[5] Secretan (2003) is a particularly helpful reference on risks to aquaculture enterprises.

Chapter 3: MANAGEMENT OF THESE RISKS

3.1 Policy-based risk management

Site licensing

Site licensing for certain types of production is required in certain jurisdictions. Often this is due to an attempt by the authorities to minimise pollution or nuisance to the general population – intensive livestock production is usually not wanted in or near to towns. However, there are also occasions when planning, subsequent zoning and site licensing has a risk management purpose. This applies especially to aquaculture, where the risk of storm damage is greater in exposed areas, while conversely the risk of losses from phenomena such algal blooms is greater in very sheltered areas, due to diminished natural water exchange.

Another source of loss in aquaculture is pollution of waters in which freshwater or marine farming takes place. Clearly, sites particularly at risk are those that are susceptible to outflow of sewage or industrial waste. This is all too common in many countries, due to excessive rain overloading storm water systems, leading in turn to contamination and outflow of the contaminated water to the sea and, sometimes, to aquaculture sites. Attention to appropriate design factors related to sewage and storm water infrastructure is clearly needed here, but given the fact that these sorts of improvements can take many years to effect, the onus to protect aquaculture enterprises falls on those selecting the sites for such enterprises. This means both fish farmers, and site licensing authorities.

A further cause of pollution and harm to farmed marine species is exposure to oil from accidental spills and from chemicals such as TBT (tributyl tin) and TPT (triphenyl tin). TBT has been commonly used as an antifouling surface treatment for the hulls of boats and ships. Although the use of TBT has been banned in some countries for certain types of craft for some years now, a global ban will only come into force in 2008 (and only then if the International Maritime Organization of the U.N. treaty on this is ratified by all countries). TPT, used in agriculture as a fungicide, has also been found in waters close to intensive agriculture. For example, in the Netherlands,

> *"Variations in OT (organo-tin) concentrations in zebra mussels were studied at two locations near potato crops that were sprayed with triphenyltin (TPT) in order to estimate the integration period over which body concentrations reflect the environmental quality……. The TPT was found in very high concentrations in mussels near sources of this fungicide." (Stab et al 1995).*

With chemicals such as these two examples, the authorities have a dual responsibility. First to minimize their use; second, to permit aquaculture operations only on sites remote from those stretches of water where toxic substances are found in concentrations that are harmful to farmed marine species. The possibility of aquaculture losses from oil spills, from oil tanker collisions and groundings, focuses attention on the increased risk presented when aquaculture is permitted close to on-shore oil terminals and near shipping lanes.

Quarantine requirements

Quarantine requirements are an attempt to help manage the risk of the introduction of exotic diseases or organisms that may be detrimental to the health, and/or production of existing species, in a given country. Recent examples of incidents involving these diseases, now termed "transboundary diseases", include, in recent years, foot and mouth and BSE disease outbreaks in the U.K[6]

More than 100 years ago, the disease rinderpest, fatal to cattle, was thought to have spread from Egypt into Uganda, and from there into the rest of East and Southern Africa. The disease affects and is carried by wild game, especially antelopes. This is believed to have facilitated the rapid spread of the disease. Rinderpest still prompts quarantine efforts in some countries, and although Africa was thought to be free from it in the mid-1990s, a later outbreak indicated the difficulty of controlling this type of disease. This difficulty is almost certainly related to the fact that feral animals are very common in this continent (see next section).

As island nations, Australia and New Zealand are among the most effectively isolated countries in which agriculture is a major part of the economy. Yet even in these naturally protected islands, the border inspection personnel are a major force, and consequently bio security is an important cost item for the public sector[7].

Compulsory veterinary procedures

These also address livestock and fish health, but relate to disease conditions already present in the country, and for which veterinary control measures and practices are known and required by the authorities in the interest of the individual farmer, the national industry as a whole, and as a food safety measure.

While compulsory veterinary procedures can be enforced for domestic animals, widespread vaccination of wild animals is practically impossible, even though suitable vaccines are available. This seriously complicates the task of controlling transboundary animal diseases such as rinderpest, which (see above) affects wild game as well as cattle. This means that in the case of some livestock diseases, game animals can constitute both a reservoir of disease organisms, and a means for their spread. The implications for cattle farmers in regions such as Eastern and Southern Africa, where game is abundant, are obvious.

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[6] An FMD outbreak occurred in the UK in 1967 and a similar outbreak was experienced in 2001. Whereas the numbers of affected farms were similar in both outbreaks, the number of stock compulsorily slaughtered was very much greater in 2001 because movements of stock were much more extensive in this year. Indeed, whereas the 2001 outbreak was national in its impact; that of 1967 was more regional. There was a BSE outbreak, also in the UK, which began in 1988 and peaked in 1992, with more than 37,000 cases being reported in this particular year. By 2003 the number of BSE-affected stock had dropped to 611.

[7] It is estimated that the losses to the New Zealand economy of the accidental introduction of foot and mouth disease would be in excess of US$6 billion over just two years, representing approximately eight percent of GDP (ref. Reserve Bank of N.Z. / N.Z. Treasury 2003). There is every reason to believe that this degree of economic damage would be the same in the case of the introduction of other devastating livestock diseases, such as bovine spongiform encephalopathy (BSE). The high level of potential losses has prompted the introduction of legislation allowing very heavy penalties for persons convicted of deliberately infecting New Zealand livestock. (Source, Hon. Phil Goff, Minister of Justice, New Zealand, 23 October, 2003) The 2004/5 New Zealand Government Budget reveals that of the total allocation to the Ministry of Agriculture and Forests, more than 60 percent (NZ$128m) is destined to be spent on biosecurity. If the contribution of other ministries (Fisheries, Health, Environment) is added to this, then the 2004/5 fiscal year volume of public funds for biosecurity rises from NZ$128m to NZ$152m (approximately US$105m).

3.2 On-farm risk management

On-farm risk management is a major, ongoing task for both livestock and aquaculture producers. Most of the non-market perils allocated to Groups in Chapter 2 above are addressed in the first instance through on-farm procedures. Indeed, the risks associated with most perils of a certain magnitude are more readily managed by the farmer as part of his normal farming operations than by external interventions.

Each major group of similar perils is now discussed, with the intention of identifying the limits of on-farm risk management.

Group 1 Health factors

These risks are associated with diseases/epidemics (local, national, transboundary) with the risk of consequences including:

- Mortality,
- Diminished production through disease (morbidity),
- Ban on sale of animals or animal products due to quarantine or health rulings,
- Government slaughter order,
- Increased on-farm costs occasioned by quarantine, curative or preventive measures.

Normal management of livestock and aquaculture farming involves close attention to health factors. These start with adherence to official recommendations for preventive veterinary procedures (e.g. inoculations, isolation and supplementary feed additives). Farmers' actions range from the ongoing monitoring of the health of livestock, fish and shellfish, to attention to siting and structural issues of buildings, cages and tanks. Care taken in the siting and construction of livestock handling facilities, as in the siting of aquaculture ponds and cages, helps protect the structures and their living contents against damage from flood, windstorm, strong currents, land subsidence, pollution etc. It also assists in protection against the actions of human thieves and animal predators[8].

Apart from the monitoring of health, as already mentioned, management procedures directly geared to the livestock *per se* include attention to stocking rates in pastures, to the density of poultry, fish and crustaceans in housing, ponds, tanks, racks and cages, and to quality factors in the respective immediate environments.

Group 2 Climate and seismic events

In terms of its global impact, drought is probably the most serious peril faced by livestock producers. Impacting as it does on nutritional adequacy, it can also be associated with death or loss of production/performance from direct causes other than lack of precipitation. When animals weakened as a result of a drought, then face another environmental challenge, they may well be

[8] As an example of the importance of siting, the largest aquaculture enterprise in Finland, which has several fish farms in Swedish waters, found significant losses were being experienced due to predation by seals. Prevented by law from shooting the predators, the company decided to move all the cages from seacoast locations to inland lakes (personal communication, Juhani Salminen, Managing Director of Saaristomeren Kala Oy, Uusikaupunki, Finland, July 2004).

affected to a greater extent than would be the case in a normal year[9]. Normal farm management practices address drought by ensuring reserve food supplies (hay, silage etc.) are either stored ahead of time, or can be purchased and brought into the region. But this is often difficult in developing countries, due to the lack of financial resources, and difficulties over supply from areas accessible from an economic as well as from other points of view. Above all, drought may be systemic and impact an entire region.

Other climate perils, flood, windstorm, freeze and lightning, all call for basic on-farm management of risks (though protection of livestock from lightning in rangeland farming is not feasible). Beyond the basic and economically sensible precautions, including siting issues (where there is freedom of choice) losses with these perils may call for other approaches, e.g. financial arrangements. The same can be said for risks to aquaculture structures (tanks, cages, racks, sluices) from storm events. These are addressed firstly by appropriate design, construction and maintenance, then by other approaches, i.e. financial measures[10].

The same attitude can be taken with the management of the risk of earthquakes and tsunamis, with a financial approach likely to be the most feasible.

Group 3 Accidents

Clearly basic farm management practices will also address the risks in this category, which include: fire, accidental injury or death, poisoning and explosion. Beyond what can be addressed on the farm, financial risk management approaches could be considered, with insurance being an obvious contender for specific risks under certain circumstances.

Group 4 Infrastructure and environmental problems

Clearly, the extent to which on-farm management can address Group 4 risks depends on the degree of control the farmer has over the risk items. Machinery and electrical breakdown can be rendered less likely by appropriate maintenance, but cannot be prevented altogether. Power outages are beyond the farmer's control, though increasingly farmers of particularly energy-dependent enterprises (e.g. fish hatcheries) are investing in standby generators. Indeed, some insurance policies make this a requirement for cover to be valid.

Malicious damage, riots and strikes are beyond a farmer's control, with the resulting losses rather difficult to manage, especially as these risks are often excluded from standard insurance policies.

Pollution losses are a particularly potent risk for aquaculture farmers. Water quality is the issue here, including: oxygen depletion, pollution from chemical and biological sources, algal toxins produced during algal blooms. In each case, there is much that can be done on the farm to reduce the risk of loss from these causes, especially daily monitoring of fish health so as to have early warning of a new danger, so that measures can be taken, where it is possible to do so.

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[9] In Mongolia *dzud* is the term given to a situation of heavy livestock deaths when inadequate precipitation in the spring and summer is followed by harsh winter conditions. Weakened animals are less able to withstand a hard winter when they suffer poor nutrition in the preceding months.

[10] Reinsurers of salmon enterprises in Chile now require regular inspections of moorings. This is now carried out by underwater robotic devices, fitted with cameras. The cost per site (group of cages) is very small in relation to the potential savings in losses from storms and "strong currents".

Sometimes a peril does not become evident until after structures have been installed and stocked. This is especially the case when a relatively new type of farming is introduced to a particular location. In the photo below (Lake Manajau, West Sumatra, Indonesia) the fish cages illustrated originally held tilapia and a species of carp. Observation of fish mortality and general health revealed that whereas the tilapia were thriving, carp were dying in large numbers, Chemical analysis of the water indicated that there was an underwater discharge of toxic gas (hydrogen sulphide), probably of volcanic origin, to which the carp were particularly susceptible.

This underlines two important factors relating to risk management in aquaculture:

- The first of these factors is that commercially-oriented aquaculture is still a relatively new enterprise for many of the operators (and indeed countries) involved. This means that much is still to be learned as to the range of perils that face the industry (especially as new species are added to the list of those being farmed), and the means by which these perils may be addressed.

- The second is that aquaculture takes place in an environment that in many respects is hidden. Not all countries have the facilities to inspect all sites thoroughly, and this applies especially to developing nations. For this reason, unexpected perils of an environmental nature, such as that in Lake Manajau, can provide an unwelcome surprise to investors and farmers. The example underlines the need for careful site examination at an early stage in any aquacultural production project.

Lake Manajau, West Sumatra, Indonesia Source: FAO Fisheries Division

Group 5 Management issues

By definition, these risks are controlled by management action. They include: infertility, loss of normal biological function, cannibalism and overcrowding / stress losses, together with most losses from theft, rustling, predation and escape. Dealing with these risks is another part of the responsibility of the farm manager.

Largely beyond on-farm control are losses from malnutrition due to unexpected feed deficiencies, problems due to contamination of feed and some losses due to rustling, theft, predation and escape (where management has taken all normal precautions, yet stock losses still occur. Mysterious disappearance is a term used in insurance when there is no obvious cause for the loss of animals or fish. More discussion on these types of losses will be given in the chapter on the use of insurance for risk management.

However, it is worth noting here that in Southern Africa losses of cattle due to theft were noted in a recent ICAR/FAO conference in Tunisia as the main reason for seeking secure identification systems[11].

Group 6 Consequential losses

More advanced and commercialized farms face significant claims if supply contracts are not met, or if the quality of products being supplied by livestock farmers does not meet standards of safety. These losses are again a matter for good management in the first instance, with financial mechanisms sometimes called upon as a safety net.

3.3 Financially-based risk management mechanisms

Introduction

Financially-based risk management mechanisms include: shared ownership, Islamic banking, marketing arrangements, insurance. These all involve mechanisms that permit some of the financial burden of losses in livestock and aquaculture operations to be shared with an entity or individual outside of the farm itself.

There is a gradation in the four examples discussed below, with an increasing direct connection between a loss of a given batch of livestock or aquatic organisms, and the sharing mechanism employed to assist in managing the risk.

A further important point is that the mechanisms briefly described are not mutually exclusive. On the contrary, there may be many situations and individual examples where some or even all of the mechanisms could operate together in harmony, providing mutual support.

Shared ownership/farming partnerships/production cooperatives

Here the risk sharing is obvious, since it is implicit in the ownership structure of the farm. Share or partnership arrangements are normally entered into as a means to raising a greater quantum

[11] Traditionally such systems have been advocated mainly as an aid to better breeding management, and more recently as an essential factor in the traceability protocols now demanded by certain markets, in the face of diseases such as BSE and FMD. Ref. Campher, Johan P (2004).

of capital than would otherwise be the case. Incorporation as a company formalizes the share arrangement, though this is not as yet common in developing countries.

Production cooperatives are another form of shared ownership of production enterprises. Cooperatives have traditionally (and this is often formalised in cooperative legislation) held reserves, built up by setting aside, each year, a percentage of the operating surplus. Clearly financial reserves can form an important first layer of funding to assist in overcoming losses.

Yet another type of share farming involves a supplier of young stock (livestock or fish smolt) retaining ownership of the stock throughout the growing-on period. The farmer contracts to deliver the grown livestock or fish at a pre-determined weight to the owner. Clearly, the risk of mortality or loss of performance is shared in this type of arrangement

Share farming and partnership arrangements can mean more capital is invested in the enterprise than an individual might have at his or her disposal. From a risk management point of view, this can mean permitting access to technology that in itself may bring risk management benefits. For example, it might provide access to more water, for livestock and even for irrigation of fodder crops. For fish-cage farmers, access to more capital can mean the ability to install and anchor cages that can be more adequately protected against perils such as storms and predators.

Similarly, when losses occur despite measures such as these, they can be shared across the owners of the enterprise and/or the organisms being farmed, spreading the resulting financial burden.

Islamic banking

Islamic banking products, especially musharaka loans, or partnership financing, offer a potent method for farmers to share farming risks with their financiers.

In essence, musharaka[12] financing arrangements mean that any losses are borne in proportion to the investment of each partner/financier. This contrasts with normal bank lending where the risk falls primarily on the farmer/entrepreneur, with the bank calling on the borrower and/or the security pledged in order to recoup the investment in the loan.

The advantage to the borrower as regards risk management is that the lender is often in a more powerful position to obtain information that will assist in reducing any given risk. Given the direct stake of the bank in the financial health of the enterprise, there is a strong incentive for the lender to use its influence and connections to assist the farmer in minimizing on-farm losses.

Marketing arrangements

Inter-linked transactions, of which formal contract farming is perhaps the best-known example, provide the opportunity for an element of sharing the cost of losses.

Contracted forward sale of animals or fish during the growing period means automatically that the risk of loss is either assumed totally by the owner of the livestock or fish at the time of loss,

[12] Musharaka basically means 'partnership'. "It involves you placing your capital with another person and both sharing the risk and reward. The difference between Musharaka arrangements and normal banking is that you can set any kind of profit sharing ratio, but losses must be proportionate to the amount invested." (Ref. www.islamic-bank.com)

or that there is a loss sharing mechanism. The details of the contract will specify the relative shares to be assumed by the farmer and the buyer in the event of loss from a given peril.

