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Food Value Chain Coordination in Practice: European and Australian case studies of the creation of chain good innovations

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Abstract:

Food value chain businesses form alliances with horizontal and/or vertical partners to take collective action to either overcome or ameliorate chain failure, or to take advantage of new opportunities available due to innovations in products or processes. The desired outcomes from the collective action would not be possible to achieve if these businesses acted independently. While such alliances may take many forms, depending on degree of commitment and infrastructure linkages, they can often be considered to be clubs. Four mini-case studies are presented which demonstrate the breadth of past collective actions that have been undertaken by a substantial proportion of businesses in food value chains, two in Europe and two in Australia. These are (1) the Euro Pool System, (2) Global Standards certification in Europe and globally, (3) Meat Standards Australia, and (4) the East Gippsland Food Cluster in Australia. Each case study yields insights into the rationale of how businesses in different food value chains in different countries have acted as a club to use their joint resources to internalise positive innovation and coordination externalities that would not have been possible to achieve were these businesses to act independently.

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Introduction

Our motivation in undertaking this review comes from trying to understand the separate and inter-related roles played by two concepts - value chain coordination mechanisms, and research, development and extension (RD&E) investments - in overcoming or ameliorating chain failure and so generating high performance food value chains.

Coordination mechanisms in food value chains

The standard supply chain texts do not place much analytical attention on chain coordination mechanisms per se. The components of the coordination mechanism, the so-called drivers, such as logistics and revenue management, do have analytical frameworks that are able to be optimised, but as yet there is little explicit guidance on how to design and implement a whole-of-chain coordination mechanism that leads to a high performing food value chain.

For example, a commonly cited text, Chopra and Meindl (2013), has one only chapter out of 18 on coordination. Further, it is written in very non-analytical language and contains only generic suggestions about how to achieve better chain coordination – aligning goals and objectives; improving information visibility and accuracy; improving operational performance; designing pricing strategies to stabilise orders; and building strategic partnerships and trust. These suggestions seem self-evident. No case studies are provided (as are in almost every other chapter) and no measures are suggested which might be used to test for example whether an improvement in objective alignment would lead to better coordination.

There needs to be a more explicit focus on chain coordination as a high level objective for well-performing food value chains, instead of as an ill-defined consequence of a collection of lower level actions, and there needs to be a more direct way of deciding when and how to invest in better chain coordination.

Research, development and extension in food value chains

RD&E in agricultural and food industries has long been recognised as having strong public good characteristics (e.g. Pannell and Roberts, 2015), justifying government intervention and funding. Much of this government involvement has taken place at the farm production level in food value chains where these public good characteristics are strongest. Private RD&E has also been prominent, but it has been confined principally to farm input industries such as seed, fertilizer and machinery.

While both public and private RD&E in food industries have received a lot of attention in the literature, a less well covered issue concerns the broader term of innovation. We follow one of the most commonly cited definitions of innovation that adequately conveys its broad nature: “An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.” (OECD, 2005, para. 146).

Innovation is widespread in food value chains where it pays individual businesses to act independently to innovate in a variety of ways. But it also can be analysed to determine whether opportunities are being missed that would lead to higher whole-of-chain surplus by the collective action by businesses in the chain to innovate. While such collective action may take many forms, depending on degree of commitment and infrastructure linkages, they can often be considered to be clubs.

Fleming, Griffith, Mounter and Baker (2018) identified four types of clubs for taking collective action in food value chains: (1) horizontal clubs comprising businesses that take collective action across a single cross-section or an aggregate of multiple cross-sections in the value chain; (2) vertical clubs, which consist of businesses that form a strategic alliance for collective action along a single value chain within a network of chains; (3) clubs that specialise in a single product or multiple products in the value chain; and (4) clubs focusing on a single input/activity or multiple inputs/activities. They concluded that the path to collective action chosen by clubs may vary according to the scope for collaboration among businesses in the chain, particularly in relation to the potential for innovation. By collectively identifying, funding and acting to capture, positive externalities associated with innovation, businesses in many parts of a food value chain can collaborate to widen opportunities to increase chain surplus as well as increase private profits.

Objectives of the review

The overall objective of this review is to examine how issues of chain failure (Fleming et al., 2018; Griffith et al., 2017; Malcom et al., 2017) have been dealt with by chain businesses acting collectively as clubs. The following four mini-case studies demonstrate the breadth of collective actions that have been recently undertaken by a substantial proportion of members of food value chains, two in Europe and two in Australia. These are the Euro Pool System, Global Standards certification in European countries, Meat Standards Australia, and the East Gippsland Food Cluster in Australia.

