Chapter 6

Case study in livestock disease management: Chile

This case study begins with a contextual overview of the livestock sector and animal health situation in Chile, and then focuses on the following aspects: government awareness of producer behaviour in livestock disease management; information, education and training for producers; and producer compensation policy in Chile. The final section presents the conclusions and policy recommendations.

6.1. Overview of the livestock sector and animal health situation in Chile

Structural characteristics and economic importance of livestock production

Chile has a unique geography occupying a narrow strip along the Pacific coast of South America whose width at maximum reaches only 420 kilometres. The long extent from north to south leads to the desert climate in the extreme north of the country evolving into Antarctic climate in its southernmost part. Most of the agricultural activity occurs in the depression between the Andes and lower Coastal range running parallel to the Pacific Ocean (FAO, 2006). Such a landscape creates natural barriers to disease transmission, although coastal wetlands with migratory birds present a risk for disease introduction. Livestock farming is concentrated in the South plains and Patagonia, the regions rich in grasslands and pasture. The husbandry is largely pastoral, with low livestock densities and dispersed herds, which also reduces the risks of disease spread. Confined poultry, pig meat and dairy intensive systems exist in the central zone and intensive dairying is also present in the southern regions.

The livestock sector generates 37% of Chilean agricultural output (OECD, 2016). Total livestock production more than doubled between 1990 and 2013 and rose by almost 60% in per capita terms (FAOSTAT, 2017b). The sector's exposure to trade over this period increased considerably, both on export and import sides. Chile became a net overall exporter of livestock products in the 2000s, but returned to net imports in the 2010s with a broadening negative balance (ODEPA, 2017a). Chile has traditionally been an exporter of sheep meat and wool and has also considerably increased net exports of pig meat and poultry meat since the early 2000s. These exports are destined to markets with different consumption characteristics and sanitary requirements – from large emerging markets such as China and Russia, to North America and the European Union. Chile is a net importer of beef and in 2015-16 it was also net-importing dairy products. A good sanitary status is thus important for Chile to both minimise domestic market risks and to ensure stable access to export markets.

Around two-thirds of agricultural establishments in Chile undertake some livestock activity (INE, 2007b).[1] The cattle and sheep sub-sectors have a distinctly dualistic farm structure with most of the herds concentrated in a small number of large operations, and numerous small establishments existing alongside (Annex 6.A1). For example, almost 70% of the total sheep number is concentrated in units with 500 hectares and more, but which represent only 2% of all holdings that keep sheep, while units below 50 hectares constitute around 80% of such holdings. The presence of many small livestock holders in these industries makes them important as a constituency to be targeted by animal disease policy. The dualistic farm structure is also observed in poultry and pig production. However, the ownership and organisation of these industries differ significantly from the bovine and sheep sectors: the numerous pig and poultry establishments are typically parts of integrated businesses that are owned and managed by the same operators.

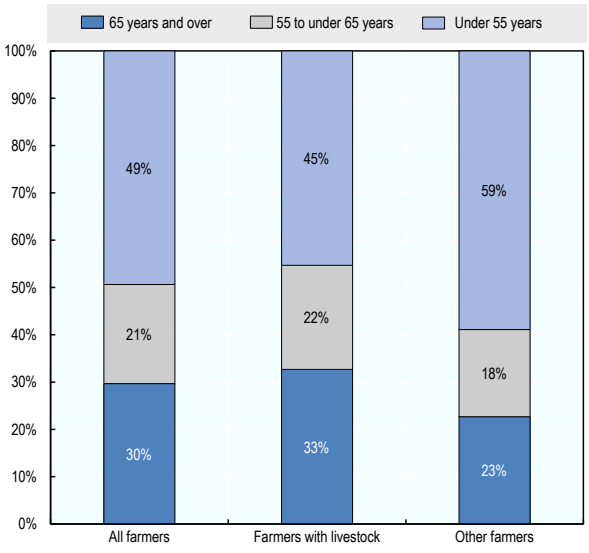
Chilean livestock producers are a relatively aged community. Among the individual farmers, persons close to or above the retirement age (55 years and older) constitute 55%. This share is higher than amongst those who are not engaged in livestock production (Figure 6.1.A). Human capital in agriculture remains low: 77% of individual livestock farmers have only basic or preparatory education or no schooling at all, while the share of those with middle, technical or higher education is 23% (Figure 6.1.B). These educational attainments compare less favourably with farmers who do not keep livestock. For this group the persons with more advanced education levels – from middle to higher education – constitute a share almost twice as high (43%).

Contract arrangements between producers and downstream operators – up to full vertical integration in some sectors – prevail in the meat and dairy chains in Chile. All this suggests that downstream companies, through contracting and industry food safety programmes, play a key role in the establishment of sanitary standards on farms integrated in commercial chains. The majority of sheep (62%), and a large part of beef cattle (47%), are collected on the premises for retail outlets and almost 95% of pigs are delivered to slaughter houses (INE 2015a; INE 2015b; INE 2016). The poultry meat segment is concentrated, with only four companies operating in the broiler segment and three companies in the turkey meat segment. These are highly

integrated companies, controlling the entire process from parent stock farms to slaughter (Hidalgo, 2016). Dairy processing is also concentrated with six companies handling nearly 90% of marketed raw milk (ODEPA, 2017b).[2] Flexible marketing arrangements, such as deliveries to auctions and sales yards, and sales to livestock traders, are important only for beef cattle: nearly 50% of animals are marketed through these channels, but only 18% of sheep and 1% of pigs.

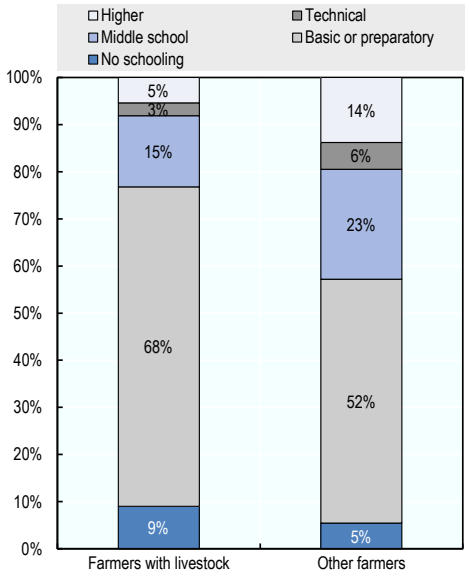
Figure 6.1. Age and education profiles of livestock farmers in Chile

A. Age



Note: This figure covers only natural persons.