An example from Bangladesh[13] describes how a contracting processor and buyer of broilers not only organizes credit for participating farmers, but also operates a risk fund – called a contributory security fund - in order to assist in protecting against production and price risks. Similarly, a large Jamaican broiler enterprise, which is also a major aquaculture operator, provides tilapia smolt to pond-owning out growers, with an agreement to buy market-sized tilapia at an agreed price. Some of the farmed shrimp in Indonesia, Bangladesh and Sri Lanka are grown in share-farming arrangements, where the ownership of the ponds is held by the contracting company, with the proceeds of sale of market-sized shrimp being shared between pond-owner and farm operator. (Based on a personal communication from Dr. John Bostock, Univ. of Stirling, Scotland. July 2005.)

A further example comes from Northern Vietnam, where fingerlings are obtained from hatcheries on credit, with payment expected after the fish have been harvested. If the fingerlings die, the wealthier hatchery operator will often waive the due payment.

Insurance – introduction

One or two references have already been made to insurance as a risk management mechanism in livestock and aquaculture farming. The present chapter has outlined other types of risk management, before introducing the topic of insurance. The phasing in the discussion is deliberate. It serves to underline that there are many mechanisms for risk management that should be explored to the full before recourse is made to insurance.

In the chapter that follows, some examples are given where livestock and/or aquaculture insurance is in force in developing countries. Some, though not all, of the related insurance products have been associated with veterinary care programmes.

Chapter 5, Insurance Approaches: Steps in the Development Process, covers some of the main points that should be appreciated by those seeking to initiate a process for making livestock and aquaculture insurance products available in developing countries.

In certain parts of this chapter, a distinction is made between livestock and aquaculture insurance products respectively. Despite the similarities in the risks faced by the two types of farming, the obvious differences in the environments mean that there are very real differences in the details of insurance approaches to risk management.

[13] See Isnat Ara Begum (2005) www.pjbs.org/ijps/fin332.pdf

Chapter 4: INSURANCE IN PRACTICE

This chapter serves to outline a few examples of experience in developing countries with livestock and aquaculture insurance.

4.1 Livestock insurance in India

Public sector livestock insurance:

The central government of India has been much involved over the years with a broad range of insurance services in the country. From 1972 until 2000, the state-owned General Insurance Corporation (GIC) was the only body permitted to transact insurance business, and it did so through its then subsidiary companies, namely: National Insurance Company Ltd., New India Assurance Company Ltd., Oriental Insurance Company Ltd. and United India Insurance Company Ltd.

In 2000, the insurance market was liberalized, permitting the private sector to develop and sell insurance products. Nevertheless, the four named state-owned companies still transact a significant share of all insurance business, and are predominant in the fields of livestock and aquaculture risk.

The latest available information on livestock insurance is summarized in Table 3 below.

Table 3: Livestock insurance in India (Public sector)

Year	Number of Policies (million)	Premium Rs. crores[14]	Indemnities Rs. crores	Loss ratio
1995/96	15.3	113.39	74.05	0.65
1996/97	14.7	122.54	74.83	0.61
1997/98	6.3	143.45	80.11	0.56
1998/99	7.9	152.02	126.08	0.83
1999/00	9.8	137.14	114.28	0.83
2000/01	7.9	145.53	127.97	0.88

Source: Adapted from Government of India website

Typically, livestock insurance products offered by the state-owned insurers are confined to mortality cover. The sum payable on the death of the animal is either the sum insured, or the market value, whichever is the lesser amount. A number of exclusions apply, most of these being designed to ensure that adequate preventive veterinary practices are followed. Annex IV provides

[14] One crore of rupees is Rs. 10 million, approximately US$220,000 at November 2005 exchange rates.

further information on the conditions applying to these policies. The focus is on the insurance of individual animals, except in the case of poultry, where a certain minimum flock size is required, for understandable practical reasons.

A feature of the Indian livestock insurance products is that they tend to target dairy production units, especially those raising crossbred and other high-yielding cattle and buffaloes. This is situation is logical, since dairy farmers milking herds of this type of livestock are likely to be more commercially-oriented than are the more traditional producers, and may therefore be expected to have a greater demand for insurance products.

However, there is another example, from India, where insurers are linking with microfinance institutions in order to reach down to a smaller-scale type of client. This programme is the BASIX livestock insurance product, described below.

Private sector livestock insurance (example, BASIX)[15]

BASIX is an Indian livelihood promotion institution, established in 1996, working (as in 2005) with over 190,000 poor households in 44 districts and eight states. It addresses the promotion of rural livelihoods by the provision of financial services: savings, loans and insurance.

As with those supplying banking services in rural areas, insurance providers face high administrative costs when dealing with small-scale clients. BASIX addresses the administrative cost problem for its financial services by linking itself, where possible, to Self Help Groups (SHGs) organized at village level. The SHGs provide a cost-saving interface between BASIX and individual clients.

Livestock insurance operations involve a partnership between BASIX and a private sector insurer, Royal Sundaram General Insurance Company. The partnership is designed to combine the insurance expertise of a major underwriter with the proven ability of a microfinance specialist, BASIX, to reach rural clientele. Both partners contribute their specific expertise in the process of product design, and in the administration of the programme.

The policies are 'group' in the sense that the insurer issues one policy for "the livestock belonging to the customers of BASIX". In this sense, it is a group policy, though BASIX maintains records of individual ownership of insured livestock. Cattle, sheep and goats are included. The table below indicates the scale of current operations, which are a fraction of the business reported in the earlier table, which addressed public sector livestock insurance in India. Nevertheless, the BASIX and Royal Sundaram partnership is clearly reaching a clientele group that would be unlikely to attract the attention of the major providers of insurance services.

A strategy of careful attention to cost containment has been a key factor in permitting this livestock insurance product to operate sustainably. Part of this strategy has been to harness computerization for recording transactions, including premium collection and payment of claims.

[15] For information on the innovative livestock insurance scheme operated by BASIX and its partner insurer, the Royal Sundaram Insurance Co. Ltd. the author is indebted to personal communications from the Insurance Executive of BASIX, Mr. Gunaranjan, who also provided the policy document reproduced in Annex IV.

Table 4: Livestock insurance – Indian private sector (BASIX)

Year	Policies sold	Premium Rs. Lakhs
To March 2004	4430	16.23[16]
To March 2005	5040	16.37

Source: BASIX website

4.2 Aquaculture insurance in Iran

General

Aquaculture insurance, as is case for crop and livestock insurance, is offered by a state-owned entity, the Agricultural Products Insurance Fund (APIF). The APIF is a subsidiary of the Bank Keshavarzi, the government-owned agricultural bank. This is a large organization, with some 2,000 branches nationwide. The APIF started operations in 1985. Aquaculture products were first offered in 1996. The APIF has 580 employees, about 500 of whom are outposted in the field.

Product design is done in-house by APIF staff. Many of these officials have technical qualifications in agronomy, veterinary medicine, animal husbandry, plant husbandry. For aquaculture there are at least two officials who have university-level qualifications that are directed related to their responsibilities within APIF

The marketing of insurance products is carried out directly by APIF field staff. Because of the close relationship between the APIF and the Bank Keshavarzi, borrowers from the bank are encouraged to manage some of their risks by using insurance.

On notification of a loss event, loss assessment is carried out in-house by APIF staff, with a high level of supervision from headquarters.

The public sector plays an active role in insurance operations, not only through ownership of the insurance company but also through the fact that it provides reinsurance for this company. In addition, it subsidizes premiums, to some extent.

Insurance coverage and results[17]

Species insured: Trout, prawns (shrimp), carp
Perils covered: Temperature variability (biggest cause of losses)
Oxygen depletion
Flood
Hail
Earthquake
White spot disease in shrimp
Exclusions: Disease – except for white spot.

[16] One lakh is 100,000. This sum then approximates to US$35,500 at November 2005 exchange rates
[17] The data in this section were provided to the author by personal communication from APIF officials, in February 2005.

Table 5: Iran - Aquaculture insurance

Year	Number of contracts	Insured area (ha)	Premiums paid ($'000 equiv. Jan 2005 rate)
2000	421	2803	366
2001	422	3141	387
2002	715	5182	623
2003	1002	4654*	736
2004	1186	3200*	632

*Despite the number of insured clients rising steadily, the insured area dropped in 2003 and 2004 due to closure for a period of a number of shrimp enterprises, due in turn to quarantine requirements following outbreaks of white spot disease.

Table 6: Iran – Aquaculture insurance loss ratios

Year	Ratio*
2000	0.19
2001	0.43
2002	1.13
2003	0.90
2004	1.09

*The Loss Ratios (L/R) quoted here are not pure figures, based on unsubsidized premium and indemnity totals. This is because the government operates a premium subsidy scheme that is apparently variable. Anecdotal evidence suggests that the overall true L/R is of the order of 2.0, which implies a significant level of subsidy to the insurance programme.

4.3 Brief notes on livestock and aquaculture insurance experience

The individual country notes that follow serve to indicate the somewhat patchy experience of a number of developing (and newly-developed) countries when insurance products have been offered as a risk management mechanism for livestock and aquaculture enterprises.

Argentina: Despite the availability of a number of crop insurance products, it believed that no livestock or aquaculture insurance is currently available.

Bangladesh: The public sector insurer, the General Insurance Corporation, has offered insurance products on a pilot basis for high technology shrimp farms. Perils covered included: flood, tidal waves, storm surges, cyclones. The pilot has had very limited success, and in its initial form has proved to be financially non-viable. This is due to a high level of claims, coupled with poor demand for the product because of the exclusion of disease as an insurable peril.

Brazil: Just one company offers livestock insurance. The demand is mainly for cover for horses and cattle. No aquaculture insurance is currently available, though proposals are now (October 2005) being finalised for shrimp insurance.

Chile: This country is one of the world's biggest marine salmon and sea trout fish farming producers. Its aquaculture insurance industry is highly developed with two main insurers. All major international reinsurers are supporting these companies. The typical Chilean Aqua Policy is a very comprehensive named-peril policy for loss of both fish stock and installations.

Ecuador: One livestock insurer, since 1997, has offered insurance covering cattle (dairy & beef) and horses. There is no aquaculture insurance at present. It is believed that a pilot aquaculture programme was severely affected by storm and disease claims, and was terminated after one year.

Republic of Korea: A pilot insurance programme directed to oyster cultivators has proved to be a failure, due to a high level of claims, and the resulting non-sustainable loss ratio for the insurer.

Mexico: This country has the most developed livestock insurance market in Latin America. Individual animal mortality cover is available for cattle, sheep, goats and pigs. In addition, since the beginning of 2006, whole herd covers with high deductibles for epidemic diseases can be purchased – see Section 5.4 for more details on this new development. The Government provides premium subsidies, but these are now geared towards catastrophe epidemic disease covers, rather than to policies based on individual mortality. Agroasemex Mexico also has more than 10 years experience with aquaculture insurance, which is mainly for shrimps.

Panama: The local state insurer offers very limited livestock insurance

Vietnam: A pilot insurance programme for aquaculture enterprises in 15 Mekong River delta provinces was offered by a local subsidiary of the large French insurer, Groupama. After two years, the scheme was discontinued, with a loss ratio of nearly 2.

Chapter 5: INSURANCE APPROACHES: STEPS IN THE DEVELOPMENT PROCESS

5.1 Decision and action steps

Considerable attention has been given in the foregoing chapters to introducing the wide range of risk management mechanisms that operate in livestock farming and aquaculture. This approach is deliberate. Although this publication is primarily concerned with the use of insurance approaches to risk management, even the most fervent proponents of agricultural insurance would readily concede the necessity of accurately identifying the role, if any, of insurance in any given type of farming.

One key point needs to be underlined at the start. This is that insurance does not and cannot obliterate risk. It spreads risk. There are two dimensions to this spread. The first dimension is the spread across an industry or an economy, extended in the case of international reinsurance to the international sphere. The second dimension of spread is through time. Most insurance programmes operate on both dimensions. The important fact to note is that insurance does not directly increase the income from the livestock or aquaculture enterprise. It merely helps manage risks to this income.

An insurance indemnity becomes payable in the event of a claim under a policy. The policy must be in force, with premium paid, by the time of the loss event. Most policies incorporate an element of risk sharing, by means of a deductible. This amount is the percentage of the loss that is borne entirely by the insured.

Premiums must cover several areas of cost. The components commonly used by insurers to calculate premiums are explained in Annex II.

Any decision-making process on insurance involves many stages. These stages, and certainly the priorities, will differ, depending on which type of body is doing the investigation. This may be a government ministry, a farmers' organization, an insurer, a bank or a group of marketing/processing agencies. In any case, some of the more important issues and steps are:

a. Demand assessment – ensuring that any initiatives are in response to real risk management needs
b. Identification of the key insured parties; where is the risk carried, and is there a place for automatic as opposed to voluntary insurance cover? Are farmers willing to pay for insurance?
c. Which is the most important factor for the farmer to insure? Is it mortality and perhaps in some cases, loss of performance? Alternatively, is it rather the risk to the gross margin generated by the livestock enterprise?
d. Determination of the perils that the insurance contract can cover
e. Decision on types of enterprise to be covered – a key factor in insurance design
f. Analysis of insurance options, administrative models and loss assessment procedures, together with determination of associated costs
g. Rating – determining the pure premium required, plus administrative and loss adjustment overheads to derive the initial premium level to be charged. Note: this step needs reliable historical data on incidences of perils and resulting losses.
h. Identifying possible complementary roles for the government and for the private sector

In any given situation the results of investigating these issues will determine whether or not insurance is the most efficient and effective mechanism to manage a particular area of risk. The results will also indicate the type of insurance product that is optimum for a given situation. Further information on insurance administration is given in Chapter 8.

The sections below set out some of the arguments, and illustrate, with examples, how some insurance solutions have been developed. Given the over-riding importance of one particular climate peril for livestock, particular attention is given to the potential of rainfall index approaches in managing the risk of losses from drought (see Section 5.5 below).

5.2 Demand assessment

This must come before any substantial investment is made by any of the parties – government, insurance companies or organizations representing potential insured farmers. The assessment is not easy, as insurance buyers want to have an indication of the likely premium cost before expressing an interest in buying the insurance product. However it is impossible to give more than a very vague estimate of the likely cost of the insurance before there has been a detailed investigation of the incidence and effect of perils on livestock and aquaculture farmers, and an assessment of operating costs,

Closely linked to this is the need for any insurance programme to respond to real needs. As stated in the introduction, the buying and selling of livestock and aquaculture insurance products is a business, and both buyer and seller must want to participate. Real opportunities to benefit from the transactions must be met for this condition to be satisfied.

While some risks, such as drought, are ongoing, new risks emerge as production practices are altered. This alteration may be due to the availability of new technology, or as a result of changes in market demand or, as is increasingly the case, to respond to other types of pressure such as environmental or animal activist groups objecting to certain livestock management practices, such as the mulesing of Merino sheep[18]. Abandonment of an established practice will lead to a search for other risk management techniques. Sometimes, in some situations, the range of options will include insurance.

In the face of these needs, the services of an experienced agricultural or aquaculture insurance team are required when insurance is under consideration. Such a specialist team would be able:

a. to examine the risk structure of certain key enterprises,
b. to identify the extent to which the involved parties are vulnerable to these risks,
c. to draft an outline of an insurance programme, with indicative costs and benefits, and responsibilities; it would also include details of further investigative, publicity and lobbying work required before insurance business could commence.

This team would consult closely with several sectors in the economy, and follow up in detail the issues that are described below.

[18] Mulesing is the removal of skin folds from the region of the anus and vulva in order to reduce the threat of flystrike. It is considered by many to be cruel, despite its effectiveness in markedly reducing the incidence of flystrike. Flystrike causes pain and, often, death of the affected sheep. As a result of lobbying, backed up by threats of market boycotts, those working in the Merino sheep industry have agreed to cease the practice by 2010.

5.3 Nature of the insured parties – automatic or voluntary cover?

Farmer/producers are one obvious party to insurance. Those who depend on a supply of livestock, livestock products, fish or other aquaculture products for their business are another. The latter group includes processors and product buyers.