Each case study yields insights into the subject of how businesses in different industries in a food value chain have acted like a club to use their joint resources to internalise positive innovation externalities that would not have been possible to achieve were these businesses to act independently.

Chain Failure and Chain Goods

Following the discussion in Malcolm et al. (2017), the concept of chain failure is analogous to the concept of market failure that is used widely in the microeconomics literature. Bannock et al. (1984) defined market failure as a “situation in which economic efficiency has not been achieved through imperfections in the market mechanism” (p. 262), where economic efficiency is the “state of the economy in which no one can be made better off without someone being made worse off” (p. 125), commonly known as Pareto optimality.

Chain failure is defined as the situation where a value chain fails to maximise chain surplus because it supplies a suboptimal level of throughput and value (Griffith et al., 2012). An economically efficient value chain is one in which no chain participant can be made better off without another participant being made potentially worse off. It can be determined by ascertaining where chain economic surplus is at a maximum. The degree to which chain economic surplus is less than its potential maximum value shows the extent of chain failure. In principle this can be determined by application of the standard microeconomic concepts of the production possibilities curve and expected iso-revenue curves (Mounter et al., 2016).

Chain failure can occur for many reasons. These reasons do not include things like inefficient logistics (poor transport, processing or storage services), which are simply imperfections in existing markets. Typically, it occurs as a result of the absence in the value chain of processes and services that we call chain goods, which result in chain externalities. These are the cross-functional drivers such as information systems, and grading and certification systems, that allow customer willingness to pay to be more efficiently created, captured and transmitted up and down the chain. Less frequently it may be from the chain bads such as sumptuary goods (cigarettes, fatty foods) that impose social

costs on customers. All these factors create positive and negative chain externalities, such that private values diverge from social values, and/or cause asymmetric information leading to adverse selection, moral hazard and the principal-agent problem. Chain failure can also arise from the many forms of market failure originating from outside the chain.

Club goods and chain goods

From a theoretical point of view the concept of a chain good can be considered as analogous to a club good (Buchanan, 1965; McNutt, 1999; Sandler and Hartley, 2001; Sandler, 2013), where the club comprises all or some members of a value chain. See Fleming et al. (2018) for a detailed discussion.

A club good is a sub-type of a public good, and populates the space between a public good and a private good. McNutt (1999) sees club goods as public goods without non-excludability, while McVitie et al. (2009) note that club goods have private attributes but are rivalrous in use due to congestion.

Sandler and Tschirhart (1980, 1997) and Sandler (2013) document the five decade history and rationale of club theory, demonstrating how its application informs a wide range of collective actions that benefit club members. None of the examples provided in the most recent review of club theory included value chains or anything close to them. Useful insights can be gained about the operations of value chains by considering them as “latent clubs”, that is, systems having the potential for improvement through collective action. Club theory can be used to examine how to increase the surplus of a food value chain using collective action within a club good framework. Such goods are “chain goods”.

Chain goods are those goods and services that enable coordination across partners in a value chain. They resemble the facilitating functions of agricultural markets (Kohls and Uhl, 1980, Chapter 2, 25): “The facilitating functions are those that make possible the smooth performance of the exchange and physical functions. These activities are not directly involved in exchanging title or physically handling products, but without them modern marketing systems would not work. The facilitating services might aptly be called ‘the grease that makes the wheels of the marketing machine go around’”. The four key groupings of facilitating functions are usually categorised as standardisation, financing, risk-bearing, and market intelligence. If these types of services and processes are missing from the value chain, the chain partners cannot make decisions to increase profit of the whole chain. If chain partners see a chance to provide collectively such goods and services, then forming a club that comprises the whole chain or a subset of the chain may be an efficient way to do it.

We now move to the four mini-case studies where we look back at some past investments in value chain coordination mechanisms that have been collectively provided by chain businesses acting as a club.

Euro Pool System

Much of the fresh fruit and vegetables that is grown in the warmer climates of southern Europe is consumed in the high population centres in northern Europe. Logistics has always been important in these value chains. However as the large German and Dutch retailers expanded their operations across borders and offered more variety to their customers, pressure to increase the efficiency of the chain was passed back to the suppliers to these retailers. In 1992 three cooperative auction houses in the Netherlands, Germany and Belgium formed an alliance to improve the logistics of packaging fresh produce for transfer in European value chains of fruits and vegetables. This alliance was named Euro Pool System (EPS). Its business was to provide to its members standardised,

reusable, stackable plastic trays that could be filled “on farm” and used to display produce on supermarket shelves, as well as the associated operational knowledge.