B. Education



Note: Only natural persons who have answered the relevant question in the survey are taken into account here. Each level of education represented includes persons who have completed their studies at that level and those who are still undertaking their studies

Source: Own elaboration based on 2007 Agricultural Census database.

Commercial product chains do not integrate very small livestock keepers, typically undertaking semi-subsistence or subsistence production. These producers raise livestock primarily for household consumption and access markets only sporadically and at local levels. Their linkages with markets are typically not well observed (or observable),[3] while the risks they present for the occurrence and spread of disease are not well informed (Chapter 2). Hamilton-West et al. (2012) provide some insights into the profile of smallholders operating outside the commercial product chains in Chile by taking the case of poultry (Annex 6.A2). The authors make a general observation that despite the different structures of the poultry sector worldwide, backyard production systems can play a major role in disease maintenance and spread because of management conditions and the lack of animal health services adapted to these production systems. They point out the need to improve the coverage of veterinary assistance and disease surveillance in backyard production.[4]

Overall situation related to livestock and animal disease risk

Chile has a favourable livestock health situation and enjoys a good reputation as a livestock product exporter for its sanitary conditions. The goal of export enhancement and a need to demonstrate good animal health and food safety status has driven significant improvements in the Chilean animal health system since the 1990s (Rojas, 2009). The overall prevention and control strategy has been strengthened, with plans developed for individual diseases, new disease eradication programmes, and an animal traceability system. Food safety has also been a major focus, closely linked with animal health. A national food safety system has been established based on international standards and involving programmes of export certification at

livestock premises, official programmes for control of pathogens, anabolics, and harmful residues, as well as voluntary food safety programmes in some industries (e.g. pig meat industry). Some insight into livestock disease as a factor of production risk can be drawn from the survey of sheep breeders. Disease has been identified as one of the less frequent causes of sheep loss, accounting for 7% of lost animals, compared to the loss from predators (50%) and climatic factors (16%) (INE, 2015b).

The country is free from the majority of OIE-listed diseases, including BSE, FMD, swine fever, Aujeszky's disease, or ovine brucellosis (SAG, 2017). Chile has been FMD-free without vaccination since the 1980s after a 20-year eradication programme (Rojas, 2009), which provides Chile a significant export advantage.[5] Since 1975, the country has worked towards the eradication of bovine brucellosis: the extreme south is currently a disease free region, while others are under the national eradication program, with the extreme north being a region of "disease absence" (SAG, 2015). In 2011, Chile also began the programme for eradication of bovine tuberculosis. Between 2003 and 2007, the country has also been successfully implementing a plan for control and eradication of porcine reproductive/respiratory syndrome (PRRS) and aimed a PRRS-free status. However, an outbreak of PRRS of a new strain occurred in 2013, resulting in almost 19 000 animals culled and a launch of a new PRRS control and eradication plan. The country has seen no outbreaks of avian influenza (AI) since 2002, until the first occurrence of low pathogenic AI in December 2016, probably caused by migratory birds. Nearly 34 000 birds were destroyed and other control measures implemented (OIE, 2017). Another relatively important disease event concerned the fowl typhoid in 2015, also involving the destruction of some flock (OIE, 2017). However, only a few establishments in the pig and poultry sectors were affected in the recent outbreaks.

Diseases that are not notifiable are not officially monitored and the information about their incidence and economic effects is lacking (Chilean Government, 2016). As shown by the studies undertaken elsewhere, diseases that do not present high epidemiological concern may have substantial economic impact on livestock industry (Chapter 5).

Institutions involved in livestock disease issues within country borders

The Agricultural and Livestock Service (*Servicio Agrícola y Ganadero* – SAG) is the main institution responsible for plant and animal health in Chile. It is subordinated to the Ministry of Agriculture as a decentralised service with national outreach. SAG has 15 regional and 63 area offices, 94 border control points for plant and animal health, and 11 diagnostic laboratories. Animal health issues are under the responsibility of SAG's Livestock Protection Division, which includes disease surveillance, sanitary emergency management, sanitary information and animal traceability system, and development and implementation of disease eradication programmes. Beyond animal health, SAG's Livestock Protection Division is responsible for other important areas, such as livestock welfare, food safety, and export certification of primary products of animal origin.

The implementation of animal health programmes rests on the Official Veterinarians, Authorised Veterinarians, and the private sector. The status of Authorised Veterinarians is granted to external professionals, who conduct one or more activities within the framework of SAG's official programmes. The aim is to optimise the use of resources and expand coverage, capacity, efficiency and response capacity of SAG's services. Authorised Veterinarians annually undergo training and performance evaluation related to the programmes for which they have been certified (Chilean Government, 2016).

Chile's livestock producers and downstream operators have created various groups. National and regional farmer associations unite primary agricultural producers. Some regional farmer associations represent southern regions concentrating most of the national livestock production, such as the Agricultural and Livestock Society of Osorno (SAGO), Union of Agricultural Producers of Valdivia (SAVAL), and Union of Agricultural Producers of Bío-Bío (SOCABIO). Other groups are organised along specific segments of livestock industry: Chilean Association of Pig Producers (ASPROCER), National Federation of Milk Producers (FEDELECHE), National Federation of Beef Producers (FEDECARNE), Association of Meat Exporters (Expo Carnes), and Chilean Association of Egg Producers. The Chilean Meat Association (ACHIC) unifies companies performing slaughter, processing, imports and marketing of meat; the Association of

Livestock Trade Fairs of Chile (AFECH) groups 10 companies that run 35 auction sites accounting for over 86% of the nationwide transactions.

