consistent management can solve the social and economic problems of the farmers in the Planalto and the Pantanal and can preserve the area's biodiversity. People have to create new institutions to balance the impact of Profit on Planet and aim for sustainable use. This case shows that even within one country, one jurisdiction, planning interventions and estimating their impacts does not automatically guarantee that all P domains are included. As a result, externalities create unforeseen problems. Existing institutions should be critically evaluated to avoid similar problems in the future.

7.3 From tapioca to manure: the pig production chain

In the Netherlands, pig production has changed from a backyard activity catering for home or local demand into a professional activity of specialists aiming at national and international markets. The division of labour leads to a production chain in which each professional actor adds value to the product before passing it on to the next actor in the chain (Figure 10).

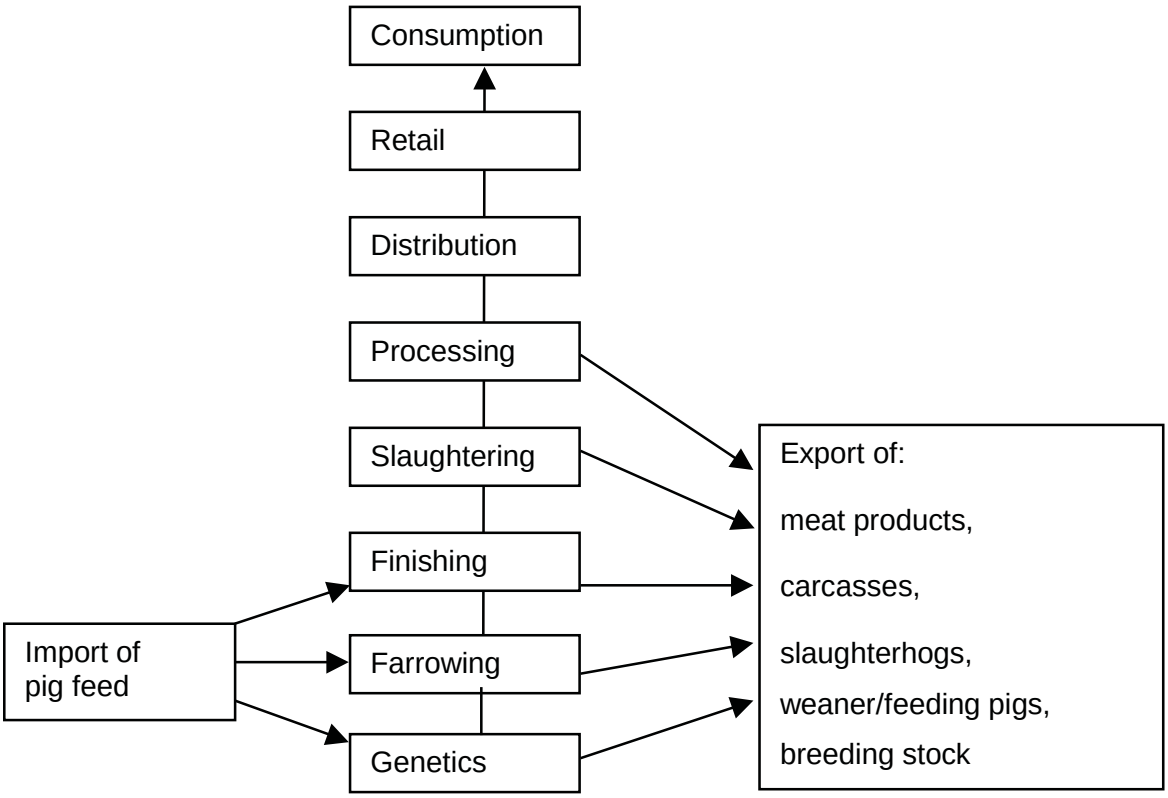

Figure 10. The Pig chain and its added economic values

Characteristics of the chain

Economies of scale lead to larger and more homogeneous batches per link in the chain. Intermediate products (including live animals) are constantly being transported to the next link in the chain. Homogeneity relates to narrow breeding goals aiming at the highest meat production against the lowest costs. As 40-50% of the costs of pig production consist of feeding costs, pigs are bred to be very efficient in conversing feed into meat. Disease resistance is only a secondary breeding goal, as it is believed that controlled circumstances in farm buildings, preventive application of antibiotics and vaccination can and will cope with this problem. However, the frequent contacts through transportation and the uniformity of batches lead to a rapid spread and large impact of contagious diseases. During the outbreak of swine fever in the Netherlands in 1996/97, 11 million of the total of 25 million pigs were slaughtered, most of them to prevent the disease from spreading.