These firms often stand to lose financially if products are not available from their local primary producer In the event of a loss on the farm, the buyer or processor may face increased acquisition costs in order to meet ongoing contractual or other market obligations. They therefore have an insurable interest in the livestock and fish.

One of the factors, which can lead to an increased demand for insurance, is the growth of contract farming arrangements. When insurance can economically address some of the production risk involved, risk that affects both growers and contractors, then there may be a case for making insurance automatic. This is the same as making it compulsory, but "automatic" is a better description of the process when insurance becomes just one of a range of services being provided, as a package, to contracted growers. Another form of linkage of insurance to other services involves credit, when insurance is sometimes a condition imposed and arranged by the lender.

Beyond these types of linked compulsion, the catastrophic FMD outbreak in the United Kingdom in 2001 (already mentioned above) sparked a debate in both the U.K. and the EU as to whether livestock farmers should be obliged to buy epidemic disease cover so that taxpayers would not be obliged to pay for future losses. Such losses include compensation to farmers for animal mortality, loss of production and clean-up costs. At the time of writing, the outcome of this debate is not known.

The key risks for livestock and aquaculture farmers have been set out in Sections 2.2 and 2.3 above. Some of these are such that they might be managed with the assistance of insurance. Others would not. Chapter 6, below, selects some of these risks and discusses them from an insurance point of view.

Firstly, however, it is necessary to look briefly at the basis for possible insurance. In other words, in the insurance contract, what is the basis for an indemnity payment to be made, is it mortality, or is it based on financial criteria, in turn dependent on the gross margin results achieved in the enterprise. This distinction is now explored in Section 5.4 below.

5.4 Approaches to livestock & aquaculture insurance

In conventional livestock/aquaculture insurance policies, a claim leading to payment of an indemnity can be made in the event of an insured peril leading to stock mortality, with the loss measured on the basis of an agreed value for the stock. This is still by far the most common form of livestock and aquaculture insurance. Moreover, it is likely to be the most readily form of insurance cover, for most developing country situations, for the foreseeable future.

An alternative approach is when an insured peril impacts on the profit of the specific enterprise being insured, i.e. the gross margin[19]. This impact may be due to mortality of numbers of

[19] The writer is particularly indebted to Charles Stutley for valuable guidance on the approach taken in this Section, and for the useful example material included.

stock – or it could be due to loss of production due to adverse climatic factors, to a ban on marketing stock or stock products, to the outbreak of an infectious disease or pollution of the environment (particularly applicable to aquaculture enterprises). Again, it could be due to a marked increase in on-farm costs, following an insured event - even without the actual death of the insured stock.

When the contractual basis between the insured and the insurer focuses on the expected gross margin of an enterprise, any significant shortfall in the gross margin is then the basis for the determination of an indemnity payment, provided it is caused by a peril recognised under the insurance policy.

This approach is far from being in common use as yet, the only mature example known to the writer being a policy popular in recent years with German dairy farmers. In Mexico too the benefits of concentrating on the financial outcome of the enterprise have recently been recognised. Detailed product development work has been completed in this country, and a commercial launch of insurance products expected in the near future. More information on the Mexican example is given below, towards the end of Section 5.4.

Clearly, with its focus on the expected financial outcome of an enterprise, the new type of policy addresses the key factor in commercial farming. Despite this logical advantage, there will be difficulties in introducing gross margin products in most developing countries. These difficulties exist on both the supply side (the insurer) and on the demand side (potential insured farmer).

For the farmer, the circumstances that would make a gross margin trigger attractive include those where there is significant investment involved, and where there is limited personal risk-bearing capacity, usually due in turn to high levels of borrowed funds for the enterprise. These circumstances certainly exist, but are by no means the rule in most developing countries.

For the insurer there must be confidence that the necessary records are available and reliable, so that a loss can be quantified. In developing countries, there will be limited situations where this condition can be met, though more and more farmers, including fish farmers, are known to be keeping records.

By contrast, insurance contracts where mortality as the basis for a claim are less demanding in terms of records, but still require a reliable system for the positive identification of the insured stock[20].

Perils covered in traditional mortality insurance include:

- Flood, windstorm
- Pollution, poisoning, land subsidence
- Machinery/electrical breakdown
- Fire, lightning, explosion
- Malicious damage, riot, strike

Common exclusions in the traditional policy were:

- Consequential loss & legal liability

[20] The importance of positive identification of livestock also has important consequences for disease control and food safety mechanisms (ref. Rweyemamu 1998). This means that the cost of identification should not be a charge to the insurance service alone.

- Epidemic diseases and Government slaughter order
- Cannibalism/ malnutrition
- Overcrowding

The challenge now for the insurance industry is to design products that would have wide applicability for many developing country farming types and systems, and would cover:

- Epidemic disease with or without a Government slaughter order
- Ban on selling animals or animal products
- Drop of production as a result of an insured peril

As mentioned above, Mexico has recently taken up this challenge. Here, government and private, commercial insurers are currently exploring options for livestock insurance against catastrophe epidemic disease. Insurance products are needed which combine coverage of direct mortality losses to the livestock enterprise **and** the consequential losses or business interruption costs arising out of the insured event.

Traditionally, Mexican insurers have offered individual animal accident and mortality livestock insurance for cattle, pigs, sheep and goats. This type of cover has been available since the mid 1990's, and has been supported by government subsidies of about 30 percent on the insurance premiums paid by livestock producers. With premium rates for individual animal insurance of 5 to 7.5 percent, or higher, according to the coverage provided, the subsidies have been important in making the product affordable for small livestock producers. Indeed, the cover has proved very popular among farmers. Consequently, insurance penetration levels have been high, particularly for dairy cattle and pigs enterprises.

In 2005 the Mexican government decided to withdraw its subsidy support for individual animal cover and instead to switch the subsidies to catastrophe livestock epidemic disease insurance products. At the time of writing the author has not seen the final details of the new Mexican catastrophe livestock insurance products, but they are understand to include the following features:

- The policies are herd (flock) based, with a first loss deductible designed to eliminate normal mortality levels and low-level frequency losses, which do not impact heavily on the financial viability of the livestock enterprises[21].

- The policies include protection against traditional accident and mortality on the one hand, and losses arising from catastrophe (OIE Class A) epidemic diseases and unavoidable slaughter on the other.

- For dairy cattle, the intention of the policies is to provide business interruption cover against lost milk production when a high mortality event takes place. For dairy farms that are directly affected by the disease event, the policies would pay out for the loss of the cow plus loss of income from milk sales for any cows that have died and/or have been culled. For non-affected herds in the controlled zone, where milk sales are banned, the cover would indemnify the producer for loss of income from milk sales. The policies would also

[21] The 'each and every loss' deductible is either expressed as a 'number of heads of animals' deductible or as a percentage of the total sum insured for the herd.

indemnify milk producers in situations where a natural peril, such as flood, prevents the producer from delivering his milk to the market.

- By restricting coverage to catastrophe events only, there is the potential to offer this insurance at rates of 1 to 2 percent, or less, though the actual rates are not known for certain at the time of writing.

5.5 Index approaches to insurance

The concept:

In a conventional or classic livestock or aquaculture insurance policy, evidence of damage (i.e. mortality of stock on the farm, or in the water) is needed before an indemnity is paid. However, verifying that such damage has occurred is expensive, and making an accurate measurement of the loss on each individual insured farm is even more costly.

An index (also sometimes known as 'coupon') policy operates differently. With an index policy a measurement is derived from factors connected to the damaging event but not directly dependent on individual loss assessment of the insured stock.

Weather index insurance

The measurement that is most commonly considered in constructing an index for insurance relates to meteorological events which are expected to be damaging, and which can therefore be used as the trigger for indemnity payments. These damaging weather events might be:

a. a certain minimum temperature for a minimum period of time.
b. a certain amount of rainfall measured in a certain time period – this can be used for excess rain and also for lack of rain (drought) cover; an alternative approach to establishing the degree of drought experienced, and the area affected, is the Normalized Difference Vegetative Index (See NDVI in Glossary). This relies on an analysis of satellite imagery, rather than the use of rain gauges on the ground.
c. attainment of a certain wind speed – for hurricane insurance.

The classic insurance policy is replaced with a simple coupon. Instead of the usual policy wording, which would give the indemnity payable for livestock mortality for losses from specific causes, the coupon merely gives a monetary sum that becomes payable on certification that the named weather event, of specified severity, has occurred. The face value of the coupon may be standard, to be triggered once the weather event has taken place for the geographical area covered. Alternatively, it could be graduated, with the value of the coupon then being proportional to the severity of the event.

Clearly, this type of trigger operates over an area, encompassing many insured farms. Again, a trigger such as this cannot be used for certain perils, such as hail, where the adverse event normally impacts on a very limited area of land. On the other hand, it is suited to weather perils that impact over a wide area, for example drought.

Since there is no direct connection between a farming operation and the coupon, even those without farming enterprises at risk could theoretically purchase risk cover of this type. This is not a disadvantage. On the contrary, there are many persons besides farmers who stand to suffer financial losses from adverse weather events. Fishermen, tourist operators, outdoor vendors are among the many categories making up the potential clientele for index insurance products.

Index-based agricultural insurance is a very new product. It has only started recently in a small way in a few parts of the developed world and it is still too early to be able to report much experience over a satisfactory time series.

Examples to date include index insurance against drought on pastureland in the provinces of Alberta and Ontario, in Canada, and a similar cover in operation in India, through the BASIX microfinance network, designed to provide a level of protection for smallholder farmers. Other examples are noted in the section below entitled, 'Index insurance: the way of the future?'

In Spain, a novel approach is being taken with livestock insurance. The risk being addressed is a shortage of pasture feed, itself largely a function of rainfall.

Agroseguro, a consortium of insurers (the operations of which are heavily subsidized) has constructed an index that is designed to trigger an indemnity when the quantity, density and quality of pasture fodder falls below a certain critical index figure. The analyses used to derive the index (termed the NDVI – Normalised Difference Vegetative Index) are based on satellite imagery from NOAA[22]. It is not yet known how successful this approach has been, but one can note that it has the potential to provide information at low cost compare with on-the-ground rainfall measurements. Moreover, data from satellite imagery are not as susceptible to tampering, as is the case with data produced by standard rain gauges.

Non-weather index insurance

There is a theoretical possibility that indices derived from events other than weather could be used as triggers for insurance products. The example below, from Mongolia, describes one such possibility, where one of the indices being considered is a zonal livestock mortality rate.

Mongolia - Livestock insurance concept, using an index approach[23]

Mongolian agriculture is largely based around raising livestock, with the national herd, nearly all of which is now privately owned, being nearly 30 million head, predominantly sheep and goats, with significant numbers of cattle, yak, horses and camels. Income from herding accounts for nearly one-third of the country's GDP.

The main climate hazard faced by herders is when a harsh winter follows a period of poor spring and summer pasture growth. The resulting *dzud* causes severe livestock losses. Inadequate nutrition in the previous spring and summer means that animals go into the winter in poor condition. In addition, poor summer growth means that the pasture is short or inadequate where

[22] National Oceanic and Atmospheric Administration, Department of Commerce, United States. This body maintains a number of satellites producing photographs of the Earth's surface. The definition of the photographic images is such that quite accurate estimates can be made of plant growth. The NDVI is being used by Agroseguro, in Spain.

[23] Ref. Skees, Jerry R. and Enkh-Amgalan A. (2002) '*Examining the Feasibility of Livestock Insurance in Mongolia*' World Bank Policy Research Working Paper No. 2886 Washington Sept. 2002

stock is kept in the winter - the winter camps. Heavy snow covers pasture to the extent that animals have very little access to nutrients in the camps. As a result of these factors, *dzud* conditions lead to high livestock mortality levels[24].

Indeed, in recent years, three successive *dzud* winters saw the national herd contracting from 33.6 million head in the 1999 census, to 23.9 million head three years later.

Traditional, individual insurance approaches to assist in the management of the losses caused by *dzuds* have been considered, but have been quickly judged unsuited and impractical, given the scattered communities, high administrative costs and the opportunities for moral hazard problems. Moral hazard in these conditions would be extremely costly to monitor, let alone control.

Accordingly, the Mongolian authorities and the World Bank recently conducted a study to see whether an index of mortality could be used as a basis for paying indemnities – on an area (local district or *sum*) basis. Facilitating this is the fact that there is a well-established practice of conducting an annual livestock census in Mongolia. Therefore, the determination of an index of livestock mortality should possible and could doubtless be done at minimum cost. The feasibility study indicated that the concept has merit, and may well be taken as a step towards meeting the strict conditions that would be required by insurers and reinsurers before they would accept the risk.

By way of commentary on the proposed use of a mortality index, one could note that it is not completely detached from management factors. Conceivably, careless management practices by a number of herders within the *sum*, and subsequent higher than necessary mortality of livestock, could influence the index. However, herders who engage in such careless management would need to collaborate in order to influence the index. A greater potential problem to the use of a mortality index is the credibility of census statistics. Local authorities (who manage the annual livestock census) could influence the reporting process and thus introduce a systematic bias that would inflate the payments made for livestock losses in their area.

In order to overcome the problem, an examination is now underway of the feasibility of using other indices, indices that would be beyond the control of the herders and the local authorities. While the obvious candidate is a weather index, as used elsewhere in the world, this is not feasible in Mongolia, as the *dzud* and its losses involve many complex factors and relationships that go beyond weather *per se.* More likely to show promise is an index using data derived from satellite imagery, coupled to sample observations on the ground that indicate nutritional levels in livestock.

Index insurance: the way of the future?

Despite the paucity of experience with index insurance, there is a high level of interest in both development and insurance circles in this risk management mechanism for developing countries. This interest is prompted by the belief that index insurance products offer an apparently practical solution to many of the barriers to classic agricultural (crop, livestock) insurance for small-scale, dispersed farmers in less developed areas of the world[25]. These barriers include:

[24] For much of the detailed information given here the author is indebted to personal communications from Prof. Jerry Skees.

[25] Its applicability to aquaculture risk is an area still to be developed. Wind speed is one possible index that could be related to damage to aquaculture enterprises. Another is water quality, where many insured fish farms rely on the same source of water.

a. adverse selection – only those farmers more at risk will buy cover;
b. moral hazard – the insured farmer may not do everything possible to avoid or minimise a loss;
c. transactions costs – the huge costs of marketing individual insurance policies, coupled with the administrative costs involved in calculating and collecting individual premiums and paying claims;
d. loss assessment expenses – if loss assessment is done on an individual farm enterprise basis the costs can be very large in comparison to the premium paid, and may not be feasible in many small farm situations; as noted in Chapter 8, index insurance avoids nearly all the steps involved in the process of loss adjustment.

These four factors are all major constraints to conventional insurance. In an attempt to counter them, index insurance products have been or are being tried in a number of countries. At this stage, the focus is on crop risk with weather indices as the triggers. The list of countries involved includes: Canada, Ethiopia, Guatemala, India, Malawi, Peru, Spain, Ukraine, Uruguay.

In summary, and on present evidence, index approaches appear to be the most promising field for new insurance products for many types of primary industry in developing countries – especially for certain perils affecting livestock and cropping. At the present stage of development, it is not clear how index insurance products could be designed for aquaculture, though this may well be merely a matter of time. Certainly, given the growing importance of aquaculture, there is every reason to believe that efforts will be made to harness the benefits of index approaches in order to facilitate insurance participation in some of the perils faced by this industry.

Some of the special features of index insurance are discussed in the following chapter, in the section dealing with drought. This peril poses particular challenges for traditional insurance products, which has led to much attention now being directed towards index approaches.

Chapter 6: RISKS THAT MAY BE MANAGED, AT LEAST PARTIALLY, BY USING INSURANCE

6.1 Disease losses

Diseases may cause actual death, or diminished production. They may also mean increased on-farm costs, occasioned by the required quarantine, curative or preventive measures. For example, the regular drenching (oral dosing) of sheep against parasitic worms in the alimentary tract is a significant cost item for many sheep herders.

Again, the presence of a disease may prompt a government ban on the sale of animals or animal products, or even a government slaughter order within a zone of possible infection. Transboundary animal diseases can affect livestock in all countries, but are particularly important where the borders between countries are land boundaries, and where the movement of both domesticated and feral animals is difficult to control. Fish diseases can similarly spread readily from the waters of one country to those of another.