EPS therefore began life as a horizontal club comprising three entities taking collective action across multiple cross-sections in the fresh produce value chain. It was incorporated in 1996, with the auction houses continuing their involvement as shareholders. During the next two decades, EPS has expanded its operations to 50 depots in 27 countries and the range of products using their folding reusable trays has been increased to include fish, meat, baked and convenience products. Annual rotation of trays has expanded rapidly and reached almost 1 billion by 2016 (EPS, 2017).

EPS (2017) emphasises the need for ‘close collaboration among retailers, EPS and other supply chain partners’ and its ‘intensive relationship with clients’ to improve what is a complex and challenging set of conditions in fresh produce value chains. To this end, its system entails a club-like form of collaboration that involves all members of fresh food value chains but which is centred on one activity in these chains – use of the trays. The process begins with fresh food producers and ends with fresh food retailers returning the trays. The provision of trays by EPS is initiated by an order for trays typically by a producer of fruits and vegetables or, increasingly, other fresh produce, who puts down a deposit and pays EPS a rent for each crate – step 1 in an 8-step system described in EPS (2017). The cycle of tray usage is completed in steps 7 and 8 when retailers return empty trays to the EPS service centre, for which they are credited, and the trays are checked and prepared for their next use. EPS offers the option to integrate its service activities into the independent distribution centres of value chain members that use large volumes of trays. This option eliminates the transport of empty crates back to an EPS service centre.

The tray rental is a quasi-membership fee for shared services – termed an entry fee by Pindyck and Rubinfeld (2012) – that is paid by value chain members for participating in the system. It is, in effect, the first part of a two-part tariff system, and is a variable amount because it is charged to all ‘club’ members according to their use of trays. EPS also offers a suite of services to chain members on a fee-for-service basis, the second part of the two-part tariff. Innovation is at the heart of this second part, which covers services ‘such as the handling and consolidation of waste packaging, pallets, displays and unsold product’ (EPS, 2017) and entails the use of state-of-the-art information technologies such as 2D barcode labels on trays. It enables members of the ‘club’ to convert latent demand for services into effective demand by sharing services that otherwise would not have been satisfied, which enhances knowledge throughout the chain thereby expanding the potential for chain improvement and higher surplus.

The benefits of the system as outlined by EPS (2017) are: guaranteed availability of trays and efficient order picking; high levels of cleanliness and hygiene; efficient logistics; CO₂ reduction; and online pool management that enhances members’ control over packaging flows and financial transactions. The blue and green trays provided by EPS, as asserted by EPS (2017), have the advantages over packaging rivals of negligible product loss or damage, easy handling, quick use, greater product capacity, low folded profile, optimal tracking and tracing, perfect stacking with other types of packaging, perfect product presentation in shops, ability to withstand heavy loads, and an estimated 10-year life of trays that are fully recyclable.

A chain failure was overcome by the provision of a chain good through the collective action of relevant value chain partners and the ongoing use of innovations in materials handling and tracking.

Global Standards Certification in European Countries

As the range of goods available to consumers expanded rapidly in the post war period and the recording of transactions moved towards electronic processes, the lack of explicit and unique identification of individual products became more problematic. Value chains were failing. After much debate, in 1973 industry leaders in the US selected a single standard for product identification. This was the barcode. An industry organisation, GS1, was created to administer the standard. A similar debate was occurring in Europe and in 1977 the European Article Numbering Association was formed. In subsequent years EAN became GS1 Europe and then in 1990 the two GS1 organisations merged to form a single standard for product identification in almost 50 countries. Today, GS1 has a presence in over 150 countries (GS1, 2018b).

GS1 is a “neutral, not-for-profit, global organisation that develops and maintains the most widely used supply chain standards system in the world” (GS1, 2018a, 2). It was set up as a club between retailers and supply chain partners. Today in Europe, GS1 is a collaboration of 46 local GS1 organisations, including Russia and many of the countries in the former USSR, Israel and South Africa. Across the globe, GS1 claim they have close to two million user companies with local member organisations in over 110 countries.

The benefits of GS1 are stated to be to “increase the efficiency of your supply chain; ensure fast end-to-end traceability in a cost effective way; reduce spoilage of food; meet the needs of the new consumer; and provide one solution serving various purposes.” (GS1, 2018c, 3).