The chain in context

The chain used to be supply-driven, allowing production in a specific region to greatly exceed local demand and leading to export of pigs and pig meat. In the Netherlands, the sector became a net exporter, with export volumes nearly twice that used for national consumption. The pigs all need to be fed while alive in the production chain. Production of feed in the Netherlands is expensive because of the high cost of land and labour, making pig production too expensive to be competitive in an export market. Importing cheap feed and transporting it cheaply via the main sea harbour (Rotterdam) and associated waterways has solved this problem, but has had major consequences. If feed is bought in developing countries, for instance tapioca (manioc/cassava) from Thailand, less food is available for consumption by the local population and the increased demand may raise the prices of the remaining food on the local market. In response to the international demand, Southeast Asian countries may decide to produce feed especially for pig production. Thus, pig production in the Netherlands means occupation of land in developing countries as an ecological footprint supporting a production branch that aims at the export of meat. On the other hand, importing pig feed leads to a pig production that is independent of, or de-coupled from holdings and land in the Netherlands. Furthermore, the amount of nutrients imported in the feed, after subtraction of the amount of nutrients exported in the meat, means a surplus of nutrients in the form of manure on farms in the Netherlands. Pig production is responsible for 20% of the manure produced in the Netherlands but contributes 67% of the excess manure. This excess leads to groundwater pollution by leached nitrate (NO_3^-) and contributes to greenhouse gases in the form of ammonia (NH_4^+), contributing to global climate change.

The feed-producing countries eventually end up with a nutrient deficit, leading to the risk of loss of soil fertility and soil degradation.

People/Profit: power relations in the chain

As long as the chain is supply-driven, the pig producer can decide on the quantity and quality of his product and can negotiate a price. If there are many buyers in the market, the producers have a strong position: the consumer has to accept the quality that has been decided upon between the producer and a professional buyer. At the

top of the chain, however, the butchers and food processing companies have now merged to form a few big players and the same has happened in the retail business. This puts producers in an unfavourable negotiating position, especially when they all have roughly the same product to sell. The bulk of the profit will end up in the hands of the retail part of the chain. A new step has been the reversing of the chain. The retailer needs to serve the citizen-consumer, who demands a particular amount of a particular quality at a particular moment, and the producer has to deliver. One quality aspect is environmental-friendly produced pig meat with attention for animal welfare. The retailer determines the price, as there are hardly any alternative markets that the producer could turn to. This reversal of the chain was temporarily slowed down because the slaughter capacity exceeded the supply of environmental-friendly produced pork, allowing temporarily traditionally produced pork to enter the chain as well against the same financial reward. Because of the way the chain is organised, the people in developing countries who produce the pig feed are unable to influence the chain, because they are scattered, unorganised and easily ignored. They will have the lowest share of the profit. Should they try to become influential, the feed import can always shift to other sources or localities.

People: consumer concerns

The role of consumers is twofold and often conflicting. Consumers are interested in low costs, but they demand quality in food and production processes. In terms of pig meat, consumer concerns may consist of

- food safety (no disease, no residues of antibiotics, no hormones);
- environmental effects of production (no water or air pollution);
- animal welfare (pigs should be able to roam about freely, pigsty floors should be lain with straw, breeding goals should be differentiated so no abnormalities are bred in);
- effects on people in developing countries (not causing degradation, fair trade).

Apart from these concerns, consumers also consider the price of meat, the time needed for shopping (supermarkets instead of 'green butchers'), the time available for preparation (convenience food), image, etc. The reversal of the chain implies that consumer demands have come to drive the production chain to a greater extent. Retailers are therefore very sensitive to these concerns. The combined consumer concerns demand that the chain ensures the supply of safe, environmental-friendly and animal-friendly meat in the supermarket, at low prices.

Profit/Planet: is environmental-friendly production more expensive?