Having noted these costs resulting from disease, how relevant is insurance as a means for assisting in the management of disease risk? On the supply side, coverage of disease risks is not easy for insurers and reinsurers, since most diseases are partially or totally preventable/curable through sound animal husbandry, livestock sanitation and vaccination programs. In addition, many diseases do not cause death, but rather loss of use or performance.

Turning now to demand, there is little doubt that farmers of widely differing scales of operation are heavily dependent on their livestock staying alive and productive. Thus, the demand for management of disease risks touches both the small farmer, with one or two draught or milch animals, as well as the large-scale beef feedlot operator, who is carrying a heavy debt burden on his current stock.

There is no doubt that the first layer of disease management must be appropriate on-farm livestock and aquaculture husbandry. Insurance, where it operates, is generally accompanied by requirements that prescribed veterinary care procedures, including vaccinations, are followed. For example, some cattle insurance contracts specify a number of required vaccinations, for which documentary proof is demanded by the insurer in the event of mortality of an insured animal. The two types of products – a veterinary care plan and insurance – are mutually supportive. Moreover, marketing to the same clientele costs less in administrative costs than would be the case if the products were to be sold separately.

The risk of exotic disease outbreaks, particularly at an epidemic level, call into question the ability of the insurance industry to design and market suitable policies to meet this type of risk. The problem here is that the exposures are potentially so high, that the only way most insurers and reinsurers could be persuaded to participate would be through caps on their exposure. Such caps could be possibly be accompanied by government partnership arrangements, with the public sector undertaking to cover losses above the cap established in insurance contracts. Despite the apparent attraction of this type of arrangement, the ability of most developing countries to undertake this sort of commitment would be very limited. Despite the difficulties posed by epidemic diseases, several traditional livestock insurance programs in Europe do cover livestock epidemic diseases, including for example insurance products offered in the Czech Republic and in Slovakia.

In short, insurance cannot substitute for sound management of the risk of diseases. Indeed, this task is a significant area of modern farm and aquaculture management, with very substantial losses resulting from failures in this area. Moreover, the growing importance of international trade in agricultural commodities impacts on the pest and disease issue in developing country farming in several ways:

a. Food safety and quality regulations mean that any evidence of pest or disease in a consignment may disqualify meat, other livestock products or fish from entry to the country of destination;
b. Similarly, pesticide and drug residues are subject to very tight limits under the standards for international trade;
c. Competition in the market is fierce, and even if produce is allowed to enter, a recent history of disease problems in the producing country may mean the produce is unlikely to find a buyer at a remunerative price.

Insurance implications can similarly be summarised in a brief list:

a. It is sometimes possible for farmers to obtain cover against diseases where there is no generally accepted on-farm livestock or aquaculture husbandry practice[26].
b. Because many disease conditions only lead to mortality when there is a nutritional deficiency, or similar failure of management, insurers require certain minimum standards of livestock husbandry, and may state in the insurance contract that indemnities will not be paid if there is evidence that these standards have not been met.
c. In an attempt to reduce the adverse environmental impact of some well-established routines for pest and disease control (e.g. certain chlorinated hydrocarbons used to control ectoparasites), alternative, benign regimes are continually being developed. Insurance may be utilised in the future in order to provide temporary risk assurance to farmers who are persuaded to use the new routines, but who are uncertain as to their efficacy.

6.2 Climate perils

Drought

Drought is by far the most important peril for livestock farmers in developing countries[27]. A quote from an IFPRI publication is relevant here:

> "Drought management interventions need to be designed so that they assist farmers and herders to better manage risk and improve their productivity and incomes, but without distorting incentives in inappropriate ways. The experience with feed-subsidy programs in the West Asia and North Africa region and with restocking projects in Sub-Saharan Africa have had mixed results. While they have helped protect incomes and food security in drought years, they have also had negative impacts on the way resources are managed. Better alternatives could be area-based rainfall insurance, particularly if offered by the private sector, and the development of more accurate and accessible drought-forecasting information[28]."

[26] This situation can of course change, as new rearing technologies and disease control regimes are developed.
[27] In extreme conditions, it can also affect aquaculture enterprises.
[28] Hazell, Peter (2000) page 99

It is worth noting that the writer of this opinion specifically mentions herders, alongside farmers, as being potential beneficiaries of improved drought management interventions. Indeed, the devastating impact of drought on livestock herds is well known.

Drought is also the natural weather event that causes most problems for insurers. The reasons for this are many. Firstly, insurers feel most confidence when an adverse event has a clearly defined time of impact, coupled with a clearly defined geographical area that is affected. The classic example is hail, which may do its damage in a matter of a few minutes, or even seconds, and will typically impact an area confined to a few hundred square metres up to a few square kilometres. Hail damage is clearly attributable to the adverse weather event, and is readily verified as such, provided that a field inspection is undertaken.

By contrast drought has a vague beginning, its effects linger for a very long time, and can extend over more than one season. Moreover, it typically impacts a very wide land area. Livestock production losses caused by drought can be aggravated by the incidence of other problems, e.g. severe winter conditions following a summer and spring during which feed was in short supply, due to lack of rain.

From a purely underwriting point of view drought poses great difficulties for a standard livestock insurer. Firstly, because drought affects a large number of farmers in the same season – perhaps the whole of a country – the losses can be very large. This systemic or catastrophe exposure means there are problems in mobilising sufficient insurance capacity to cover the sum insured that is at risk, even with recourse to substantial reinsurance. Secondly, droughts in recent years, at least in many parts of Africa, have tended to extend over more than one year. This experience means that it is extremely hard for insurance companies to obtain reinsurance for insurance portfolios that carry drought risk. Thirdly, the magnitude of the risk in most developing countries means that actuarially calculated premiums would be very high – too high perhaps to attract all but the most at-risk livestock farmers. No insurer wants to build a portfolio based entirely on such clientele.

For these reasons, insurers are very wary of covering drought as an inclusion in standard agricultural insurance policies. This is particularly the case in those parts of the developing world where drought is the major weather constraint to livestock production. These include: Southern and Eastern Africa, Sahelian Africa, Horn of Africa, North Africa/Near East, Eastern Europe, Central and East Asia, South Asia, Central and South America. These are also regions in which livestock play an important role in farming generally, and in small-scale farming in particular. The list illustrates the key role that drought plays in the lives of much of the developing world's rural population.

Given the almost insurmountable problems involved in including drought in standard mortality policies for developing countries, attention in recent years has turned to examining whether index (coupon) policies could provide a useful degree of loss control in the event of a serious shortfall in precipitation. For drought, the index used would most likely be precipitation over a given period and within a pre-determined zone. However, other indices may also be applicable in particular circumstances. Initial developmental work in this field is promising. As mentioned above, the NDVI index is already in use, in Spain. This index, or similar remote-sensing applications, could well bring low cost benefits to certain developing countries where livestock farming is based on pasture, and where drought is an occasional peril[29].

[29] See NDVI, as defined in the Glossary, for more information on this index

Again, the Mongolian example, described by Skees and Enkh-Amgalan, and noted in Chapter 5 above, suggested that a livestock mortality index insurance product could overcome the high costs of the more conventional insurance programmes. The policy would be triggered by a mortality index above a certain threshold. An annual livestock census would provide the necessary baseline and "after loss data". As an area or zonal programme, all livestock farmers in a given zone would receive the same level of indemnity, as this would be fixed on a zonal basis. This standardization means of course that there is every incentive for individual farmers to minimise their losses – i.e. nil moral hazard, as could be the case with insurance products where losses are adjusted individually[30].

More generally, a weather (e.g. rainfall) index insurance product involves using a meteorological measurement as the trigger for indemnity payments. In practice, the most likely trigger format would be a series of indemnity steps, each step corresponding to a given level of rainfall deficit. The assumption is that farmers could select a level of indemnity suited to individual circumstances. Thus the indemnity payable would increase as the rainfall shortfall increased from a defined "drought trigger" amount.

At the time of writing (2005), index policies covering drought or other climate risks cannot be described as being a standard, tested product ready for introduction in developing countries. Rather they are in the nature of a promising new insurance technique, attracting much interest among farmers' organizations, policy-makers, insurers and other risk management professionals[31], with the likelihood of more pilot programmes being implemented, in developing countries, in the near future.

Windstorm

Windstorm insurance for developing country livestock and aquaculture enterprises relates chiefly to losses resulting from damage to structures such as livestock housing for intensive rearing enterprises, and to those aquaculture structures that can suffer damage from excessive winds and the resulting storm surges. Clearly siting considerations, together with construction quality, are factors that will affect vulnerability to windstorm losses. Before accepting windstorm as an insured peril, insurers would take these sorts of management practices into account. They make certain that it is only exceptional events that will trigger the insurance.

Windstorm is associated with catastrophic losses to life and property, as well as to crops. Hurricane Andrew, one of the most destructive storms ever recorded, hit Florida and Louisiana on 25 August 1992[32], while more recently, and perhaps more disastrously, Hurricane Katrina hit the

[30] Skees, Jerry R and A. Enkh-Amgalan (2002) The peril here is not simply a drought, which is why a simple rainfall index is not suitable. Rather, and as noted in Chapter 5, the livestock losses during what is termed a *dzud* are the result of poor rainfall conditions in the spring and summer, leading to poor feed availability for livestock. If a particularly harsh winter should follow, then there is high mortality among the animals already weakened through poor nutrition.

[31] One of the major objections to index insurance for drought is the practical difficulty of ensuring that rainfall readings are genuinely accurate. This requires rain gauges that are tamper-proof. Various methods for tackling the problem of tampering are being developed. One of these is a system of multiple rain gauges that can be sited on the top of telegraph poles, and which measure rainfall by means of tiny buckets which trip a measuring device. These have the advantage that they do not store the rainfall; merely record the volume falling at that point. The data can be downloaded to a computer. Remote access to the data could be readily arranged, and a pattern of rainfall readings built up form the multiple measuring points. Satellite imagery over the insured period could also be utilised to confirm an insurable weather event.

[32] Total damage from Hurricane Andrew was estimated at $26.5bn, of which all but $1bn occurred in Florida. The greater part of this was wind damage, and the value quoted includes all damage- not just agricultural losses. At the time

Louisiana and Mississippi coasts at the end of August 2005. Storms of this magnitude, and lesser, but still serious weather events of this nature, are believed to be increasing in frequency. This may be due to the incremental energy levels in the world's weather systems, as a result of global warming.

Because of the increasing frequency of damaging weather events, it is expected that in the short term this will result in a significant rise in premium rates for conventional insurance. In the longer term, the challenges posed will doubtless give an impetus to a trend that is already apparent, that is, the search by risk management professionals and others for new ways by which losses arising from severe climate events can be managed. One such development has been catastrophe bonds. These provide a mechanism whereby investors can earn an attractive return on such bonds, but stand to lose some or all of the capital invested in the bonds, in the event of a catastrophe.

Freeze

Freeze is not a peril generally associated with livestock or fish deaths in developing countries. However, it does affect fish farmers in northern latitudes, for example in Norway and Finland, and along the eastern coast of Canada, especially when particularly violent storms accompany the normal freezing over of the top layer of water. In these circumstances, ice is broken up and is stirred down through the zone where the fish are found, super-cooling the water, and causing high fish mortality. Another example relates to carp broodstock in pond culture in Eastern Europe. High mortality levels of these carp have been experienced during extreme winters. This risk is often insured in the countries where this risk needs to be managed.

The other type of enterprise affected by freeze is livestock raising in northeast Asia, for example in Mongolia, here the *dzud,* can cause a very significant number of deaths among sheep, goats, cattle, camels and horses. The exploration of a means for insuring against this peril using an index approach is described above in Chapter 5.

Flood

Flood damage may be due to excessive rainfall on-site, but it can also be caused by excessive precipitation elsewhere, and the subsequent rise of river and lake levels, to cause flooding of farmland, overflowing (and pollution) of aquaculture ponds and dams, and heavy losses of livestock and fish. It may also be caused by structural failure of dams or levies, but this is usually a secondary consequence of an extreme climate event, so flood as a peril is listed under Climate in this discussion.

Flood is sometimes one of the results of severe oceanic storms. Examples are the frequent tropical cyclones experienced in the Bay of Bengal. These usually cause flooding of low-lying farmland along the affected coastal zone. Records indicate that although the fundamental peril is windstorm, the actual losses on farms – to livestock as well as to aquaculture enterprises, have been due to flood damage resulting in turn from wind-induced high sea levels, which are known as *storm surges*. At the time of writing (September 2005), much attention is being given to the flooding in Louisiana, Mississippi, and Alabama in the southern United States as a result of Hurricane Katrina. In this case, excessive precipitation was accompanied by wind-induced storm surges that broke the levies protecting, among other areas, the city of New Orleans.

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of writing, the losses from Hurricane Katrina have yet to be estimated, but it is believed that they will be at least as large as those from Hurricane Andrew.

Another extreme example of an ocean-related flood is the seismic sea wave, or tsunami. As its name suggests, this oceanic wave is the result of a seismic event, usually an underground earthquake, or volcanic incident affecting a relatively small part of the ocean in a massive way. The resulting wave travels at a speed of several hundred kilometres per hour, over vast distances. As the wave meets a rising seabed, it grows massively in height, leading to serious flooding of the land adjacent to the sea front. Aquaculture enterprises are particularly at risk, as they are very frequently located along or close to the seashore. Damage can be to the growing fish and to livestock; it can also affect fish cages and ponds, mollusc racks, on-shore fish farms, which are often sited on shorelines and livestock housing (in intensive rearing systems). As a result of an undersea earthquake off the Aceh Province of Indonesia on 26 December 2004, and a subsequent tsunami, significant damage was done to coastal regions of many countries. For example, in Aceh itself, more than half of some 44,000 ha of fishponds were destroyed, along with their stock. Ponds were filled with debris and silt that was often found to be toxic. The resulting clean-up and rehabilitation of facilities is proving to be a costly exercise.

The insurance technology for flood risk is not overly complex, so in many circumstances this risk is insurable. Exceptions would be for enterprises that are situated where the risk is regarded as high, for example, flood plains that by definition are exposed to a very high risk of inundation. Premiums charged to manage the risk of flood in such areas would be prohibitively expensive, although in some developed countries the public sector has subsidized insurers in order that farmers in the area are covered against losses from this peril.

6.3 Other perils

Seismic and volcanic events

Although seismic events are relatively common, those causing significant damage are rare, as are seismic sea waves, or tsunamis. Livestock housing and aquaculture structures can be destroyed, leading to deaths, or deaths may occur as a result of accompanying inundation and/or pollution.

Insurance protection against these events is usually possible, at least from an underwriting point of view. For the farmer, these types of events bring the expectation that disaster relief will be forthcoming from public funds. This will reduce the demand for insurance, even if insurance products are available in the market.

Fire

Fire is one of the oldest perils to be covered in property insurance. It is also a major peril for many livestock enterprises, particularly those involving housing, such as broiler and egg production units. Bush and pasture fires can also result in livestock losses. Again, insurance protection is usually possible – often as part of a multi-risk policy.

Fires are caused by human action (and carelessness) and also by lightning strikes during electrical storms. Whatever the cause, there are control measures to reduce any losses. These may be through early detection and the subsequent means to take action. This implies the use of smoke detectors and alarms, together with adequate access to fire extinguishers and/or the more basic means of putting out fires, such as water and sand buckets. Insurance policies will normally state

the expectations under the policy of the means to control fire losses. Again, this is an example of insurance being just a part of a cluster of measures used to control risk.

Theft and predation

Mysterious disappearance, rustling, theft, predation, escape are of growing concern in certain parts of the world. For example, and as already noted above, theft of livestock in Southern Africa is the major incentive for herders to use stock identification systems. Insurance policies often exclude theft and 'mysterious disappearance' from cover, due to the difficulty of proving that stock was present immediately prior to the disappearance. Even when this type of loss is covered, the policies are likely to specify high deductibles, thus forcing herders to rely principally on their own careful management to minimize losses of this type[33].

