Cooperative Principles as Constraints for Public Goods Production

NCR-194
Annual Meeting
Dec. 12-13, 2000

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American agricultural cooperatives have a distinguished record in having improved market performance and implementing institutional reforms in many commodity industries. When market or institutional improvements are available to all producers in an industry, whether cooperative members or not, they can be considered public goods for those producers.[1] The role of cooperatives in discovering and generating public goods has not been central to the research agenda. To some extent this topic has been crowded out by the more pressing task of trying to correct operational or structural inefficiencies and deficiencies of cooperatives. (Torgerson *et al*) In part, too, the process of how coordination opportunities are discovered and developed has not been a major subject for economic analysis and modeling.[2]

The theoretical work that stands out as most applicable to farmer cooperatives in regard to generating public goods was Mancur Olson's well-known book from 1965. There have been several subsequent theoretical developments on non-governmental and voluntary production of public goods. Some new directions, in which Olson has been extended and amended, are examined by Sandler. Although Olson's work was initially received as path-breaking, early exceptions were taken with aspects of his theory as it would apply to cooperatives (Torgerson, 1967). But despite theoretical developments that are filling in some gaps, the late Mancur Olson is remembered for having inspired many new directions and developments (Remembering).

In Olson's theory, group or collective maximization is not achieved unless some critical mass of individuals believe that the contributions from each are indispensable, a condition that is rarely met. He believed that in situations of large membership, concerted efforts for group gains would not work without either selective incentives that result in by-product public goods or external regulations for coercing private groups to produce them. The latter approach involves an external constraint, but the potential for internal or voluntary constraints as a mechanism for public goods was not analyzed by Olson. His dissertation adviser had suggested the idea of voluntary group constraints as one avenue

for accomplishing collective action to produce a public good, but in Olson's words, "… it is not the aspect that is central to this study." (Olson, p.93)

The voluntary group constraint aspect has been studied in its applications to governance of common-pool resources (Ostrom). The design principles in that application are voluntary group constraints for addressing a similar type of coordination problem to that of producing public goods. Olson's by-product idea for explaining public goods is relevant to cooperatives, since they are organized for generating returns to members and not for producing public goods. But a by-product mechanism is often insufficient to induce the extent of coordination needed for a public goods innovation without the constraining influence of principles. This paper examines cooperative principles functioning as constraints to induce Pareto improving public goods for producers.

The emergence and adoption of standards or procedures in industries is a type of public good. The early history of cooperatives in grading farm commodities for members demonstrates a mechanism of principles-as-constraints in making provision of this public good feasible. The role of cooperatives in applying, and in some cases, developing grades and standards has received far less attention than their role in the traditional policy issues of price stabilization and protection from monopolistic price discrimination. Admittedly, this example is from a by-gone era, and the importance of grades is declining. New technology is making it possible to more closely design agricultural products to match consumer demands and identify them by brands. Yet, it is not the specific contents of the examples that are important, but how they demonstrate mechanisms where farmers maintain an essential influence on product development and control of how food and natural fibers are to be produced. These mechanisms involve cooperative principles constraining individuals to make decisions in a strategic perspective of maintaining and increasing their specialized skills for production, while avoiding contractual systems that replace such skills.

The purpose of this paper is to consider how efficiencies are gained from producer control in discovering and coordinating group or industry-wide adoptions of certain

actions and procedures. Its purpose is to contribute to the on-going work of determining how cooperative principles and institutional practices can be adapted or reformed for the benefit of members. The use of more completely defined property rights is being proposed and applied to ameliorate many of the negative effects of constraints contained in principles and in institutionalized practices of cooperatives (Condon, Royer, Cook, Iliopoulos). The selected principles examined in this paper are not advocated as being optimal for today's cooperatives, but rather to demonstrate that principles of cooperation can affect industry changes that benefit all producers in a commodity industry.

Principles-as-Constraints

Constraints are pervasive. They are found in our laws, in the design of optimization programs, in biological mechanisms, and in any dynamic process with equilibrium properties. Constraints can have negative or positive impacts or can be conflicting. The constraints of concern in the social sciences occur either by design or spontaneously in markets, market institutions, and in social behavior. In this paper the focus is on principles that constrain choice and their role in cooperatives.