Again, a two-part tariff arrangement is used. A membership fee based on turnover provides access to the GS1 standards, while individual businesses which need specific solutions pay user charges for that. And again, a chain failure was overcome by the provision of a chain good through the collective action of relevant value chain partners and the ongoing use of innovations in electronics.

Meat Standards Australia¹

Meat Standards Australia (MSA) is a voluntary grading system designed to predict beef eating quality that was introduced in the domestic market in Australia in 1999/2000 (Griffith et al., 2010). The MSA grades are based on the taste panel responses of untrained consumers (Griffith and Thompson, 2012) while the system itself uses a “total quality management approach”, from animal genetics through to cooking method (Polkinghorne et al., 1998; Thompson, 2002).

The rationale for investing in the original RD&E that underpinned the MSA model was that beef consumers in Australia in the early 1990s were turning away from beef because they could not be guaranteed the same eating quality experience they were willing to pay for, each time they purchased beef. Eating quality was subjective and based on vague notions of breed, age and feeding regime, and there was no relationship between consumer preferences, willingness to pay, and the offered quality differentials. Ways of classifying carcasses and therefore ways of describing quality varied across suppliers. Brands were little used at the retail level. There was no objective, uniform system to provide the guarantee that consumers wanted and were willing to pay for.

We now recognise that this was a clear case of chain failure. Recall that chain failure occurs when a value chain fails to maximise chain surplus because it supplies a suboptimal level of throughput and value (Griffith et al., 2012). An economically efficient value chain, where chain economic surplus is at a maximum, is one in which no one chain participant can be made better off without another chain participant being made potentially worse off. The degree to which chain economic surplus is not at its maximum shows the extent of chain failure. Prior to 2000, the Australian fresh beef value chain

¹ The material presented here has been summarised from Mounter et al. (2016).

was not able to deliver the product that consumers' wanted, so chain surplus was less than it could have been.

The solution to the chain failure, the development of MSA, is a chain good. As pointed out by Griffith et al. (2010), Doljanin (2016) and Griffith and Thompson (2012), the value of the MSA scheme is derived at the retail level where consumers are willing to pay premiums for beef cuts that are guaranteed tender (MSA-graded beef) in contrast to ungraded beef marketed through the conventional grid system where minimal inducements are offered for eating quality improvements. The feedback on carcass quality received by registered producers combined with adherence to MSA standards facilitates product consistency in both production and consumption. Thus the MSA scheme is able to create a new source of value by delivering guaranteed quality, and to capture and transmit that value back through the chain. The evidence shows that all participants in the value chain for MSA beef share in the additional value created by the introduction of the MSA scheme (Griffith and Thompson, 2012).

The chain failure resulted from both the absence of a well-functioning beef grading scheme, and asymmetric information leading to perverse economic behaviour known as adverse selection, moral hazard and the principal-agent problem (Pindyck and Rubinfeld, 2012). As well, the investment required to undertake the collection of data in the field and in the processing plant of many thousands of animals and the more than 100,000 consumer taste tests was simply too large to be contemplated by any one business in the beef value chain or even by the whole network. That is, the transactions costs were too high. A strong argument could therefore be made for a public contribution to funding, as outlined by Swann (2003).

East Gippsland Food Cluster in Australia

The East Gippsland Region is located approximately 300 kilometres east of the state capital, Melbourne, in the Australian state of Victoria. The East Gippsland Food Cluster (EGFC) commenced operations in 2011 with eight foundation members which has since grown to around fifty members.

The stated aims of the EGFC (2017) are to: sustainably grow the East Gippsland food sector; explore opportunities to improve productivity through innovation and supply chain synergies amongst members and other regional enterprises; and develop workforce capability to support the sector and promote industry excellence. The EGFC operates on a 'project basis', implementing various projects that are approved by the Board. The majority of projects involve 'strategic alliances with external parties' that are aligned with 'key regional initiatives' and are underpinned by the cluster's 'principles of collaboration and innovation' (EGFC, 2017).

The EGFC is essentially a horizontal alliance (Malcolm et al., 2017) although many members have involvement at different levels of their respective value chains. It is organised as a not-for-profit organisation that is governed by a Board and is financially supported by its members along with funding contributions from local and state governments. Members pay a membership fee and a levy which is determined by the size of the member organisation. It is therefore a club.