There is no institutionally established biosecurity partnership between industry groups and government, including any *ex ante* formal agreement on sharing of responsibilities and costs in disease emergencies. Chile's Master Plan for the Management of Health Emergencies only states as a principle an active engagement of representatives of the private sector in emergency response (SAG, 2013). SAG and its Early Response Task Group perform simulations of exotic disease outbreaks to evaluate the responsiveness of the veterinary service and carry out training in outbreak control (e.g. related to avian influenza in 2015, classical swine fever in 2010, and FMD in 2009). Producer organisations, along with the SAG's Official Veterinarians and Authorised Veterinarians, participate in these simulations (Chilean Government, 2016).

Several other examples of industry group involvement in biosecurity work can be highlighted. In the cattle and sheep segment, industry groups (SAGO, SAVAL, AFECH, ACHIC and FEDECARNE) participate in the National Beef Commission, a public-private consultation and co-ordination platform. Among other issues, this Commission considers veterinary and sanitary programmes in the meat chain (see below). The Chilean Association of Pig Producers (ASPROCER) participates in animal health programmes in the framework of the sectoral Food Safety Management System. The poultry industry also participates in the surveillance programme for avian influenza and farmer training, and in the past has been involved in the management of the 2002 outbreak of avian influenza.

6.2. Government's activity to increase its awareness about farmer behaviour

Private operators are the ultimate decision makers of farm enterprises. Evidence about farmer behaviour and their response to policy is thus a necessary input into policy making, including in the area of animal disease.

Availability of information about farmers undertaking livestock activities

As a starting point, governments require sufficient information about the number, structural and social characteristics of the livestock farming community they engage with. This information should have adequate national coverage and consistency. As elsewhere, Agricultural Census is the most important primary source of such information in Chile. The most recent one was conducted in 2007 (INE, 2007). It reports the numbers of holdings keeping livestock and total livestock inventories; individual characteristics of producers (sex, age, and education), legal status of enterprise, as well as availability of machinery and equipment, and characteristics of members of farming households. With regard to farm size structure, the publicly released data includes the distributions based on farm area (Annex A.1). The primary census data could also be used to inform about the distribution of farms according to herd size. This is of interest for developing policies that are targeted to holdings of different herd size.

The Chilean National Institute of Statistics (INE) undertakes regular farm surveys. Surveys of sheep, goat and bovine farms are done every two years in the regions concentrating over 90% of the total stocks of these animals. These surveys cover only the establishments above a certain size: the sheep survey includes farms with 60 heads and more (around 74% of total inventories based on the situation of 2007 Agricultural Census); the bovine survey includes units with 10 heads and more (90% of total inventories in 2007 Census); and the goat survey units with 20 heads and more (all units included in the 2007 Census). The issues covered have broad scope and include updates on the farm numbers and livestock inventories, individual characteristics of producers with special emphasis on the use of technical assistance and access to internet. These surveys also inquire about the technological aspects of an enterprise (herd structure, feeding, land use, availability of infrastructure, etc.), farm investments, and marketing channels. Two separate surveys of pig and poultry producers (eggs and broilers) are also conducted. They are more frequent (semi-annual) and cover farming units above a certain size and disposing of infrastructure for commercial activity.[6] Compared to sheep, goat and bovine surveys, pig and poultry surveys inquire about a relatively narrow scope of issues, such as herd management and marketing systems of enterprise. None of the livestock surveys mentioned

above look into aspects of animal health, such as farmers' perceptions about disease risks, use of different practices to prevent disease, or farmer awareness of key biosecurity information sources and their use.

Beyond statistical and analytical data collected through the Agricultural Census and farm surveys, there is also the Livestock Information and Animal Traceability System (*Sistema de Información Pecuaria y Trazabilidad Animal* – SIPEC). This system generates data on livestock inventories and other livestock characteristics for the purposes of biosecurity surveillance and control and food safety. SIPEC is based on annual declarations by livestock holders and covers all livestock types. The traceability system for the bovine sector contains information by individual animal.

To conclude, Chile's statistical system maintains regular observation of producers engaged in livestock activity and generates updated information about the existence, economic and individual characteristics of these farmers. The Agricultural Census sets a minimum area or animal number threshold for the inclusion of economic units into observation.[7] The observation between the census years (over a period of ten years) is based on surveys that exclude the smallest and predominantly "backyard" farmers and also the regions where specific livestock activities have low importance. Thus, although there is substantial census- and survey-based statistical work, the observation of the smallest livestock operations is limited – a feature common to statistical systems in many other countries.

Funded research into farmer behaviour

A preliminary examination points to an overall lack of studies in Chile on farmer behaviour, including studies focussed on livestock disease management. The available publications concern general aspects of animal disease management, such as Rojas (2009) which outlines the context and development of the biosecurity system in Chile, or Max et al. (2007) which analyses the experience of the avian influenza outbreak in 2002. Some behavioural research in agriculture has been focussed on environmental issues (Roco et al., 2015; Salazar and Rand, 2016). Other research by Guarnan and Lerdón (1999), CONAF (2011) and Reyes and Lensink (2011) looked into farm typology and the specificities of the small farming segment. PMG (2015) undertook a broadly scoped survey of farmer marketing practices, use of financial instruments, insurance, organic farming, etc. All these studies touch upon farmer behaviour in some ways, but do not include livestock disease aspects.

Awareness through interaction with industry organisations and veterinarians

Chile's government has traditionally interacted with agricultural producers in various formats, both at national and sub-national levels. This is facilitated by the fact that geographically Chile is a relatively small country and with a relatively limited number of stakeholders, in particular concerning the livestock sector. Another important feature is the activity of the Agricultural and Livestock Development Institute (INDAP), subordinated to the Ministry of Agriculture that has the mandate for agricultural and rural development. It implements a wide range of development programmes targeted to subsistence producers and family farmers and deploys a large number of personnel in the field. INDAP's activity is an important channel linking government with a farming segment of small producers.