Fish farms, especially those in which fish are held in sea cages, are at risk from predation by sea birds, and also from seals and predator fish such as sharks. Cage design can assist in controlling predation of this sort, but only at a considerable cost in terms of the use of stronger materials. This risk has been covered by insurers in some developed countries, but losses have been considerable. There is little evidence that insurance for this type of risk will be readily available in most developing countries, in the foreseeable future. In inland, pond culture systems, animal predators can be responsible for significant losses. For example, monitor lizards are a particularly important source of predation losses of farmed fish in some African countries, for example, in Uganda.

Water quality

Water quality problems are of particular concern to aquaculture. In their natural environment, fish deal with threats to their survival by simply swimming away. When caged, or in ponds, this is not an option. Three main types of peril affect water quality:

- Oxygen depletion – can be due to high water temperatures, or to decomposing organic matter, or to the presence of high concentrations of algae. The condition is also known as 'summerkill' ;
- Pollution – may be organic or inorganic; it is worth noting that pollutants are not only the substances commonly classed as such; even fresh (non-saline) water can be a pollutant that causes harm to certain sensitive seawater species ; floods may also lead to pollution losses;
- Algal blooms – often caused by a series of unusual weather events, giving rise to rapid multiplication of algae. Farmed fish, in cages, are unable to move to clear water, and can die through oxygen depletion in the water, from toxins produced by the algae or from other effects of the presence of algae, such as the clogging of the gills of the fish, with the result that oxygen transfer across the gill membranes is inhibited.

In the main, this risk is best addressed by farm management practices, starting with careful siting of fish cages, care with water recharge in pond systems, avoidance of over-stocking and even selection of species being farmed[34]. However, some of the underlying causes of these problems may themselves be insurable. Storms can induce summerkill in pond systems, by stirring up

[33] The BASIX example in Annex IV places great importance on identifying animals to be insured, through the use of ear tags – plastic devices that are provided by the insurance company.
[34] Tilapia and many types of carp show greater resistance to low levels of dissolved oxygen than other species, which is one reason for the popularity of these species in developing country aquaculture.

oxygen-deficient water from the bottom layer of ponds. Ponds, sea or lake cages, or shellfish may all be subject to pollution resulting from flooding of nearby land.[35]

Accidents

Many insurance policies for livestock and aquaculture will cover losses from accidental poisoning, explosion, and other incidents resulting in infrastructure and environmental problems, and also machinery/electrical breakdown and power outages. Similarly, damage to structures (tanks, cages, sluices) from collisions on land or water will generally be included as insurable risks.

Losses from malicious damage, riot and strikes are sometimes covered in insurance policies, but insurers often list these risks as exclusions.

Consequential losses

As farming becomes more commercial, with contractual arrangements for supply to processors and exporters more common, so too can losses consequent upon a failure to supply farm products become an issue. Similarly, as food safety measures include such mechanisms as tracing produce back to points of origin, issues of responsibility for the freedom from harmful substances or pathogenic organisms can impact upon food producers. It is envisaged that consequential loss and legal liability due to such livestock losses and/or food safety considerations will have increasing financial consequences for producers, and may be a growing area for insurance protection in developing countries.

In Europe, consequential losses due to measures such as trade bans on livestock and livestock products, may be compensated through private insurance schemes (e.g. The Netherlands, Germany, UK), or through public-private partnerships (e.g. Denmark, Finland, Spain).

Management issues

These are usually rated as exclusions in livestock insurance policies. Examples include: infertility; loss of normal biological function; cannibalism and overcrowding losses; malnutrition (though the last named may be insurable when due to unexpected feed deficiencies, beyond the immediate control of the farm manager).

[35] In the early months of 2005, one oyster farming area in the north of New Zealand was closed for harvesting following excessive rainfall, and the inability of the storm water system to prevent flooding of a nearby sewage treatment facility. The flooding caused polluted water to run into the ocean, and affect the oysters growing on racks situated in aquaculture farms along the coastline.

Chapter 7: HOW DOES INSURANCE RELATE TO VARIOUS TYPES OF ENTERPRISE?

7.1 Benefit/cost issues

It is often stated that virtually any enterprise can be insured, against virtually any peril. However, primary industries such as livestock and aquaculture production pose stiff challenges to this general principle. Moreover, at the time of writing, with squeezed profit margins on the production of many livestock and aquaculture commodities, a paradoxical situation arises. The tight margins highlight the need for improved levels of risk management, including insurance, but also reduce the ability of farmers to buy the desired level of protection.

In the discussion below, the focus will be on identifying insurable areas of risk. These are determined by the nature of the livestock or aquaculture enterprise, and by the perils they commonly face. This means that some enterprise types and some perils are more suitable than are others for the use of insurance as part of a risk management strategy.

In this discussion, 'insurance' relates to the various types of contract, which make up the more traditional type of cover, as opposed to index policies. With the latter, the nature of the enterprise is less of an issue than the means for deriving the index.

Insurance of farming enterprises usually involves insurance of an expected future value, as a result of growth and/or reproduction This sets agricultural insurance apart from other property covers (e.g. motor vehicle, buildings, machinery) when the value (frequently maximum value) exists at the commencement of the insurance.

One of the factors that can determine whether a particular enterprise/peril combination is suitable for insurance is the ease and economy by which losses can be satisfactorily assessed. This will be touched on below, with some of the more general loss assessment issues discussed in greater detail in Chapter 8, under the section, Loss Assessment.

7.2 Intensive livestock enterprises

These include operations such as broiler and egg production units, high input/high output dairying, intensive pig production units and cattle feedlot operations.

Six features mark these types of enterprises as being potentially insurable at reasonable cost to the farmer:

- They all involve significant investment in fixed infrastructure, coupled to high recurrent costs. They are also likely to involve bank loans, with loan servicing as a major cost item. There is therefore considerable dependence on a regular cash flow from sales.

- Many intensive livestock enterprises have a defined production cycle, with identifiable 'off take' or marketing phases. This means that shortfalls in expected production can be identified at an early stage, and remedial action taken wherever possible to do so. Relevant examples include: dairying, broiler and egg production units.

- The nature of intensive enterprises means that accurate records of stock numbers are likely to be kept.

- Those managing the enterprise will have close contact with the livestock, meaning that animal health can be monitored carefully, and early action taken in order to control losses.

- The managers are likely to have a good level of education and operate to a good standard of husbandry. This is likely to be accompanied by access to ongoing sources of up-to-date information on risk factors such as disease threats and imminent, extreme weather events.

- Most intensive enterprises have a defined marketing chain and virtually all of the production enters the commercial market, and requires processing. This means that there is control over quantities produced, year after year, together with an opportunity for establishing a strong database of producers and of details of production enterprises. The availability of information of this sort is vital to creating the climate of confidence necessary for efficient and economical insurance transactions.

As a rule, the more commercial the nature of the enterprise, the greater will be the likelihood of identifying a cost-effective role for insurance in risk management. As a corollary, enterprises that fall outside of any of the factors listed above will be less likely to be able to utilise insurance as a risk management mechanism. This is due to their inability to pay the high premiums that would be charged as a result of the insurers' perceptions of the risk involved.

7.3 Traditional mixed farming systems

It will be evident from the list in 7.2 above that traditional mixed farming systems that involve livestock do not lend themselves to conventional insurance approaches. This is because the enterprises are small and not highly monetized; moreover, the livestock and livestock products are consumed at home or are traded in an unrecorded local market, where tracing is all but impossible. This means that insurance assessments are similarly difficult for this type of livestock enterprise.

Similarly, on the demand side, this is limited by the risk management implicit in a mixed farming system. However, for those mixed farms where livestock income becomes of increasing importance, with a move towards a more commercial type of operation, then insurance products may well be sought for certain risks.

Again, where animal draught power is important in cropping operations, farmers have an added incentive to seek to insure some, at least, of their livestock. The loss of a key ox or buffalo can have a costly outcome for the farming operation as a whole, through its impact on the production and profit generated.

Nevertheless, novel approaches will be necessary in order to overcome the problems (administrative cost, lack of good information linkages) of dealing with small-scale clients. In this respect, the second Indian example quoted in Chapter 4 shows how a partnership between microfinance and insurance providers can develop insurance products suited to small-scale farmers, many of whom are operating mixed farming systems. An alternative approach is to turn to weather indices as the basis for insurance. This is discussed above in Chapter 5.

7.4 Extensive livestock ranching systems

Turning again to the six factors facilitating insurance applications to the management of risk in livestock production farming, it is clear that few apply to extensive ranching systems for larger livestock such as cattle and deer. For this reason, this type of enterprise is ill suited to conventional, individual-animal insurance approaches. On the other hand, whole herd policies, giving protection against catastrophic herd losses, due to perils such as drought, are likely to enjoy a demand.

Perhaps the most promising approach for insurance protection of this type is weather index cover (ref. Chapter 5, Section 5.5). The NDVI pasture index is currently in use in Spain, and a similar approach is used in Canada. Spain experienced, in 2005, the worst prolonged drought for more than 50 years, so the index was thoroughly tested under very difficult conditions. The result is reported to have been satisfactory.

7.5 Aquaculture – sea/lake cage systems

Perils that may kill fish in cage systems start with the water in which the cages are moored. Water can be the means of transmission of a variety of harmful organisms and substances. As already noted above, in their natural state fish can swim away from threats to their survival, whether such threats are in the form of algal blooms, pollutants, low levels of dissolved oxygen or predators. Caged fish do not enjoy this option.

There are structural issues too with cage systems. Sea water sites that are optimum for fish health and wellbeing are those that are characterised by high levels of water exchange, which in the main means they should have some degree of exposure to winds, tides and currents. These factors are not conducive to the ease and safety of moorings, and to the structural integrity of the cages.

Cage systems of aquaculture involve frequent feeding of the fish, and therefore a high level of human oversight of the operation. As such, the health of the stock can be monitored and remedial action taken when a problem is identified[36]. Moreover, cage systems are generally well-documented, since cages are stocked with fingerlings, and the numbers of these are known.

These two factors, the presence of records, and the monitoring of fish health, are both positive as far as an insurer is concerned. However, because the cage rearing of fish is still a new type of farming, with the magnitude of many of the risks being still unknown, insurance product availability is far from certain. This applies especially to policies that cover diseases and parasitical infestations, though some experts believe that it should be possible to design policies to cover the risk of exotic diseases for which on-farm control measures have yet to be developed. Such policies, as and when available, are likely to carry a high level of deductible, say more than 20 percent of the total sum insured

Insurance against storms and severe weather events is likely to be more readily obtained, though insurers impose stringent requirements in terms of the design adequacy and condition of moorings and cages.

[36] This can be done, but inspection by divers, or the use of underwater cameras, is usually required to monitor adequately the fish stocks in the full depth of the cage.

7.6 Aquaculture – pond systems

The generally poor results of insurance products geared to pond cultivation in various Asian countries (ref. Chapter 4 above), especially of shrimp, serves to underline the challenges of this type of aquaculture. It is no surprise therefore that as a whole, and at the time of writing (2005) this class of aquaculture in Asia is believed to be virtually uninsured, despite the importance of this type of aquaculture in many parts of the region. In Latin America, it is understood that shrimp insurance has been available in Mexico for a number of years.

Apart from the losses that insurers have experienced in the few experimental programmes to date, there are some fundamental reasons for the reluctance of insurers to assume part of the risk of this class of aquaculture. Firstly, records are seldom kept, or if kept, are not often thought to be reliable. Second, the farmers have a tendency to attempt to maximise profits by overstocking their ponds, even where much extension advice dwells on the dangers of disease and parasite build-up, and subsequent mortality, when the stocking rate is too high. Third, the level of education of many pond farmers is still very low, meaning that they are less exposed to sources of advice on better management, and threats such as disease outbreaks.

On the positive side, and as with cage farmers, insurance against storm damage should eventually be possible, possibly through index approaches, with technology yet to be developed.

7.7 Aquaculture – recirculation systems

Recirculation systems of fish rearing depend for their success on close and careful control of water quality factors – pH, dissolved oxygen, temperature, presence of organic or inorganic toxins, etc. Along with this close level of control of water quality, the health of fish stocks is readily monitored as they can be seen easily in the tanks and raceways. These controls mean that the most situations that could lead to abnormal mortality can be quickly identified and remedial action taken. Given the dependence of recirculation systems on machinery and power, risks to these are likely to lead to a demand for appropriate insurance cover, since the nature of the installation means that high fish mortality can result from an interruption to water flow.

From the point of view of the insurer, farmers operating recirculation systems are likely to have invested considerable sums in plant design and construction. They are also likely to have appropriate back-up mechanisms in place, for example, standby power-generation machinery. Records are likely to be sufficiently accurate and informative to give confidence to an insurance underwriter that the risk he is asked to assume is readily quantified and that moral hazard risk is minimized.

Chapter 8: INSURANCE ADMINISTRATION

8.1 Loss assessment issues

The ability to assess losses is a *sine qua non* for any standard insurance business. For this reason, this chapter, on insurance administration, starts with a brief consideration of loss assessment issues. This discussion focuses on conventional insurance. Index-based policies avoid the challenges posed by loss assessment[37].

With livestock and aquaculture insurance, loss assessment procedures centre on the need to ascertain that mortality has occurred, and that the cause was an insured peril. Where the policy is not 'all-risks' but rather 'named-perils' then any loss assessment process should also be able to ascertain as to whether the loss was caused by an insured peril. If this is difficult or impossible, then even at the product design stage, it might be necessary to make a judgement that an insurance approach may not be appropriate.

As in any insurance contract, it is vital that the process of loss assessment is made clear, so that in the event of a loss, the assessment process can start in a manner that has the prior agreement of both insurer and insured.

The loss must then be measured, and the indemnity to be paid determined. The whole process of assessing the loss, determining the indemnity and paying it, is known as *loss adjustment.*

The loss assessment process will take into account any financial benefit that can accrue if the dead stock is sold. For example, in Finland, salmon dying as a result of some types of physical damage (from birds, for example) can be sold as food for animals farmed for their fur pelts, e.g. minks.

8.2 Cost containment

The management of insurance, as a business, has several stages. These are: market identification, product development, setting indemnity and premium levels, marketing, risk selection and policy issuance, collecting premiums, accumulation control[38] and handling claims. The over-riding aim in the design of administrative structures and procedures is to lay a foundation for minimising costs. Since the potential clientele comprises small and often widely dispersed growers, costs can easily escalate to the point of non-viability of the business, unless special care is taken. In this connection, the new index insurance products, mentioned earlier, offer much scope for drastically lowering the costs of administering a financial risk management mechanism.

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[37] Loss assessment is not a part of the operations of an index policy. This pays out a pre-determined indemnity, on the basis of weather or other records. The state of the insured enterprise is not a factor affecting the eventual payout. Because loss assessment in the field, or in the water in the case of aquaculture, is a very expensive process, this is a major advantage of index policies.

[38] An interesting example of field operations designed to avoid the insurer accumulating too much exposure in a single district, comes from Australia. Field agents, selling policies for a particular insurer, download each day's sales from their laptop computers, through a telephone connection, to a central computer at head office. After analysis, the agents are then informed as to the districts where the limit of risk has been reached, indicating that the next day's sales must be outside of these districts.

The various stages of standard insurance administration offer some scope for economies. The tasks involved in these stages are briefly described below, with mention of particular examples where efficient procedures have been developed in order to save costs.

The extent of involvement of the public sector varies from country to country, but it always has a role, even if this is exercised in the main through setting supportive and regulatory policies. It may be particularly important in the early stages of developing new insurance products, and in situations where financial support is considered both desirable and possible.

8.3 Market identification and product development

This is a vital stage. Buying insurance involves increasing the up-front costs for a farmer. The advantages of buying cover must be clear, with careful positioning of any proposed insurance product. Firstly, this means recognising that insurance as such may not have a legitimate role in a particular industry for the major perils as seen by the owners. Secondly, where there is believed to be a role, it means that careful attention must be paid to benefit/cost considerations for both contracting parties – the insured and the insurer. These two conditions can best be met by identifying the real points of financial risk in an enterprise type, and examining whether a financial risk-sharing mechanism can be economically applied.

In general, the more commercial the operation, the more likely is it that insurance could be designed to address certain of the risks involved. This applies, in particular, to the intended market for the produce of the insured farming enterprises. A formal, commercial market implies the ability to collect information on quantities of production from particular producers. Time series data of this type, since they are based on transactions involving payment, are likely to be highly accurate. A market outlet may also facilitate administrative economies in arranging the cover, or even in paying premiums.