'Feast on East Direct' including 'East Gippsland Produce Naturally Good' is an example of an EGFC project with the key objectives of supporting access to new markets; supporting innovation and value-adding across value chains; building more awareness of Eastern Gippsland produce; and supporting efficiency and productivity gains (EGFC, 2017). The project can be likened to an online farmer's market, which provides a direct connection between producers and customers via an ePlatform. Customers purchase a 'basket' of goods online and receive delivery via distribution systems and pick up points. The business model is built around the themes of fresh produce aligned

with sustainable food systems. EGFC highlight that the 'regional produce aggregator' signifies three core principles; Provenance - developing and leveraging a regional brand that is linked to the region's 'clean' & 'green' environment; Process – seamless end-to-end processes that connect suppliers and customers, with a particular emphasis on the use of 'disruptive' online technologies; and People - connecting consumers to the people behind Eastern Gippsland food, and sharing of 'who', 'how' and 'where' food is produced.

Social media and a number of 'Feast on East' events are held in the Gippsland region and in Melbourne where low cost marketing strategies are implemented to assist in raising consumer awareness of the business. The perceived benefits of the project to cluster participants as indicated by EGFC (2015) are: connecting suppliers with the expectations and needs of their customers; efficiencies and economies of scale built into distribution processes, particularly for smaller suppliers; providing market leverage to producers and value-adders instead of them being 'price takers'; and minimising the costs associated with storage through real time order processing.

Whilst the project appeared to achieve some impetus it was not enough momentum to sustain the business in its current form. Feast on East Direct paused operations on 7 June 2017 citing reasons of difficulties in stimulating adequate variety in supply and a lack of sufficient demand. Other EGFC projects however continue.

Concluding Comments

In the four very different case studies presented above it has been shown that value chain businesses have formed clubs to act collectively to achieve specific chain coordination objectives in the industries in which they are engaged. These objectives could not have been achieved by these businesses acting individually. The clubs have been both horizontal and vertical and both input and product focussed. In practice, the concepts of clubs, club goods and chain goods seem to provide a useful framework to analyse how value chain businesses work together to implement innovations and deal with chain failure.

However, the case studies have also shown that these clubs have changed quite markedly over time. Business models and governance models have evolved, and while three of the case study clubs have expanded their operations across regions and across products, the EGFC club has contracted their portfolio of projects.

Some of the differences may be due to the links mentioned earlier between innovation and coordination – certainly GS1 and EuroPool have been able to take advantage of the spectacular advances in electronics to refine the value chain coordination mechanisms they use and to add value to their members.

Some of the differences may also be due to the degree to which the objectives of all club members are aligned. Again, GS1 and EuroPool have a narrow and specific focus on particular value chain inputs – product identification processes, and fresh produce packaging, respectively. Every member of those two clubs is vitally interested in those processes. The EGFC is a much more diverse club. Members undertake their business in the same region, but they are in different industries and at different levels of their value chains. Some of their business objectives may be closely aligned with the EGFC concept, but others may not.

References

Bannock, G., Baxter, R.F. and Davis, E. (1984), *Dictionary of Economics*, 3rd edn, Hutchinson, London.

Buchanan, J.M. (1965), "An economic theory of clubs", *Economica* 32, 1-14.

Chopra, S. and Meindl, P. (2013), *Supply Chain Management: Strategy, Planning and Operation*, 5th edition, Pearson Education, Inc. publishing as Prentice-Hall, Sydney.

Doljanin, I.A., Thompson, J.M., Griffith, G.R. and Fleming, E.M. (2016), "Processes for measuring, communicating and valuing eating quality and saleable meat yield in the Australian beef value chain: current status and future opportunities", *Australasian Agribusiness Perspectives* Paper 113. Available at: http://www.agrifood.info/perspectives/2016/Doljanin_et_al.pdf.

EGFC (East Gippsland Food Cluster) (2017), Downloaded 19 July, 2017 from <http://www.eastgippslandfoodcluster.com.au/>

EPS (Euro Pool System) (2017), Being the standard is only part of our story. Downloaded 15 July 2017 from <http://www.europoolsystem.com/en>

Fleming, E., Griffith, G., Mounter, S. and Baker, D. (2018), "Consciously pursued joint action: Agricultural and food value chains as clubs", paper to be presented at Igls Forum, Austria, February.

Griffith, G., Umberger, W., Gow, H. and Fleming, E. (2012), "What is the role of local governments in new global food markets?", Paper presented at the 6th International European Forum on System Dynamics and Innovation in Food Networks, Innsbruck, Austria, 14-18 February.