Chile's government has sought to increase public-private co-operation in recent years. In 2011, the National Commissions were created as public-private co-ordination bodies on cross-cutting issues of sectorial and (or) national importance. Among 11 such Commissions for key product sub-sectors, there is the National Beef Commission (*Comisión Nacional de la Carne Bovina*). It unifies representatives of livestock farmers, downstream operators of the meat chain, and government. SAG, as a public body in charge of plant and animal health, is one of the institutions representing government. The National Beef Commission currently works on animal farming productivity, improvement of information and co-ordination across the meat chain. Animal health issues are cross-cutting, but largely fall under the work stream related to meat export growth. This includes disease eradication programmes, exports of live animals, livestock traceability system, and the programme for official certification for livestock establishments. As a regular platform for public-private consultation, the National Beef Commission is focussed only on the cattle chain, and does not concern specific issues of dairy, pig meat, or poultry sub-sectors. In the sheep sector, several working groups operate

at regional level and there is an intention to organise a nation-wide group involving producers and leaders of peasant organisations connected with INDAP.

SAG and INDAP interact with producer organisations also through *ad hoc* working groups, workshops, seminars, training courses, as well as specific livestock projects. One example is INDAP's project implemented in collaboration with farmer organisations in the region of Coquimbo. It seeks to convert small goat farmers from meat to milk production based on semi-extensive system. Biosecurity aspects are considered in this project among other issues. Another example is the project on eradication of bovine tuberculosis in the region of Los Lagos (see Section 4). Overall, the results of these *ad hoc* activities have not been analysed or systematised, however, according to SAG the concerns are addressed.

Regular contact between the Official Veterinarian (MVO) and Authorised Veterinarians exists in the framework of training for veterinarians organised on subjects of interest for SAG. The results of these activities are communicated by the MVO at national meetings, co-ordinated by the Central level. Interaction with veterinarians is also possible within sectoral working groups and public consultations on new regulations. However, there are no explicit arrangements, e.g. regular surveys or questionnaires of veterinarians about issues of on-farm disease management (Chilean Government, 2016).

6.3. Communication, information and training for farmers

Information and education influence all aspects of farmer decision making. Appropriate communication and information about disease existence, identification, consequences, costs and benefits of control and prevention programmes, responsibilities and policies, enables farmers to make well-informed decisions and ensure the diseases are managed effectively.

Communication and information

SAG is the principal provider of animal disease information. This includes communication about disease emergencies: general regulation and contingency plans for specific diseases, disease reporting requirements and export certification. The annual updates of the national sanitary situation are also provided. Another stream of SAG's information concerns compulsory disease eradication programmes, including national disease eradication plans, current actions and situation. SAG also informs about voluntary sanitary programmes, import and export legislation and procedures. All this information is available on-line at SAG's website (www.sag.gob.cl). In addition, a bi-monthly newsletter covering the most important international sanitary events is circulated to interested users in the public and private sector (Chilean Government, 2016). SAG vets are permanently present in the livestock establishments to supervise the operations, which generates a frequent flow of information about good practices from the SAG to the livestock farmers.

INDAP, through a range of its activities, acts as an important channel of information for the segment of small farming. To the extent these programmes concern livestock production, they are likely to include information on biosecurity and animal disease issues. Since 2015, farmers and other stakeholders have been involved in INDAP's activity planning. Such participatory approach can help to better identify small farmers' information gaps and adapt the provision information, including in the area of biosecurity and animal disease. However, the extent to which this is occurring and what issues are emerging is difficult to specify as INDAP's activities are significantly localised.

The websites of the national livestock industry associations – Chilean Association of Pig Producers (ASPROCER), National Federation of Milk Producers (FEDELECHE), National Federation of Beef Producers (FEDECARNE) and Chilean Association of Egg Producers – seem to provide limited and not frequently updated information, which does not cover disease management. One exception is the Chilean Association of Pig Producers, which communicates the on-going industry food safety programmes on its website, including those related to animal health (Annex 6.A3). The existence of other private and public providers of animal health information and their activities – e.g. at the level of regional or local administrations, education and training institutions and NGOs – requires further examination.

Overall, the government constantly interacts with small farmers in the framework of agricultural development assistance. With regard to larger farmers who are not covered by INDAP's programmes, it may be tentatively observed that for this farming segment animal disease information has a top-down character.

For the moment, the government has not undertaken any specific inquiry into the information needs of livestock farmers or other stakeholders and the most appropriate channels for its provision. The extent to which producers use official sanitary information and whether they find it useful has also not been investigated (Chilean Government, 2016). The targeting and adapting of veterinary and sanitary information to recipients with different profiles may be particularly relevant in the context of Chile's farming structure combining small and subsistence farmers on one side and technologically advanced and highly integrated operations on the other. For example, only 26% of cattle farmers and 14% of sheep farmers in Chile use internet (INE 2015a; INE 2015b).

Communication about livestock disease in Chile concerns mainly epidemiological and sanitary aspects. As noted in the other country studies included in this report, there is a lack of communication about the economic aspects of disease management. Economic considerations largely affect farmer disease management decisions and farmers need to have sufficient understanding about the costs and economic effects of good (or bad) biosecurity practices, both at farm level and across livestock industry and consumers. The evidence generated in that regard in Chile seems to be limited. According to the Chilean Government (2016), the official disease control and eradication programmes concern OIE-listed diseases that interfere with trade and impact economically, but there has been no systematic work on estimating the economic impacts of animal diseases. Some economic impact studies are performed in the private sector, for example, in the context of the recent disease outbreaks affecting poultry and pig producers. However, these studies do not always reach the public domain.

Education and training

Agricultural education and training in Chile is decentralised and involves a wide range of providers which have high autonomy – public institutions, foundations, universities and private companies (OECD, 2008).

Training and technical assistance have been an important component of agricultural policy in Chile addressed to small farmers. This is one of INDAP's activities, reaching out to more than a thousand users. For example in 2015, 44% of cattle producers and 43% of sheep producers received technical assistance through INDAP in the veterinary field (INE 2015a; INE 2015b).[8] SAG and INDAP develop special programmes covering, among others, biosecurity and reproductive diseases, as well as some regional programmes for traceability and sampling. The amount and the scope of training generally vary by farmer profile: subsistence producers typically receive elementary knowledge, while producers of "business profile" are offered broader and more specific training (Chilean Government, 2016). INDAP's training modules are developed on the basis of detection of local training needs, so it is difficult to generalise about the extent to which they cover livestock producers and incorporate animal health thematic.