At this stage too it is important to identify the insurer. Is it to be a local general insurance company, perhaps one that has little direct connection with the clientele? This is the case with the BASIX insurance in India, where the insurer utilises the existing interface of the microfinance provider with the clientele, while using in-house insurance expertise for product design and underwriting.

Alternatively, it can be handled by a special agency, as is the case in Iran, where much effort goes into building up the specialist knowledge required within the insurance company. It is not possible to give an opinion as to which of these alternatives is better. However, one can note that if an existing company were to take on livestock and/or aquaculture risks as an additional line of business, then it will start a number of advantages:

a) It will already have staff trained in insurance;
b) It will have, in place, the necessary systems to handle information concerning the sums insured, and claims;
c) It will have accounting systems in place;
d) It is likely to have existing business relationships with re-insurers;
e) It will have a capital base, one that may be sufficient for it to enter into a new area of business.
f) It will already have a government licence to transact insurance business.

Realistically, neither livestock and nor aquaculture insurance in developing countries is likely to be any more attractive to existing insurers than is lending in these sectors to most commercial banks. As with the provision of financial services to these sectors, special attention will be needed to careful design, and identification of suitable innovative approaches. The impressive BASIX example in India (see Chapter 4) is a case in point.

Product design, and the determination of the required administrative arrangements for these types of insurance as a new line of business, whether in an existing company, or in a new entity, calls for the best experience available. At the time of writing, the required expertise is most likely to be found within the reinsurance industry, and with specialized consultants/researchers.

Costs are likely to be substantial, for product development is a highly skilled task, requiring a detailed knowledge of livestock farming / aquaculture, coupled with a sound appreciation of the principles and operational imperatives of insurance. As such, this can be an expensive stage in the process, but it is an investment with which international agencies can often assist.

This assistance might be in the form of direct partnership in product design, or training existing insurance staff to handle the new challenges. In practice, it is likely to start with both approaches. What is important to note is that the design of insurance products, like the design of products for other financial services, is an ongoing task.

8.4 Marketing

Implicit in any moves to start livestock or aquaculture insurance is the assumption that there is a demand for the product. Whereas automatic or compulsory insurance has many advantages, it is not often possible to design or to get the necessary agreements with farmers for this type of policy. Marketing therefore is important. Several factors are important here:

a) Close links with the representatives of farmers, and speedy response to new needs for insurance.
b) Similar linkages with banks, product buyers and others with business connections with insured producers.
c) Attention to appropriate publicity, including information packages designed for farmers.
d) Scrupulous fairness in loss assessment and claims handling.
e) Speedy payment of claims.
f) Appropriate staff training.

8.5 Setting indemnity and premium levels; valuation; deductibles

In conventional insurance, the basic issue to be addressed is whether the insurance is meant to substitute for farm income in the event of a loss event, or whether the indemnity would merely cover the cost of inputs lost, because of mortality. The second option is certainly the easier and lower cost alternative, as the level of overall coverage would be significantly less. The second alternative is also the most commonly used in existing livestock and aquaculture insurance policies. This means that as a given enterprise goes through a cycle, costs increase (more food, more use of veterinary products, more labour) and thus the basis for valuation also increases.

With index policies, the choice would be more flexible, since an insured individual could choose the level of coverage, purchasing the number of units that suits his or her needs.

In any case, it is vital that an actuarial balance is struck between premium and indemnity levels, and that this balance be continually checked in order to ensure the financial sustainability of the programme, and its ability to meet commitments to insured producers.

A key issue is the level of deductible (excess) that applies. The effect is twofold. Firstly, and more obviously it impacts directly on the premium level through an inverse relationship between the quantum of deductible and the pure premium required for a given level of insurance protection. Secondly, it also impacts through economies in loss assessment and adjustment costs. Having a significant deductible, since it implies self-insurance of the first part of any loss, means that minor losses will not prompt a claim, and therefore no loss assessment will take place.

With both livestock and aquaculture policies it is necessary to distinguish between individual animal insurance (individual cage/rack/pond in the case of aquaculture) and policies that apply to a whole herd (whole location – group of cages/racks/ponds for aquaculture). In individual policies, the deductible (co-insurance) applies to the individual animal and might be typically 10 to 20 percent of the sum for which the animal is insured. Such cover is expensive, with rates for dairy cows being typically 5 to 7.5 percent of the sum insured, and 10 percent or more for pigs. Whole herd policies specify a deductible expressed as number of head lost, say two deaths out of 100 in a 100-cow herd. Whole herd policies avoid small losses, and enable insurers to offer cover more cheaply. Whole site deductibles for aquaculture similarly mean lower premiums than when deductibles apply to individual cages, racks or ponds.

A major area of difficulty in setting indemnity and premium levels is the lack of data linking the incidence of adverse weather events, disease outbreaks or other insured perils, and actual losses. Experience has shown that historic newspaper reports are unreliable (they usually exaggerate the losses) and that reports kept by government ministries are similarly inaccurate, since in the absence of insurance there is little incentive, or need, for precision.

In any case, insurance products in agriculture are seldom launched on the basis of all the data an actuary would wish to have in order to set premiums at the level required to meet expected indemnity liabilities. Experience must be gained during the early years of a programme. During this period, adjustments can be made to the indemnity and premium levels, and also to the percentage of deductible applied.

8.6 Collecting premiums

The main objective here is to keep costs as low as possible. Consequently, there is a strong incentive to build linkages with existing providers of services to the livestock and/or aquaculture sector.

Perhaps the most obvious linkage is between the insurer and banks serving the same clientele. In this case, the premium for insurance protection could be included in the loan, as a cost item alongside other expenses for the growing cycle in question. These other expenses could be the costs of young stock (e.g. fingerlings in aquaculture), feed costs and veterinary expenses. Since the premiums in such cases are paid in bulk by the banks to the insurer, costs are minimized.

Similarly, there is sometimes scope to build insurance into the transactions between certified hatcheries of fish fingerlings and fish farmers, or between suppliers of young poultry (e.g. day-old chicks) and broiler and egg producers. Such arrangements have the added benefit of facilitating technical assistance and sharing of technical expertise.

8.7 Handling claims

Again, cost containment is very much an objective in designing procedures for the notification of claims, for assessing the losses and for paying indemnities. Clearly, the big divide is between the older, traditional type of policy, in which losses need to be assessed on each individual enterprise, and the newer types of policies in which a wholesale approach is possible.

As already noted, a further potent field for cost economies is through building linkages with entities already providing services to farmers. These include banks, input suppliers, processors and other buyers.

It is worth repeating that index policies neatly avoid most of the steps involved in claims handling. This is a major reason for the index approach to have a greater potential for developing countries than that enjoyed by conventional insurance.

8.8 Roles for government and the private sector

As a business, insurance belongs in a business setting. However, the very nature of primary industry insurance operations for livestock and aquaculture risks means that there is bound to be strong governmental involvement.

Most governments have a close interest in risk management for basic industries of this nature, both for productivity reasons, and for concern for the wellbeing of rural populations. This often means, in practice, that governments are active, not only in an overall policy and prudential regulatory sense, (and in some countries state-owned enterprises also directly transact insurance business) but can be more directly involved in other ways. This can start with capacity building geared for the special nature and demands of primary industry insurance operations.

These other ways may include funding the initial investigation of the feasibility of introducing insurance products for risks in livestock and/or aquaculture enterprises. Another is ensuring that the necessary infrastructure for efficient insurance business is in place; an example of infrastructural needs is a network of accurate and reliable weather recording stations.

In many cases, the assistance by the government it may also involve funding part of the initial operational costs, once an insurance product is launched. It may extend to providing a 'start-up' subsidy to the premium pool, and a layer of reinsurance for the first few years of operations.

Spain has an interesting private-public sector partnership in offering insurance products for livestock and aquaculture enterprises, and for agriculture as a whole. The partnership revolves around Agroseguro, an entity that is, in effect, a pool of more than 40 insurers co-insuring agricultural risks. Products are based on an annual 'insurance plan' that is jointly developed by producers (the eventual buyers of insurance), the insurers, and Enesa, an agency of the Ministry of Agriculture. Enesa also provides premium subsidies. Finally, a Reinsurance Consortium is run by

the Ministry of Economics, and this provides reinsurance for the products offered under the insurance plan.

The Spanish example suits a developed country where agriculture still occupies a section of the population in which significant numbers are disadvantaged as compared with the population as a whole. However, the Spanish system is costly, with some Euro200 million in public funds applied as subsidy to the programme in 2003[39]. Few developing countries could afford this level of support.

The Spanish example attempts to harness the best of both private and public sectors. There are strong reasons for the business operations in insurance to be handled by a commercial concern (as in Spain, by Agroseguro and its pool participants). This is for reasons of efficiency, and convenience in terms of insurance operations complementing other commercially-run services to farming.

As already noted, the public sector role is also important. However, the dual parentage of this area of insurance can lead to tensions. The most crucial areas of concern lie in the areas of premium setting and claims handling. In these areas, experience has shown that undue and inappropriate political influence on an insurer can be very damaging.

Accordingly, much attention is given during the design of livestock and aquaculture insurance programmes to avoiding these tensions to the extent possible. Such avoidance is aimed at optimising the role of the public sector, while harnessing the drive and efficiency of the commercial insurance sector.

Several steps are involved. One listing might suggest the following as important:

a) Ensure that any existing company or new entity has a sound legal basis on which to offer insurance products, with the required level of business competence.

b) Clarify the government's objective in promoting insurance for livestock and aquaculture producers. Is it purely an additional risk management mechanism, or is it also an avenue of subsidy to these sectors? If the latter is the case, then the avenue for financial support has to be ring-fenced from day-to-day political interference[40]. This is not easily done, yet it is essential if there is to be the required continuity of financial conditions in order to build efficiency and fairness into the system.

c) Establish strong linkages, at an early stage, with international re-insurers. These companies can assist not only with technical advice, but can also be instrumental in ensuring the necessary adherence to correct application of premium setting procedures, and settlement of claims. Although the opportunity for profit may be some years away, such companies are often prepared to become involved in a new field of business, or work in a new geographical area. They operate with long-term time horizons, and this can work very much to the benefit of a nascent insurance product line – whether this is being offered by a new company or by a new section within an established company.

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[39] In Mexico, livestock and aquaculture premiums are subsidised to approximately 30 percent. This compares with a similar subsidy of about 45 percent in Spain.

[40] This can be done, for example, by setting up an endowment fund. The investment income from such a fund can provide a regular adjunct to the premium and investment income from normal insurance operations.

d) The financial base for the insurer must be adequate. This must be sufficient to survive initial years in which conditions might be such that underwriting profits are sharply negative. On top of this loss, administrative expenses have to be met. In many developing countries there may have to be public sector participation in ensuring a sound financial base.

e) Work closely with representatives of the production sectors. This will help ensure that the services and products meet real, felt needs, and that they enjoy a lively demand as a result. Again, the Spanish example quote above indicates how this is done, with producers collaborating with insurers and the Ministry of Agriculture in the production of the annual insurance plan.

ANNEX

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II Note on premium calculations[41]

A premium payment must cover a number of costs. These are expressed as a percentage of the sum insured. Insurance is very much a data-driven business, and as such, careful records are kept of costs of all types. Some costs can be estimated with a great deal of accuracy. These include:

a. internal administrative costs, office premises, staff, equipment and running costs;

b. external administrative costs, mostly associated with the acquisition of clients, i.e. advertising, farmer education etc.

Other costs are not so readily estimated, especially in the early years of a given insurance product. These are the costs of meeting claims. The term for this is 'loss cost', and is the sum of indemnities plus adjustment expenses, divided by the total sum insured. Historic data is the basis for the calculation. Naturally, in a new programme this base figure can only be an estimate, based on loss histories for similar ranges of perils in equivalent agricultural areas[42].

The base figure is then adjusted by the addition of 'loadings'. These are sums that insurers need to set aside for factors that can increase the likelihood and/or the size of claims under the policy. In primary sector insurance, such as that for agriculture and aquaculture, these factors are:

a. Catastrophe loading: to make prior allowance for the incidence of perils that have a very low frequency, but which are marked by high severity, that is, they are potentially very damaging and therefore very costly for insurers involved. An example would be the Munich hailstorm of July 1984[43].

b. Volatility loading: to make prior allowance for marked changes in the type and frequency of perils.

[41] Dick (2001) provides a useful summary of the factors to be taken into account in the premium-setting process

[42] Some recent work in the Ukraine has utilised data from the Mid-West United States as an indicator of likely losses, as the agro-climatic conditions are similar.

[43] See Roberts (2005) pp 36,37

III Countries in which aquaculture insurance is or has been available

(List may be incomplete)

Australia, Bangladesh, Canada, Chile, China, Denmark, Finland, France, Germany, Greece, Honduras, Iceland, India, Ireland, Italy, Japan, Republic of Korea, Malta, Mexico, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Turkey, United Kingdom, United States, Vietnam

Ref. Secretan (2003) & others

IV Examples of livestock insurance proposal forms

Example 1 Standard Policy issued by a large insurer

The New India Assurance Company Limited[44]

Head Office: 87, M G Road, Fort, Mumbai-400001

PROPOSAL FORM FOR CATTLE INSURANCE

(This proposal must be accompanied by a certificate given by a qualified Veterinary Surgeon)

BENEFITS OF THE POLICY

The Insured animals are covered against death by diseases contracted or occurring during the period of policy, or accident (including of fire, lightning, flood, inundation, storm, hurricane, earthquake, cyclone, tornado, tempest and famine) occurring anywhere in India or such other country or countries as the Company may agree to but excluding death directly or indirectly due to or resulting from:

1. Malicious or wilful injury or neglect, overloading, unskilful treatment or use of animal for purpose other than stated in the policy without the consent of the Company in writing.
2. Accident occurring and/or diseases contracted prior to commencement of risk.
3. Intentional slaughter of the animal except in cases whether destruction is necessary to terminate Incurable suffering on humane consideration on the basis of certificate issued by qualified veterinary surgeon or in cases where destruction is resorted to by order of lawfully constituted authority.
4. Transport by air and sea.
5. Rinderpest, Blackquarter, Haemorrhagie, Septicaemia, Anthrax and Foot and Mouth disease. These diseases are covered by the policy if the animal is successfully inoculated and necessary veterinary certificates are supplied to the Company.
6. Pleuroneumonia in respect of Cattle in Lakhimpur and Sibsagar District of Assam.
7. Consequential loss of whatsoever nature.
8. Theft or clandestine sale of the Insured animal.
9. Partial Disability of any type, whether permanent or temporary.
10. Permanent Total Disability which in the case of Milch Cattle results in permanent and total incapacity to conceive or yield milk, which in the case of Stud Bulls results in permanent and total incapacity for breeding purpose.
11. War invasion, act of foreign enemy hostilities (whether declared or not) civil war, rebellion, revolution, insurrection, mutiny tumult, military or usurped power or any consequences thereof or attempt threat.
12. The indemnity or compensation provided by this policy shall not apply to or nor include any accident, loss, destruction, damage or legal liability directly or indirectly caused by or contributed to by or arising from nuclear weapons materials.

[44] Reproduced by kind permission of the New India Assurance Co. Ltd.

1. Name of Proposer(s): _____

2. Address: _____

3. Occupation: _____

4. Give the following particulars in full, of each of the animals proposed for Insurance:

Animal's No or Mark and how identifiable	Species and Breed	Sex, colour and full distinguishing Mark (such as ear mark, soars etc)	Age in Years	Height	Date of purchase by the proposer and cost price to the proposer	Present Market Value	Sum for which Insurance is required

5. (a) State for what purpose the animal/s will be used: _____

   (b) Number of calvings: _____

   (c) Date of last calving: _____

   (d) Location of the Farm of place where the animals are stabled: _____

6. (a) Where is/are animal/s stabled: _____

   (b) Give full particulars of the construction of the stable: _____

   (C) Is it under your sole occupation? If not, whose other: _____
   animals are stabled in it?