Griffith, G., Fleming, E., Mounter, S., Malcolm, B., Umberger, W. and Baker, D. (2017), "Chain failure and chain goods: re-thinking value chain upgrading in developing countries", *International Journal on Food Systems Dynamics* 8(2), 146-154.

Griffith, G.R., Rodgers, H.J., Thompson, J.M. and Dart, C. (2009), "The aggregate economic benefits from the adoption of Meat Standards Australia", *Australasian Agribusiness Review* Volume 17, Paper 5, pp. xx-xx. Available at: http://www.agrifood.info/review/2009/Griffith_et_al.html

Griffith, G.R. and Thompson, J.M. (2012), "The aggregate economic benefits to the Australian beef industry from the adoption of Meat Standards Australia: updated to 2010/11", *Australasian Agribusiness Review* Volume 20, Paper 2, pp. 11-38. Available at: http://www.agrifood.info/review/2012/Griffith_Thompson.html

GS1 (2018), What we do. Downloaded 4 January from <https://www.GS1.org/about/what-we-do>

GS1 (2018), How we got here. Downloaded 4 January from <https://www.GS1.org/about/how-we-got-here>

GS1 (2018), Creating value for the fruit and vegetable sector. Downloaded 4 January from <https://www.GS1.org/about/retail>

Kohls, R. and Uhl, J.N. (1980), *Marketing of Agricultural Products*, 5th Edition, Macmillan Publishing Co., New York.

Malcolm, B. Griffith, G., Fleming, E., Mounter, S., (2017), "Chain failure theory as a framework for evaluating horizontal and vertical strategic alliances among food value chain participants: A red meat industry perspective", *Australian Farm and Business Management Journal* Volume 14, Paper 4, 47-62.

McNutt, P. (1999), "Public goods and club goods", in B. Bouckaert and G. de Geest, (eds), *Encyclopedia of Law and Economics*. Cheltenham, Edward Elgar. Downloaded on 30 May 2011 from: <http://www.scribd.com/doc/239217/0750-Public-Goods-and-Club-Goods>

McVitie, A., Moran, D. and Thomson, S. (2009), A review of the literature on the value of public goods from agriculture and the production impacts of the single farm payment scheme, Research report, Rural Policy Centre, Scottish Agricultural College, Edinburgh. Downloaded 1 October 2013 from: <http://www.scotland.gov.uk/Resource/Doc/278281/0093368.pdf>

Mounter, S., Griffith, G. and Fleming, E. (2016), "Achieving better strategic fits and higher surpluses for Australian beef value chains by recognising and countering chain failure", *Animal Production Science*. Available at: <http://dx.doi.org/10.1071/AN15460>.

OECD (2005), *The Measurement of Scientific and Technological Activities: Guidelines for Collecting and Interpreting Innovation Data: Oslo Manual*, 3rd edition, Working Party of National Experts on Scientific and Technology Indicators, Organisation for Economic Cooperation and Development, Paris.

Pannell, D. and Roberts, A. (2015), *Public Goods and Externalities: Agri-Environmental Policy Measures in Australia*, OECD Food, Agriculture and Fisheries Papers No. 80, Organisation for Economic Cooperation and Development, Paris. <http://dx.doi.org/10.1787/5js08hx1btlw-en>

Pindyck, R.S. and Rubinfeld, D.L. (2012), *Microeconomics*, 8th edition, Pearson Education Inc. publishing as Harlow, Sydney.

Polkinghorne, R., Watson, R., Porter, M., Gee, A., Scott, A. and Thompson, J.M. (1998), "Meat Standards Australia, a 'PACCP' based beef grading scheme for consumers: 1. The use of consumer scores to set grade standards", *Proceedings of the International Congress of Meat Science and Technology* 45, 14-15.

Sandler, T. (2013), "Buchanan clubs", *Constitutional Political Economy* 24(4), 265-284.

Sandler, T. and Hartley, K. (2001), "Economics of alliances: The lessons for collective action", *Journal of Economic Literature*, 39, 869–896.

Sandler, T. and Tschirhart, J.T. (1997), "Club theory: Thirty years later", *Public Choice* 93, 335-355.

Swann, G.S.P. (2003), "Funding basic research: when is public finance preferable to attainable 'club goods' solutions?", in A. Geuna, A.J. Salter and W.E. Steinmuller (eds), *Science and Innovation: Rethinking the Rationales for Funding and Governance*, Ch. 10, Edward Elgar, Cheltenham.

Thompson, J.M. (2002), "Managing meat tenderness", *Meat Science* 62, 295-308.