There is an example of INDAP-industry collaboration in farmer training related to biosecurity. INDAP and poultry industry represented by Meat Exporters Association (Expocarnes) organise training for small and medium-sized farmers and the professionals from INDAP's technical teams under the thematic of poultry health and productivity. The specialists from the University of Chile, SAG, and Expocarnes give theoretical and practical courses on production and animal health, including preventive measures and rapid reporting of avian influenza.

Training for larger producers who do not qualify for INDAP's assistance is a matter of their individual initiative. Large farming enterprises can also offer training to employed staff on subjects of interest and benefit from a tax concession for personnel training – a capped income tax credit. This concession is not specific to agriculture and is available to businesses in all economic sectors.

In sum, the government currently implements no specific systematic training programme for farmers focused on livestock disease management, although this thematic is included in overall training for small

farmers. Until present, SAG has not been involved in evaluation of the existing training programmes from the perspective of disease management.

6.4. Current experience with farmer compensation policy

Compensation is the principal economic instrument of livestock policy with a direct impact on producer incentives and actions to manage disease risk. Compensation is understood in this case study to be any payment or reimbursement provided to farmers within the framework of disease control and prevention programmes. This includes (i) indemnity for direct disease losses, such as dead or destroyed animals; (ii) compensation for consequential losses, such as those from business interruption; and (iii) payments for farmer *ex ante* actions, such as subsidising biosecurity investments and operations. This part examines the degree to which Chile's compensation policy stimulates or discourages producers to make adequate efforts to prevent disease and report it in a timely fashion when it occurs.

Producers in Chile have to report a disease that is subject to obligatory notification according to SAG's list – a failure to report entails fines. The national legislation does not foresee indemnities to producers in the case of disease outbreaks, whether it concerns compensation for destroyed or sick animals, or any other types of losses resulting from outbreak control measures. There are no national funds for indemnification of livestock producers based on public sources, or co-funded by producers (or industry).

Ad hoc measures

Some *ad hoc* assistance has been provided in the past and more recently. In the 1980s, producers were compensated on an *ad hoc* basis when animal destruction was involved. This was implemented in the context of either a disease outbreak, or planned measures in some disease eradication programmes. The assistance to affected farmers in some cases was in the form of supplies of live animals for restocking.[9]

In 2013-15, indemnification for culled animals was provided in the framework of the programme for eradication of bovine tuberculosis (BT) in the region of Los Rios. The objective was to encourage slaughter of infected animals. Indemnities were paid for each animal that has been detected BT-positive on quarantined farms up to January 2013, and for animals eliminated in slaughterhouses. The compensation amounted to 4 UF[10] (approximately USD 160) for adult cattle and 2 UF (USD 80) for calves.

Livestock insurance

Chile has been implementing subsidised insurance programmes in agriculture since 2000. They began in the crop sector and recently have been extended to the livestock sector. Insurance for beef and dairy cattle was introduced in 2012 and for sheep in 2015.

Livestock insurance is a multiple risk instrument: among the perils covered it includes animal death and livestock diseases. This instrument, however, does not cover the loss due to culling of animals by the order of veterinary authority and due to exotic diseases (according to SAG's statements). Conditions of insurance are similar for bovine cattle and sheep and foresee an insurance premium concession. A 40% subsidy to the insurance premium is provided and can be increased up to 65%-70% if all additional concessions apply (Table 6.1).

Livestock insurance is relatively new and is still being rolled out. The penetration of insurance is currently relatively low. In 2016, it covered 0.4% of total cattle inventories and less than 0.4% of sheep inventories. Also, the government intends primarily to assist small producers. According to Chilean Government (2016), the uptake of the insurance is constrained by a lack of experience with insurance amongst livestock producers who do not yet have sufficient "insurance culture". Another issue is the spatial dispersion of producers, who often appear to be off-site for the underwriting of a contract and its settlement in the case of accident. There is also a lack of interest among insurance companies to operate this product.

Table 6.1. Subsidised livestock insurance in Chile

Items	Conditions
Regions covered	All regions
Eligible producers	• All farmers registered with the Internal Revenue Service and payers of VAT • Farmers not registered with the Internal Revenue Service, but credit borrowers from INDAP, BancoEstado, or other institutions – in this case insured amount is capped at UF 250 (around USD 10 000).
Animals covered	Only animals in the official identification system and for which there is record of sanitary management and vaccinations.
Basic subsidy	40% of insurance premium, plus UF 1 (around USD 40) per policy, capped at UF 80 (around USD 3 200)
Additional cumulative subsidy	Basic subsidy is increased by the additional percentage points of the insurance premium in the following cases: • Renewal of policy (+10%) • Collective contracting, i.e. if insurance is purchased through institutions such as producer associations, guilds, financial organisations or downstream companies (+10%) • Less favoured areas (+5%) • Cultivation of cereals (+5%) for cattle farmers
Indemnity deductible	Value of animal at the purchase of contract, minus a deductible of up to 10% of animal value, a deductible varying according to the size of establishment.

Source: Agroseguros (2017) and Chilean Government (2016).

Other support activities

INDAP operates credit and investment programmes for livestock producers for development of farm infrastructure. These programmes may include improvements in the sanitary conditions of farms. However, this assistance does not concern direct action to eradicate diseases. The extent to which these programmes direct resources to sanitary improvements on farms is not known (Chilean Government, 2016).

In the dairy sector, there is a voluntary industry initiative to promote biosecurity at farm level. Some dairies apply an incentive scheme whereby milk producers participating in the government programmes Farm Free from Bovine Brucellosis and Farm Free from Bovine Tuberculosis receive price bonuses for delivered milk.