7. Is /are the animals in the stable sound & healthy & free from vice? _____
   If not, give full particulars of defects & ailments, if any_____

8. Veterinary Services available:
   (a) Whether own veterinary services available or dependent on Government veterinary services_____
   (b) Number of qualified veterinaries whether part-time or whole time or on retainer basis _____
   (c) Veterinary services provided_____
   (d) Number of cattle covered by each veterinary surgeon_____
   (e) Total area covered by each veterinary surgeon_____
   (f) Distance from veterinary dispensary _____
   (g) Annual budget sanction for drugs, vaccine, etc. for the entire dispensary_____
   (h) Storage conditions for drugs, vaccine etc. _____
   (i) Details of veterinary check up that insured animal gets as part _____

Of routine veterinary attention

9. (a) Have you lost any animal/s during the last three years? If so state particulars

Year	Cause of Loss	Number of animals lost

(b) Previous Cattle Insurance Claims experience (for the last three years)

Year	Policy No.	Name of the Insurer	Claim Amount	Whether claim settled in full or part or outstanding or repudiated

10. Have any of the animal/s proposed for insurance been ill or incapacitated through injury/s during the past 12 months? If so, give particulars and state whether a Veterinary Surgeon was in attendance.
_____

11. (a) How many other animals do you own? _____
    (b) Are they insured and where? _____
    (c) If not, why are they not proposed for insurance now: _____
    (d) Were they insured previously and if so, where? _____

12. Are any of the animals now proposed for insurance or have any other animals belonging to you have been previously insured? If so, state name of the Company or Underwriter: _____

13. (a) What is the mode of branding /marketing the animals for the purpose of I identification as indicated under question (4) above? _____
    (b) Are the animals owned by the proposer but not proposed for insurance hereunder also similarly branded/marketed? _____

14. Has any Company or Underwriter
    (a) Declined Insurance of any of your animals, or _____
    (b) Refused to renew their insurance or _____
    (c) Increased your premium or imposed special conditions on renewal _____

15. For what period is insurance required? For _____ months from _____

16. (a) Are you the owner of the animal? If not state name and address of owner and also nature of your interest in the animal. _____
    (b) Is any bank or other financing institution interested in the animals? If so, state (i) name and address of the bank (ii) amount of loan outstanding _____
    (c) Is/are the animal/s proposed for insurance covered by SFDA/MFAL project. If so state: (i) Address of the SFDA/MFAL agency _____
    (ii) Amount of subsidy obtained from SFDA/MFAL agency
_____

I/WE hereby propose to insure the abovementioned animal/s owned by me/us with THE NEW INDIA ASSURANCE CO. LTD. subject to the terms, conditions and exclusions of the Company's policy. I/WE warrant that the answers to the above queries are true and that all the animal/s are correctly described, are sound, in good health and free from vice and that they are and shall be used solely for the purpose above stated. I/WE declare that no information material to the insurance has been withheld and agree that this proposal shall be the basis of the contract between me/us and the Company.

Date: _____

_____

Place: _____
Signature of the proposer

PROHIBITION OF REBATES:

The following is an extract of Section 41 of Insurance Act, 1938

1. No person shall allow or offer to allow, either directly or indirectly, as an inducement to any person to take out or renew or continue an Insurance in respect of any kind of risk relating to live or property in India, any rebate of the whole or part of the commission payable or any rebate of the premium shown in the policy; nor shall any person taking out or renewing continuing a policy accept any rebate, except such rebate as may be allowed in accordance with the published prospectuses of rebates of the Insurer.
2. Any person making default in complying with the provisions of this section shall be punishable with fine which may extend to five hundred rupees.

Example 2: Policy using intermediation of microfinance network[45]

(BASIX/Royal Sundaram Livestock Insurance)

Livestock Master Policy - Agreement on insurance process[46]

It is hereby agreed, subject to the terms, provisions, conditions contained herein or endorsed or otherwise expressed hereon in the Master policy insurance process to cover the livestock belonging to the customers of Bhartya Samruddhi Finance Limited (hereinafter called BASIX) with Royal Sundaram Alliance Insurance company limited (herein after called Royal Sundaram) under livestock insurance policy.

This agreement covers the customers of the BASIX against death of the animal insured during the period of insurance as per the terms and condition of the Master policy to which this agreement is attached.

This agreement shall be with specific reference to the animals belonging to the customers of BASIX and declared for insurance and for which the premium has been duly remitted.

It is agreed that the animal will be insured as per the business process laid under –

BASIX Livestock Master Policy Business Process

1. Enrolment process:

1.1 Screening for Health, status and Valuation:

CSAs[47] screen the animals for the health, status and for value.

Health: Animal proposed for insurance should be Sound in health and free from illness (healthy and no symptoms of any suffering or aged).

Status: Status of the animal need to be classified on two accounts-
Calving status- Sex & age of the calf & milk yield per day
Pregnancy status – If pregnant enter the Number of months pregnant.

Valuation: Animal should be insured only to the extent of market value it is worth at the time of proposal. Future value (anticipated value if become pregnant) cannot be taken for insurance

[45] The BASIX approach uses its network to reduce the costs of offering livestock insurance. Other economies are built into the operations, for example, using CSAs (Customer Service Agents) who tag animals to be insured to also certify that they appear to be in good health, rather than the more usual, and expensive alternative of using the services of a veterinary surgeon for this purpose.
[46] Reproduced by kind permission of BASIX
[47] CSA = Customer Service Agent. CSAs work fulltime with BASIX, although they are not employees. They are remunerated on the basis of business transacted – n the case of lending operations, their income depends on the repayment performance of the loans they arrange.

Productive animal: Animal recently calved (calf age three months and less) and animal pregnant (6 months and above) alone can be treated as productive animal. Maximum value an animal can be insured is up to Rs 12,000/-

Ordinary animal: All other animals are to be treated only as Ordinary animal for valuation purpose. Maximum value an Ordinary animal can be insured is up to Rs 7,000/- only.

1.2 Tagging:

CSAs tag the animal in the field locations, only on three days in a week (Monday, Tuesday & Wednesday). Only plastic tags shall be used. Royal Sundaram will ensure adequate supply of tags, applicators & documents. The unit office shall keep a register of on receipt and supply of these items.

Only after successful application of tags to the animal the details will be entered in the enrolment form.

All information – customer name, tag number, type of animal, colour, other natural identification marks including status & values shall be entered in the Insurance enrolment form.

2 Information processing

BASIX unit office will capture the information from the Livestock Insurance Enrolment Form in the IDIAS by Thursday evening.

IDIAS will allow entry of Livestock Insurance data only from Monday to Thursday in the week.

IDIAS will only allow entry of Insurance proposals, where the tagging has been done only on Monday to Wednesday of the current week.

3 Premium remittances

BASIX will submit every Friday (or the immediate working day in case Friday is a holiday), to Royal Sundaram, a schedule of all Livestock enrolled on Monday to Wednesday of that week, along with a premium cheque payment for covering under the master policy.

BASIX will pay the premium @ 3.75 % (net) on the value of animal. The rate will be reviewed at the end of each quarter on the basis of claims outgo.

BASIX shall keep the physical papers (Enrolment forms) at the Unit Office for the record, without having to send them to the Insurance Company. All the information required by the Insurance Company relating to individual enrolment will be supplied in the schedule submitted by BASIX every week.

4. Policy commencement

The period of insurance for each animal will commence from the 10th day after the day of tagging the animal i.e. if the animal is tagged on 1st January the cover will commence from 11th January.

5. Retagging

In the event of falling of ear-tags, animal should be retagged immediately subject to:

a) Ensuring that the Insured Animal and the animal to be retagged are one and the same.
b) Animal is sound in health.

No animal can be tagged when it is sick.

Royal Sundaram will supply retag-form which shall be used for reporting retagging. Unit Office will intimate retagging through entry in IDIAS. At the end of each day, IDIAS will generate a summary statement of all retag intimations done on that day and send the same by e-mail to the Insurance Company.

Retag intimation would be provided within a span of 3 working days. 10 days waiting period will be applied for the risk to commence on this new tag number.

6. Claims process:

CSAs / Insured intimate the death of animal immediately to BASIX unit office. Unit office registers the claim in IDIAS and report the loss to RS on the same day and also uses the services of designated surveyor / veterinarian for certifying the loss.

Royal Sundaram will settle the claim for the Value it is insured.

6.1 Through designated surveyor:

Royal Sundaram shall identify designated surveyors at units for certifying the loss of the animal.

BASIX will report the death immediately (within 12 hrs of death) to this surveyor who will visit the place, see the carcass, take a photo and submit his report to Royal Sundaram. The designated surveyor's phone number, address will be given to for calling them directly.

In the event of designated surveyor not reaching the spot within 12 hrs of reporting, customer can take a photo of the diseased animal (with tag visible) and dispose the carcass. Royal Sundaram will pay Rs 100/- for photo charges.

6.2 Certificate through local veterinary doctor:

Where designated surveyor is not identified or not reachable, customer shall take a photo, obtain certificate from local veterinarian and submit the papers within 15 days of intimation along with Ear tag to the Company.

Royal Sundaram will pay Rs 100/- for photo charges and reimburse Rs 200/- for veterinary fees in the event of claim admitted for settlement.

V Glossary of common terms used in crop, livestock and aquaculture insurance

Accumulation
The concentration of similar risks in a particular area such that an insured event may result in several losses occurring at the same time.

Act of God
An event arising from natural causes without human intervention and which could not have been prevented through reasonable care or foresight, e.g. floods, earthquakes, windstorm.

Actuarial
Describes the calculations made by an actuary. Essentially this is a branch of statistics, dealing with the probabilities of an event occurring. Actuarial calculations, if they are to be at all accurate, require basic data over a sufficient time period to permit likelihood of future events to be predicted with a degree of certainty.

Actuary
A person with a mathematical and statistical background who is responsible for the application of probability and statistical concepts to insurance aspects such as rating, premium, reserves and dividend calculations.

Adverse selection
The tendency of individuals with poorer-than-average risks to buy and maintain insurance. Adverse selection arises when insured persons or entities select only those coverages that are most likely to result in losses. In agricultural insurance, this can arise when:

a. high-risk farmers, or farmers using backward practices participate, while other farmers, with more certain production expectations, do not;

b. farmers apply for insurance only on the high-risk parts of a given farming enterprise, withholding other units.

Agricultural insurance
Insurance applied to agricultural enterprises. Types of business include crop insurance, livestock insurance, aquaculture insurance and forestry, but normally excludes building and equipment insurance although these may be insured by the same insurer under a different policy (See aquaculture insurance, crop insurance, livestock insurance).

All risk insurance
A term used to describe a policy that covers the insured property against any fortuitous cause including acts of God, accident, disease, fire, theft and pilferages. In agricultural insurance, all risk policies may cover all weather risks, fire, theft etc. It excludes those perils defined in the policy and inevitabilities such as wear and tear or depreciation.

Anti-selection
Same as adverse selection.

Aquaculture insurance
Protection for fresh water or salt-water fish farming enterprises against mortality to fish stocks.

Arbitration clause
A provision in a policy stating that any differences between the insurer and the insured shall be settled by arbitration. Each party shall appoint an arbitrator and these shall select a neutral umpire.

Area approach (area-yield basis)
An agriculturally homogeneous area that can be insured as one unit. This unit may comprise several blocks of land farmed by the same farmer or different farms farmed by different farmers. For loss adjustment, in this approach, the actual average yield is assessed by sample survey through product sampling e.g. crop cutting or other methods, and compared with the normal (insured) yield. The average yield loss is applied to all land of all farmers within the defined area, disregarding individual differences in actual damage and yield.

Assessor
A person appointed to assess and settle any claim made under an insurance policy. (see loss adjustor).

Assurance
Same as insurance. Usually applied to life and marine policies and not to agricultural insurance.

Attachment
The commencement of an insurance policy i.e. start of insurance coverage.

Average
If the property value has been under-insured, then the insured's claim for a loss is reduced proportionately to the undervaluation.

Basis of valuation
The basis on which the potential insured property is valued, the established value being used to determine the Total Sum Insured. In livestock and aquaculture insurance policies, often the basis of valuation is the production cost involved up to the point of the claim. The valuation therefore increases through time.

Basis risk
This is effectively the risk of differences between an insured (or contract) valuation and the actual valuation. In agricultural and aquaculture insurance, it relates in particular to insurance contracts where the valuation of loss is calculated on a group or district/regional basis, giving rise to the possibility of significant differences between the indemnity received by an individual insured farmer, and the group indemnity.

Blanket policy
A policy in which a single sum insured covers a number of individual items, for example, several buildings in a fire policy, or a broiler house plus its contents, including poultry and production equipment.

Bonus
(See 'No claims bonus').

Bordereau
There are two types of bordereau, one for premiums and one showing details of losses. Both are submitted to insurers/reinsurers at regular intervals. 1) The premium bordereau gives details of the insureds, sums insured, location of risks and premium rates. 2) The loss bordereau provides such details as date of occurrence of insured peril, date and amount of claim, amounts paid and amounts outstanding.

Burning cost
Burning cost is a term used in excess of loss reinsurance to describe the amount of claims paid above the excess level, expressed as a percentage of the total premium.

Business interruption insurance
The insurance of losses resulting from unforeseen circumstances that reduce the output, both physical and financial, of a business. Business interruption policies may be used for the insurance of agricultural processors, and may cover, for example, any shortfall in delivery to the processing plant of the animals, fish, or crop products or to be processed.

Capacity
The maximum amount of insurance or reinsurance that the insurer, reinsurer or insurance market will accept.

Catastrophe
A severe, sudden and unexpected disaster that results in heavy losses.

Catastrophe bond
A tradable bond issued by an entity requiring protection from a specific disaster. Such bonds earn a high rate of interest while they are in force, but are forfeited, in whole or in part, in the event of a catastrophe covered by the bond. These bonds are popularly known as ‘cat bonds’.

Cede
To purchase reinsurance.

Ceding company
A direct insurer who places all or part of an original risk on a reinsurer.

Claim
The application for indemnity (payment) after an insured event has occurred.

Consequential loss insurance
Insurance against monetary loss other than material damage caused by the insured peril(s). Consequential losses can include inability to carry on business profitably – for example due to a shortfall in the supply of livestock, fish or crop produce contracted for sale to an exporter or processor. This type of policy is also often applied to irrigated agriculture, where cover is purchased against loss or damage to the crop consequent to breakdown of irrigation equipment, leading to loss of ability to irrigate the crop. In this case the material damage is the broken machine; the consequential loss is the crop shortfall due to lack of irrigation during the period of the breakdown.

Constructive total loss
When the insured property has been damaged to such an extent that it is uneconomic to salvage it, a constructive total loss may be declared. A constructive total loss is not the same as an actual total loss, in which the insured property is totally destroyed. In crop insurance, a constructive total loss may be declared when damage levels exceed a pre-determined percentage of the crop making it uneconomical to harvest the remaining crop, i.e. harvest costs are greater than the value of the undamaged crop. The term is less relevant to livestock insurance.

Coupon Insurance
See Index Insurance.

Crop credit insurance
Provides protection against loss or damage to growing crops including perennial crops such as tree crops against specified or multiple perils, e.g. hail, windstorm, fire, flood. Measurement of loss could be by "yield" basis, production costs basis, agreed value basis or rehabilitation costs basis. While most crop insurance is geared towards loss of physical production or yield, cover may also be provided to loss of the productive asset, such as trees.

Cyclone
Areas of low pressure around which wind blows clockwise in the southern hemisphere and anticlockwise in the northern hemisphere. The terms “hurricane” and “typhoon” are regional names for a strong "tropical cyclone", with “hurricane” used in the North Atlantic and “typhoon” used in the Pacific Ocean. All originate in tropical or sub-tropical waters, and have sustained wind speeds in excess of 119 km. per hour.

Deductible (Excess)
An amount representing the first part of a claim that an insured has to bear as stated in the policy. The deductible is usually expressed as a percentage of the sum insured, but equally may be a monetary amount.

Drought
This is one of the most commonly requested perils by farmers, but it is also one of the most difficult perils to insure because of the problems of its definition, isolation and measurement of effects on agricultural production. In contrast to most weather perils, drought is a progressive phenomenon, in terms of an accumulating soil moisture deficit for plant growth, and its impact on crop production and yields is often extremely difficult to predict, then measure and isolate from other non-insured causes.

Earned premium
Premium is said to be earned once the insurance has expired.

Excess
Same as deductible.