An analysis of the supply-driven chain leads to the conclusion that the price of meat is currently very low, due to the fact that many side effects of pig production are not being accounted for. Life Cycle Analysis (LCA) would tell us that the global chain implies the use of many non-renewable resources such as energy and depletable soil qualities for feed production and transport. Other indirect costs relate to the purification of polluted drinking water. Prices should also account for the costs of regular outbreaks of diseases, during which large numbers of animals have to be destroyed, mainly to maintain the producers' export position. Another cost, which is however hard to monetarise, is animal suffering. When all these costs are taken into

account, the current traditional production methods may well be more expensive than organic pig production. The current production methods would never pass the test of sustainable production.

Options for change

Assuming that the current rationale (mode) of production cannot be changed, options for change focus on shortening the chain. Transport volumes and the risk of contamination can be reduced by applying genetics, farrowing and finishing on the same (closed) farm. The manure problem can be treated by stimulating pig farmers to enter into manure contracts with crop farmers to spread the nutrients on Dutch fields. Both changes are already taking place. In an extreme scenario, all activities could be concentrated in one huge, multi-storey pig factory on an industrial estate. In such a system, all inputs and outputs would be controlled, including those that are undesirable. Manure is seen and treated either as industrial waste or as a valuable input for fishponds located at the same site. Production and processing take place on site, reducing transport. It would be economically most feasible to concentrate pig production near a harbour, as the price of feed contributes up to 50 % of the costs of production, which is partly because of its transport costs. Although economically and ecologically feasible, the concept of such multi-storey pig factories is difficult to sell to the public, as it largely ignores animal welfare and the industrial production method conflicts with the romantic idea citizens tend to have of animal production.

An alternative is to change the rationale of production. In view of the categories and causes of costs like those of transport, excess manure and depletion of soils in developing countries, it might be better to have local pig production and consumption, based on locally produced feed. Organic farming in the Netherlands is an example of such a mode of production. Pigs can move freely, have straw in their sties and are often allowed to roam around outside. Manure can be exchanged for straw with cereal farmers. The problem is that this mode of production requires large tracts of land, which is very expensive in the Netherlands. Production for an export market would be difficult, as there would not be enough resources to sustain the 25 million piglets that are sustained with the current intensive mode of production. Even the domestic markets could not be fully catered for by organic pig production, unless the price of organically produced pork is substantially higher than the conventionally produced product.

A third option is to produce pork in the areas where the feed is grown, e.g. in Thailand. However, the consumers are still in the industrialised countries, so the meat would then have to be exported. For food-safety reasons, however, transport should be in frozen or otherwise well-conserved form. This is no option for European consumers as they prefer fresh meat, but American consumers generally accept frozen meat. Another complicating factor is the tariff system in which imports of raw materials such as tapioca into Europe are cheap but imports of meat and other end products are submitted to high import duties.

There is a wide variety in production costs among individual pig producers in the Netherlands, wider than between average pig producers of different countries.

Moving production to countries with lower costs of labour or land is therefore not necessarily a solution. On the other hand, studying the economically most efficient producers within the Netherlands can suggest options for change.

A fourth option would be to produce protein in alternative ways. Meat replacement products can be made from protein produced by legume crops or by micro-organisms, removing the need to produce meat.

7.4 Overall conclusions from the three case studies

All three cases show the externalities of a single-P approach. In fisheries, the Planet has been severely damaged by short-term Profit, sometimes aggravated in the long run by economically inefficient fishery practices. In the Pantanal and pig production cases, Profit has dominated, to the detriment of the Planet, or causing economic losses in the long run in some of the areas involved. The interests of People are seldom made explicit. Profit in terms of increased income in one place may lead to problems like flooding and economic and social losses elsewhere (Pantanal). Nutrient depletion and erosion have affected large areas far from the actual area of production and consumption. In both cases, the benefits and the costs affect different people. In the Pantanal and fisheries cases there has been some progress in combining Profit and Planet. In all cases, effects in the People domain are hard to specify. The cases show clearly that there is a need for a framework to address the three P's and their trade-offs when planning an intervention or when evaluating food chains. Many adverse effects require adequate and sometimes unpopular decisions on a higher and more complex level than is currently accomplished by the responsible authorities. Evidently, governments find the international scale of underlying mechanisms hard to tackle.