6.5. Conclusions

Chile enjoys a favourable animal health situation, thanks to geographic conditions impeding disease transmission and decades of successful work on disease eradication. Strict sanitary regulations and border controls prevent entry of exotic animal diseases. The efforts to strengthen national biosecurity system enabled the expansion of Chilean livestock product exports in the 2000s, while the need to maintain good sanitary reputation as an exporter necessitated continued action. The improvements in the national biosecurity in recent period were focussed on food safety and export certification systems – the work which had important implications for animal disease management. This includes the establishment of the livestock farm register and livestock traceability system, a suite of export certification programmes for livestock farms, and further disease eradication programmes. In intensive production poultry and pig meat sectors, disease surveillance was strengthened through government-industry programmes. There were also industry initiatives for better biosecurity practices on farms, e.g. in the pig meat, dairy and beef sectors.

Disease risks are always present and their probability and nature evolves, as evidenced by the most recent outbreak of avian influenza in Chile in 2017. This latency of risk requires constant improvements in the responsiveness and efficiency of the biosecurity system even with its good performance today. Increasing farmer incentives to prevent and report disease is the essential part of this task. This case study highlights several areas where further progress could be made in this regard.

Export interests largely drive animal disease policy in Chile, which focusses on commercial livestock producers supplying domestic and export markets. This farming segment is well integrated into product chains with vertical food safety controls ensured by the official national biosecurity system and industry standards. There remain small farmers who are weakly linked with commercial product chains, and whose disease situation cannot be perfectly monitored. Improving disease surveillance and prevention amongst such farmers is an issue in many countries. This does not appear to be a significant present concern for Chile, given the limited record of livestock epidemics in recent decades, but rather an issue of increased preparedness for potential risks. One essential challenge is to strengthen the incentives of small producers to early detect and report disease. The policy related to livestock epidemic compensation is an important area where individual incentives can be aligned with public objectives.

Chile's national legislation currently foresees no direct compensation of livestock holders in the case of compulsory measures to control disease (e.g. destruction of animals and movement restrictions), while non-reporting of disease entails penalties. This raises a question on whether penalties alone are sufficient to produce desired reporting behaviour by farmers. Compensation generates positive incentives to early-report disease and comply with control measures. A broader rationale for epidemic assistance is that economic impacts of livestock epidemic on farm enterprises are typically beyond the capacity of individual farmers to cope with – the argument particularly relevant in the case of subsistence and small farmers. Furthermore, livestock epidemic may endanger not only the economic activity of small holders, but their entire livelihood. Insurance could in principle be an instrument alternative to direct compensation. However, the currently existing insurance schemes in Chile do not cover diseases of high epidemiologic risk and are available only for bovine cattle and sheep. The early experience of these schemes in Chile indicates that both the supply and the uptake of livestock insurance face certain limits, even with substantial subsidy. This instrument is unlikely to expand to cover catastrophic risks.

Thus, the rationale for direct compensation of small livestock holders related to livestock epidemics warrants consideration. Chilean livestock industry stakeholders have previously examined a possibility of introducing compensation in respect to certain diseases, but this did not materialise considering the need for financial resources and also a favourable epidemiological situation. However, as discussed at length in Part 1 and the case studies for Australia and Korea, a good design can reduce the moral hazard associated with the indemnification and make these schemes more cost-effective. This includes appropriate and transparent criteria triggering the assistance and its scope (i.e. types of losses compensated), eligibility conditions, and the valuation of compensation. The underlying funding does not need to be necessarily based on public funds only and can include contributions from industry.

Chilean livestock policy could become more informed and thus more effective through increasing the bottom-up linkages within the national biosecurity system. This concerns at least several areas.

There seems to be little focus in Chile on studying livestock farmer behaviour: their risk perceptions, drivers and constraints to undertaking disease management. A preliminary examination suggests that research related to farmer disease management in general and focussed on farmer behavioural drivers in particular, is lacking. This may be due the overall perception of animal disease in Chile as low economic and social risk. However, such studies are a necessary forward-looking input into policy development, and they may warrant public support through research calls and possible funding. In addition, the regular surveys of livestock producers by the National Institute of Statistics represent a readily existing instrument to be exploited. These surveys could, beyond current topics, inquire about the issues of interest to government related to farmers' disease management.

Increased awareness about producers could help to improve the up-take and the usefulness of official animal disease information. The provision of biosecurity information could benefit from clarifying the needs and preferences expressed by producers and other stakeholders. The government may consider an investigation into the willingness of producers to use external information, their awareness about the existing information channels, which of them are preferred and actually used, and the degree to which farmers find official information relevant and applicable. The government may consider expanding the scope of information beyond the SAG-listed diseases, to also cover those which represent normal production risk, but

may have substantial economic impact on farm enterprises. Furthermore, the information could be diversified to provide evidence about the costs and economic effects of disease on individual farms and rural communities overall. The understanding of potential risks and losses may encourage farmers to prevent and report disease more effectively than formal compulsion. The government could also work together with industry groups to engage them in dissemination of biosecurity information more actively than is the case today.

Increased feedback from producers to government is also required to improve farmer knowledge and skills. The scope of farmer training in livestock disease management and the extent to which they take it up seems to be insufficiently informed. An inquiry developed jointly by the veterinary and sanitary authority, INDAP, and education providers into knowledge and skills gaps of livestock farmers may be warranted to identify critical topics and different target groups to adapt current training programmes. The systematic and adapted farmer training in animal disease management is important given the small share of producers with advanced education amongst livestock holders.

The issue of bottom-up linkages within the national biosecurity system has specific implication when it concerns the small farming segment. INDAP's networks and programmes constitute an active basis for engagement with small farming populations. There is co-operation at regional level between SAG and INDAP to foster disease prevention amongst small farmers and improve their capacity to do so. However, these activities are often informal and driven by the choices and enthusiasm of people working on the ground. These practices deserve some systematic examination which could increase government's awareness, help to identify good local practices that could be applied more broadly, as well as to exploit possible synergies across regions and stakeholders.