Excess of loss policy
A policy that covers claims once they have exceeded a certain amount. A non-proportional type of reinsurance, where the reinsurer agrees to pay the reinsured losses that exceed a specified limit arising from any risk or any one event. A reinsurer may decide to limit his exposure by setting an upper limit above which he will not pay claims. For example, a reinsurer may agree to pay claims of $200,000 in excess of $100,000. If the claims are more than $300,000, the reinsured will have to

bear the remainder of the claims. Alternatively, the latter may take out further excess-of-loss reinsurance with other reinsurers, until the total sum insured of the original risk is covered.

Excess rain
Definitions of this peril vary widely, but generally relate to abnormally high rainfall intensities over short periods of time which cause direct physical damage to crops (lodging, shedding of grain etc.) and this may extend to secondary losses caused by saturation of soil and chlorosis and necrosis of plants. Some policies also provide protection against excess rain at the time of harvest that prevents access to fields in order to carry out the harvest operations in a timely fashion, resulting in yield loss and/or a reduction in quality. Clearly excess rain can lead to livestock losses through flooding, and or through loss of feed when fodder crops are destroyed.

Excessive heat
Excess heat cause by high ambient temperatures. These can cause stress in livestock and farmed fish. Heat may also cause severe damage or loss in crops, such as at the pollination stage when excess heat will inhibit seed set. Because of difficulties in isolating and measuring losses due to this peril, it is seldom accepted by crop insurers, though it may be included as an insured peril in livestock and aquaculture policies.

Experience rating
Rating the risk using the insured's own loss/accident history and not taking into consideration general market loss ratios and rates.

Flood
The overflowing or deviation from their normal channels of either natural or artificial water courses and the bursting or overflowing of public water and other flow of water originating from outside the insured property.

Forestry Insurance
Protection against loss or damage to trees (standing timber), most commonly against fire, catastrophic windstorm, snow, flood or earthquake events. Escalating valuation and indemnity systems are applied in order to reflect the increasing volume of timber and thus exposed values at risk with increasing age of the trees.

Franchise
An amount of loss that has to be reached before the insurer will pay a claim. Once this threshold is met, the insurer has to pay the claim in full. e.g. A farmer insures a poultry operation for $1000 with a franchise of $100. If the claim is for $99, then this must be borne by the farmer. If the claim is for $101, then the whole amount of the $101 is paid by the insurer.

Freeze
Damage to crops begins when temperatures fall below zero degrees Celsius, either through freezing of surface water or through freezing of internal plant cell moisture. In many crop insurance circles this term is used interchangeably with frost. In the US, however, the term "freeze" is commonly applied to advection caused by the invasion of low temperature air masses into an area, as distinct from "frost" which relates to radiative cooling. Advection cooling tends to occur on a widespread scale, critical temperatures apply to all areas and may last for many consecutive nights and can result in severe damage to crops. Conversely, radiative cooling tends to occur only for a night or two, and frost prevention measures, notably increasing wind circulation, has a strong warming effect on temperature. Freeze is a hazard faced by aquaculture farmers in some cold countries,

where water becomes super-cooled (i.e. below 0 degrees Celsius) at which point some bodily fluids, e.g. in the eyes, are affected. Serious mortality can result.

Frost
See freeze.

Gross margin
This term is use in analyzing the performance of individual enterprises within an overall farming operation. It is the margin (profit) from gross returns to the enterprise less direct expenses again related to the enterprise. Overhead costs are not included in the calculation, as these are independent of the type of enterprise being undertaken.

Guaranteed yield
The expected physical yield of a crop stated in the insurance policy, against which actual yields will be compared when adjusting any losses.

Hail
Precipitation in the form of ice granules. According to the size and quantity of the granules, severe damage can result to livestock, crops, buildings, vehicles etc.

Hazard
A physical or moral feature that increases the potential for a loss arising from an insured peril, or that may influence the degree of damage.

Hurricane
See Cyclone.

Inception date
The date on which the insurance cover commences.

Indemnity
The amount payable by the insurer to the insured, either in the form of cash, repair, replacement or reinstatement in the event of an insured loss, is termed the indemnity. The amount is measured by the extent of the insured's pecuniary loss. It is set at a figure equal to but not more than the actual value of the subject matter insured just before the loss, subject to the adequacy of the sum insured. This means for many agriculture and aquaculture enterprises, an escalating indemnity is established, as the growing season progresses.

Index Insurance
This a very new type of insurance in which an indemnity becomes payable upon the certified occurrence of the weather event to which the insurance relates. This is also known as “Coupon Insurance” since coupons or tickets replace the normal insurance policies. The main difference between this and standard insurance is that losses are not measured, either on individual insured farms or on an area basis. Rather, reliance for triggering the coupon is based upon an index derived from data other than those generated from the process of individual loss assessment. The most common form of index is one based on weather measurements. Aerial or satellite photography may be used to verify the indication from weather recording instruments that an insured event has reached sufficient severity to trigger the policy.

Insurable interest
An insurance policy is only valid if the insured is related to the subject matter insured in such a way that he will benefit from its survival, suffer from loss or damage caused to it or may incur liability in respect of it.

Insurable yield
A term used in crop insurance to represent the maximum yield that will be insured under a policy. It is usually expressed as a percentage of the potential yield of a crop; the latter being established by reviewing previous production in the area to be insured, assessing the potential of the land to grow the crop and the management capabilities and by inspecting the actual growing crop to assess its potential yield.

Insurance
A financial mechanism, which aims at reducing the uncertainty of loss by pooling a large number of uncertainties, so that the burden of loss is distributed. Generally each policy holder pays a contribution to a fund in the form of a premium assessed by the insurer, commensurate with the risk he introduces, which is established and administered by the insurer and out of these funds are paid the losses suffered by any of the insured.

Insurance damage rate (IDR)
$$\text{The IDR} = \frac{\text{indemnities paid}}{\text{total sum insured}}$$

Generally, the insurance damage rate is expressed as a percentage and is applied for the sum total of one type of an insurer's business in a given year. For example, the IDR for paddy rice in Japan in 1976 was 8.3 percent. Another term of IDR is "damage rate" or "lost cost".

Insurance policy
A formal document including all clauses, riders, endorsements and papers attached thereto and made a part thereof, which expresses the terms, exceptions and conditions of the contract of insurance between the insurer and the insured. It is not the contract itself but evidence of the contract. In compulsory schemes, the individual insured may not hold a formal insurance policy document directly related to the insurance contract, but rather he will be issued with an insurance certificate that gives a brief outline of the insurance terms and conditions.

Insurance unit in individual approach
A term used in crop insurance to represent the area of land to be covered by a policy. The area of land may either be a single plot or the total of several plots of the same crop type farmed as one unit by the insured. The spread of risk improves as the area to be insured increases. Conventional livestock policies insure individual animals, in which case the insurance unit is the animal itself. As with crop policies, a greater spread of risk is achieved by insuring a flock or herd.

Insured
The person or business entity covered by an insurance policy.

Insured peril
The cause of loss stated in the policy which on its occurrence entitles the insured to make a claim; e.g. hail, frost, wind, drought, excessive rain, pests and diseases.

Insurer
The company, which issues an insurance policy and is named in the policy as being responsible for paying a claim should a loss event result in damage to the insured property.

Livestock insurance
This is a class of agricultural insurance that generally centres on the provision of mortality cover for livestock due to named disease(s), and accidental injury. Insurance cover is normally restricted to adult animals and may be taken out on an individual animal or herd basis. Major classes of insured livestock include beef and dairy cattle, sheep, goats and pigs and domestic fowl. In some countries, economically important animals such as elephants and camels are also insured.

Loss
An event giving rise to a claim under the insurance policy; a claim, or the disappearance of the insured property through an act such as theft as opposed to its survival in a damaged state.

Loss adjuster
A representative of the insurance or an independent person employed by the insurer to assess and determine the extent of the insurer's liability for loss or damage claimed by the insured.

Loss adjustment
Determination of the extent of damage resulting from occurrence of an insured peril and settlement of the claim. Loss adjustment is carried out by the appointed loss adjuster who works on the behalf of the insurer.

Loss assessment
The first stage of loss adjustment i.e. estimation of extent of loss caused by the insured peril.

Loss cost
Same as the insurance damage rate i.e. claims expressed as a percentage of the total sum insured or total liability.

Loss frequency
The rate of occurrence of losses, often expressed in terms of the number of incidents over a period of time. This measure can be used to assist in rating a policy and for judging the effectiveness of loss prevention facilities.

Loss ratio
The proportion of claims paid (or payable) to premium earned. $LR = \frac{\text{Indemnities}}{\text{Premium income}}$

Malus
An addition to insurance premium as a result of previous claims.

Maximum possible loss (MPL)
The largest loss believed to be possible for a certain type of business. See also Probable Maximum Loss (PML).

Moral hazard
The risk or danger to look for from human nature, both individual and collective. Moral hazard depends mainly on the character of the society, the character of the insured, and on the character of

his employees and the manner in which they work and behave at work. Examples of poor moral hazards are carelessness, fraudulent claims, crime or arson, irresponsibility, gross over insurance, general moral climate due to period of depression and recession and unreasonable demands over claims settlements.

Mutual company
A company established to undertake its own insurance thereby receiving all benefits from profits. A mutual company has no risk capital provided by external parties. In agricultural terms, a mutual company could be formed by a group of farmers who each pay a premium into a fund that they control, rather than to an insurance company.

No claims bonus (discount)
For an insured who in previous years of insurance has made no claims, underwriters may decide to reduce the renewal premium, the premium reduction being termed the No Claims Bonus or No Claim Discount.

Normal yield
This is that yield which a number of years' experience indicates can be expected from a particular plot under normal conditions, when no extraordinary natural disaster or unusual meteorological events occur. In practice the modal yield value (the yield most commonly occurring) is taken as the normal yield. The mode is also the yield most commonly conceived by farmers as being acceptable, since they generally ignore bad years when estimating future yields on the basis of past performance.

Notification of claim
Insurance policies usually contain a provision stating that any occurrence of an insured peril, which could result in a claim, must be reported to the insurer within a specified period of time.

NDVI - Normalised difference vegetative index

Based on remote sensing data, the NDVI gives an indication of deficiencies in rainfall and can therefore be used as a convenient technique for gauging the extent and seriousness of droughts. The NDVI is an estimate of the amount of radiation being absorbed by plants. This in turn depends on the rate of evapotranspiration, and therefore on the amount of water in the soil. (For an example, relating to SW Asia, see http://dms.iwmi.org)

Off risk
A term used when insurance has either expired or been cancelled.

On risk
A term used to describe the policy during the period of insurance.

Partial loss
The loss of part of the insured property. This is often experienced in crop insurance, but not so much in livestock insurance (except when herd cover applies).

Peril
A potential cause of loss or damage to the property. Perils can be insured or uninsured; both are normally named on the insurance policy. It is therefore important that loss adjustment procedures enable distinction to be made between damage caused by insured and by uninsured perils

respectively. The main natural perils covered in agricultural insurance include fire, flood, freeze, hail, wind, excess rain and drought.

Period of insurance
The period of protection for which the policy is issued. Any losses taking place outside this period are indemnified. For annual crops, this period of insurance normally commences at the time of sowing, sprouting, blooming or transplanting and ends at the time of harvest. For perennial crops, e.g. oil-palm, the period of insurance may be on an annual basis. For livestock and aquaculture policies, the period of insurance will depend on the nature of the enterprise and the period of time from inception of insurance to the point of harvest. For broiler operations this is clearly only a matter of weeks for each batch of birds. For most aquaculture operations the period is measured in months or even years.

Physical hazards
A physical feature that increases the chances of a loss happening, for example, in crop insurance, if a disease is insured, the occurrence of a weather peril, such as continuous rain may enhance the occurrence of the disease, just as hot, dry weather increases the fire risk in a forest. Similarly, caged fish weakened by parasites may be less able to survive the stress of a storm.

Policy
A document setting out the terms of insurance for the insured property.

Premium
The monetary consideration payable by the insured to the insurers for the period (or term) of insurance granted by the policy.

Premium rate
The price per unit of insurance. Normally expressed as a percent or per mille of the sum insured.

Probable maximum loss (PML)
An estimate of the maximum loss that is likely to arise on the occurrence of a single event considered to be within the realms of probability. Remote coincidences and possible but unlikely catastrophes are ignored in the estimation of a PML. See also Maximum Possible Loss (MPL).

Pure premium
The amount required by an insurer to pay losses under an insurance policy prior to taking into account the insurer's general expenses.

Rate
The amount charged by the insurer or reinsurer for the insurance. Usually expressed as a percentage of the sum insured. The amount this equates to is the premium.

Reinsurance
When the total exposure of a risk or group of risks presents a hazard beyond the limit that is prudent for an insurance company to carry, the insurance company may purchase reinsurance i.e. insurance of the insurance. This purchase is also known as ‘ceding’. Reinsurance has many advantages including (i) levelling out the results of the insurance company over a period of time; (ii) limiting the exposure of individual risks and restricting losses paid out by the insurance company; (iii) may increase an insurance company's solvency margin (percent of capital and reserves to net premium income), hence the company's financial strength; and (vi) the reinsurer participates in the profits of

the insurance company, but also contributes to the losses, the net result being a more stable loss ratio over the period of insurance.

Retention
1) The net amount of a risk that an insurer or reinsurer keeps for his own account and does not reinsure. 2) The premium kept by an insurer, having paid any claims and expenses, which equates to the insurer's profit.

Return period
The time period between occurrences of the insured peril. For example, the return period for a hurricane may be once in every ten years. Return periods are established by analysing historical data on the insured peril.

Risk
In insurance this has several meanings: 1) the subject matter of insurance; the insured property. 2) Uncertainty attached to the outcome of an event. 3) The probability of a loss. 4) The insured peril. 5) Danger.

Risk management
Care to maintain income and avoid/reduce loss or damage to a property resulting from undesirable events. Risk management therefore involves identifying, analysing and quantifying risks and taking appropriate measures to prevent or minimise losses. Risk management may involve measures such as inoculating animals against a disease, spraying a crop against aphids or planting windbreaks; it may also involve financial measures, e.g. hedging, insurance and self-insurance.

Seismic Sea Wave
See ‘Tsunami’ below.

Specific risk insurance
A policy that defines the perils to be covered by the insurance as opposed to an "All Risks" policy which covers a multitude of perils.

Sum insured
The amount specified in the policy up to which the insurer will pay indemnities, should the insured peril(s) occur and result in a loss to the insured property.

Tropical storm
Any cyclone circulation originating over tropical waters having a distinct rotary circulation with wind speeds ranging between 63 and 118 km. per hour. Sustained wind speeds greater than 118 km/hr. bring a change of terminology to cyclone (or typhoon or hurricane, depending on geographical location).

Tsunami
This is more descriptively termed ‘seismic sea wave’. As the latter name suggests, this oceanic wave is the result of a seismic event, usually an underground earthquake, or volcanic incident affecting a relatively small part of the ocean in a massive way. The resulting wave travels at a speed of several hundred kilometres per hour over vast distances. As the wave meets a rising seabed, it grows massively in height and can cause widespread flooding and damage in low-lying areas.

Typhoon
See Cyclone.

Underwriting profit
Any profit resulting from an insurance or reinsurance before any interest has been added.

Unearned premium
Either premium of an insurance policy which never came to fruition or if an insurance policy has attached, the part of the premium which relates to the insurance period still to run.

Value
The value of the property to be insured. The basis of valuation varies depending upon the property to be insured. In agricultural insurance, the insured value may be based upon the production costs of the enterprise, the market value, or re-establishment costs.

Voluntary scheme
An insurance programme in which individuals may choose whether or not to insure their property.

Windstorm
Currents of air of such a velocity that they cause physical loss or damage to the insured crops or agricultural buildings etc. See also cyclone, tropical storm and hurricane.

Yield
Production per defined unit in a given period of time. For example, in crop farming the number of tonnes/ha. of crop product harvested; in livestock farming it could be the quantity of milk (or milk solids) per cow or goat; in aquaculture, it could be the weight of fish harvested per cage, or molluscs harvested per unit area of racks.

Zoning
Dividing the geographical limits of an insurance programme into zones for rating purposes. For example, in agricultural insurance an area may be divided into zones according to climate, topography and natural vegetation. The premium rates vary between the different zones, depending upon the frequency of occurrence.

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