Notes

1. This share does not account for the establishments with poultry.
2. In 2016, the individual shares of these companies were: Colún 27%, Soprole 24%, Nestlé 19%, Watt´s 12%, Surlat 6% and Quillayes 2% (ODEPA, 2017b).
3. For example, the survey of marketing channels for cattle and sheep in Chile does not cover units with less than 60 heads of sheep and 10 heads of cattle (INE 2015a; INE 2015b).
4. Several works at the University of Chile also examined biosecurity practices of small farmers raising beef cattle, goat and sheep (Lazcano Hevia, 2010; Vásquez Silva, 2008; Rojas Guajardo, 2012). These studies applied a common method: for the production systems and livestock types under investigation the sets of technical biosecurity measures were defined, i.e. kinds of biosecurity protocols. Sample farms were selected and surveyed about the extent to which they apply these biosecurity measures. The general finding is that surveyed farms practised only a small number of measures out of these biosecurity protocols. This early work by young analysts provides interesting insights into a little-researched topic related to biosecurity practices of small producers, however, it cannot be regarded as a comprehensive assessment of farms' biosecurity status.
5. Rich et al. (2005) indicate that an FMD-free status enables countries to sell products at a 10-50% premium. Furthermore, because it is difficult to distinguish between meat of an infected animal and one with an immune response to FMD vaccination, some countries (e.g. Japan) allow full market access only from sources designated as FMD-free without vaccination.
6. The pig survey covers establishments with at least 40 pigs or 20 sows and which have the necessary infrastructure to develop commercial activity. The poultry survey includes establishments with at

least 150 broilers and (or) laying hens, and which have the necessary infrastructure to develop commercial activity (direct communication from ODEPA).

7. The Agricultural Census includes establishments with the area of annual or permanent crops of at least 0.1 hectare, or with the natural pasture or forest area of at least 0.5 hectares. The Census also includes establishments having at least any of the following: 2 large adult animals; 4 large young animals; 10 small animals; 50 geese, turkeys or rabbits; 100 roosters, hens, broiler chickens, ducks, quail or pheasants; 10 ostriches or emus; or 10 beehives (INE, 2007).

8. These figures do not cover producers keeping less than 60 heads of sheep and less than 10 heads of cattle.

9. In the 1984 FMD outbreak producers received animals for re-stocking as an indemnity, while families in the mountainous regions received subsistence allowance. In the 1987 FMD outbreak, a monetary compensation was provided for destroyed animals, valued at market price (producers with genetically improved animals could receive higher compensation). In the programme for eradication of classical swine fever (1995-98), to achieve total eradication of the pathogen, Chilean Association of Pig Producers (ASPROCER) collaborated with SAG. Animals for restocking were provided to subsistence producers in the north whose animals were culled. Similarly, SAG and ASPROCER worked together on PRRS eradication project – at its final stages, the private sector partner, provided a stock of young animals for breeding. These animals were delivered for repopulation of farms that were subjected to sanitary cleaning, disinfection and depopulation measures.

10. The Unidad de Fomento (UF) – a unit of account used in Chile, equalling approximately USD 40.

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Annex 6.A1

Distribution of farm and animal numbers in Chile by farm land size, 2007

Figure 6.A1.A. Cattle

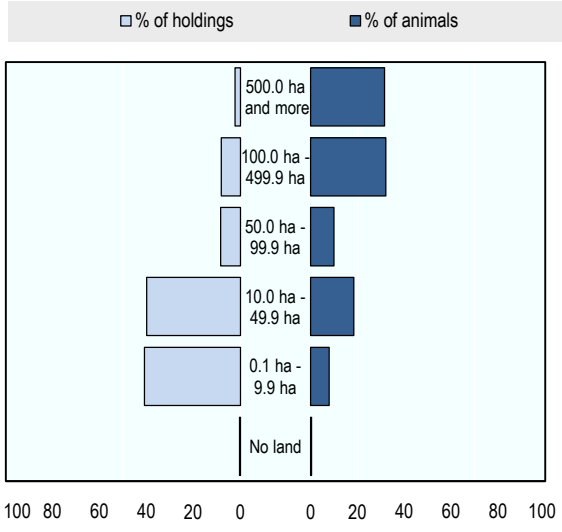


Figure 6.A1.B. Sheep

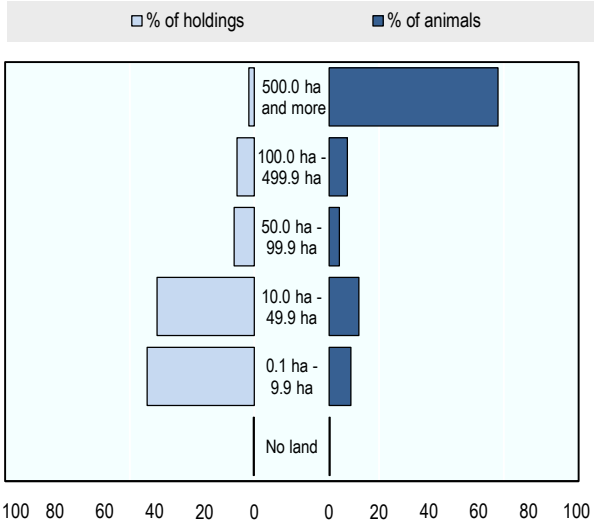


Figure 6.A1.C. Pigs

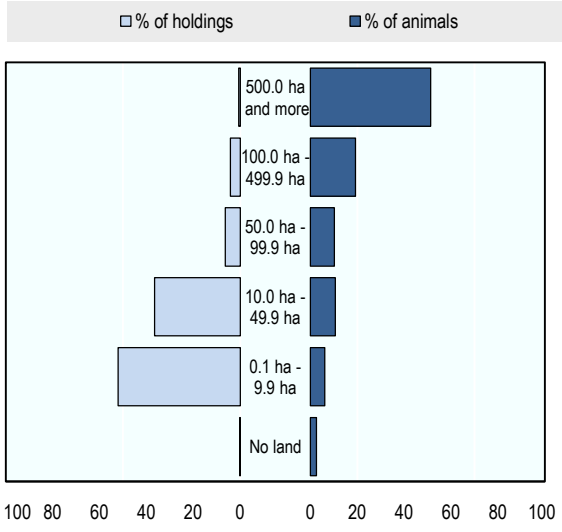
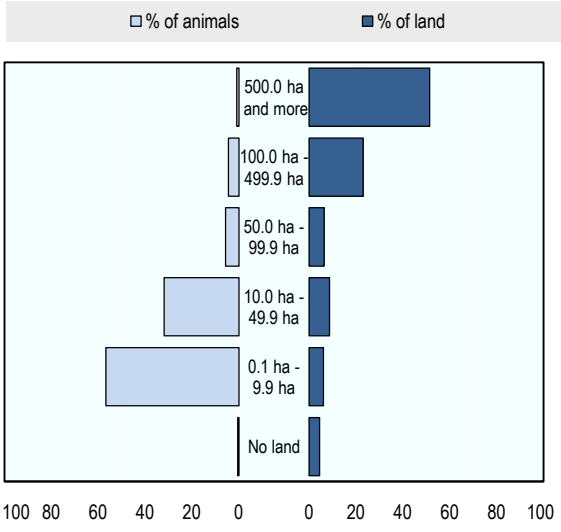


Figure 6.A1.D. Poultry



Source: ODEPA (2017c).

Annex 6.A2

Studies of backyard poultry production systems in Chile

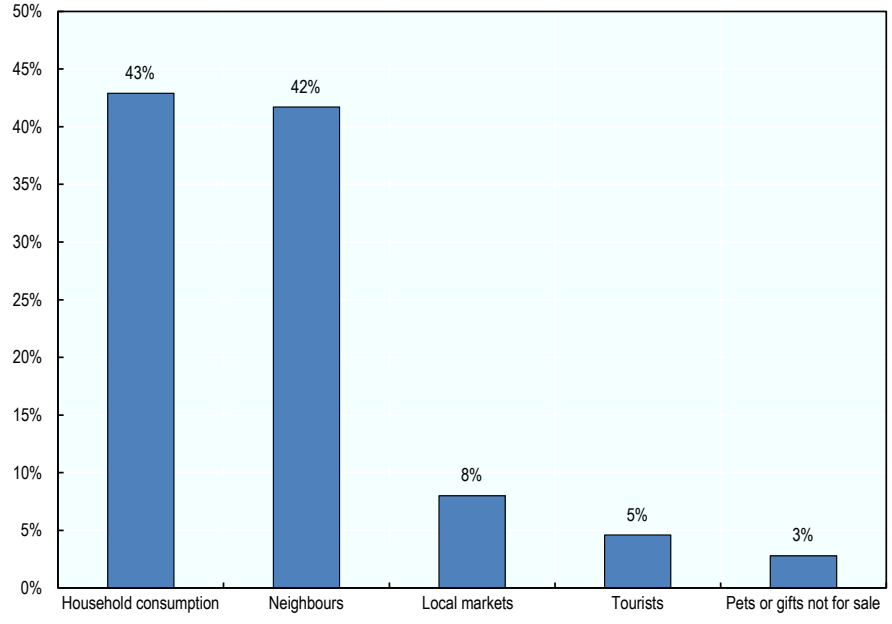
Approximately 95% (2012) of poultry meat production is located in Chile's central zone (Valparaiso, O'Higgins and Metropolitan Region). Seven companies operate in this sector across the full poultry meat value chain exercising high biosecurity standards (Hamilton-West et al., 2012). This zone also concentrates 67% (2015) of the national egg production, but with a larger number of companies engaged in this activity (131 companies) and not all of them covering the full value chain (INE, 2016; Hamilton-West et al., 2012).

Hamilton-West et al. (2007 and 2009) estimated that 14 179 establishments with backyard production systems (further – BPS) existed in Chile's central zone which kept 418 809 birds. This roughly corresponds to below 1% of the national poultry number (FAOSTAT, 2017c).

A subsequent survey identified the main characteristics of these bird keepers, their connection with markets and biosecurity practices (Hamilton-West et al., 2012). This survey included 175 establishments and was conducted between December 2007 and June 2008. The average flock was 37 birds across all locations included in the survey, with domestic chickens representing the most common species kept in 93% of the surveyed units.

Most commonly, BPS farmers produced for own consumption and also sold products to neighbours, with only a small part directed to local markets (Figure 6.A2.1).

Figure 6.A2.1. Marketing channels for backyard poultry production in Chile: Survey results



Source: Hamilton-West et al. (2012).

Almost 90% of surveyed BPS farmers used either free-range or mixed confinement (birds kept free-range during the day and in pens at night). Hamilton-West et al. (2012) note that such keeping systems

increase the probability of contact between poultry of different flocks and between domestic and wild birds. In most of the surveyed BPS (98%) visitors could come into contact with backyard birds and no disinfection procedures were employed prior to entering or leaving a farm.

No BPS farmers had any formal training on disease identification and relied on own experience and knowledge exchange among neighbours. In somewhat less than three-quarters of BPS no health management of any type was performed and no treatment of sick birds or preventive measures. However, most of those who practiced some health management made recourse to veterinarians or health technicians. An official surveillance by veterinary services personnel for detection of exotic disease was carried out in 20% of BPS.

Annex 6.A3

Food safety management system in Chile's pork sector

Official programmes

Livestock Farms Under Official Certification (PABCO, for its acronym in Spanish)

National Pig Health Surveillance Programme (PNVSP, for its acronym in Spanish)

National Pathogen Control Programme

Residue Control Programme for Livestock Products

Integrated Surveillance Programme for Dioxins, Furans, and PCB's

Integrated Inspection Programme and Official Certification from the Agriculture and Livestock Service

Improved biosecurity

Best Practices at Pig Farms

Integrated Traceability System

Water and Ice Sampling at Exportation Slaughterhouses for Pork Products

Best Practices Manual for Animal Welfare for Pigs

Surveillance of Listeria Monocitogenes

Microbiological Control in Products Ready for Consumption

Country specific programmes

Pharmacological – Russian Federation

Microbiological Self-Control in Pork Meat – Russian Federation

Verification of Species for Raw and Cured Meat Products

Microbiological Self-Control – People's Republic of China

Coumaphos Self-Control – People's Republic of China

Salmonella Sampling – Sweden and Finland

Source: ASPROCER, 2017.