There are various similarities and differences in the way constraints are analyzed and interpreted in economics and in other behavioral sciences. Economists generally reason from the perspective of the individual in making rational choices without principles. In fact, inefficiencies are often analyzed as due to group decisions that prevent further exchange or curtailment of transactions (Lazear). The idea of strategic advantage from principles has been developed in behavioral sciences that specialize in the study of decision-making, including the emerging field of behavioral economics.

A general distinction about constraints is whether they are external or internal for an individual or for a group. Constraints that a national government enforces on its citizens are external, while an individual's personal morality are internal constraints. Neoclassical economics usually involves analysis of external constraints, such as market outcomes of

profit and loss. New institutional economics is likewise oriented toward the analysis of the external, yet its property rights approach combines both external and internal constraints. For example, assets are protected or externally constrained from value dissipating uses by non-owners. But asset owners are internally constrained in their use by virtue of market transferability opportunities.

The study of internal constraints has been more central to the research agenda in behavioral sciences than in economics. Rationality assumptions in economics account in part for this difference. Behavioral economists have shifted the focus to internal constraints or principles as supplements for shortcomings in rational calculation. The tendency of this research has been to focus on decision-making by the individual. The use of internal constraints in both settings, by the individual and by groups, has not developed as an integrated field of study. However, there are notable exceptions to this tendency (Schelling, 1978, 1985, and Elster).[3]

In respect to characteristics of enforcement and adoption, the external and internal constraint distinction can be alternatively considered as involuntary and voluntary. These terms are infrequently used because of the seeming redundancy in referring to constraints as involuntary or as contradictory in saying constraints are voluntary. Yet, making constraints binding while also having flexibility is a central dilemma for individuals and society. In this discussion, involuntary (external) constraints are the common and civil laws of a nation and the market outcomes that such laws protect and enforce. Voluntary (internal) constraints are principles for guiding decisions and actions of individuals and associative groups. Given these distinctions, principles-as-constraints is defined as voluntary restrictions that are sufficiently binding to accomplish goals or satisfy preferences.

Another contrasting aspect of constraints is their role in maintaining stability of preferences over time. As mentioned, property rights offer an internal constraint on an individual's intertemporal preferences by means of market opportunity to transfer ownership. Behavioral economists identify a role for principles, i.e., voluntary

constraints, in situations where benefit-cost calculations are likely to be incorrectly performed due to saliency effects or when preference orderings change over time. For example, principles can prevent preference reversals in period t+1 when a competing preference was not salient in period t (Akerloff, McFadden, Prelec, Thaler). The reversal phenomenon might be operative in the difficulty that many cooperatives have had in sustaining pooling programs (Jermolowicz).

Making constraints binding often complicates how they are to be understood as positive or negative. Our legal system generally rejects an individual's access to this system for the purpose of contractual binding of the self in managing addictions (Schelling, 1985). By contrast, some groups can secure passage of laws that apply constraints only to members of their group (Jaffe). The legal status of some cooperative principles offers the power to bind to some extent (Baarda), but may institutionalize inefficiencies (Royer 1992 and 1999, Iliopoulos) and create special ethical dilemmas for cooperatives (Lasley *et al*). Principles-as-constraints do not always turn out to be positive in later stages of human action. Behavioral economists and social scientists analyze negative impacts from excess adherence or over-commitment to principles (Akerloff, Elster). These negative results are often side effects of the effort to stay committed to principles and make them binding.

Cooperative principles are likely to have negative effects when not connected to accomplishing the goals individuals want achieved, or if they diminish incentives for members to assume an ownership interest in cooperatives. To address industry-wide opportunities and threats, cooperatives and their members may benefit from the coordinating influence of organizational principles. Local organization interests and isolated decision-making by individuals can gradually undermine the type of coordination needed to maintain farming and ranching as autonomous businesses. The term "isolation paradox" is applied to this type of market failure, which can be addressed by means of self-governing principles of cooperation (Randall).

Public Goods in Grading and Standards

Public goods are defined as products or services that involve nonrivalry and nonexcludability in consumption. When applied to a specific group or industry, nonexcludability may or may not involve a free rider problem. There is nothing necessarily "good" in the qualitative sense of the word about public goods. In fact, their provision is motivated by a belief that the market has failed in some capacity. Public goods are usually not free, and in examples such as national defense, it is as if the enormity of the expense is in part what drives this good out of the private and into the government domain. The term "public" refers only to the consumption attributes, and does not refer to their production by a public sector, i.e., government.

In recent years there has been a burgeoning literature on private provision of public goods, inspired in part by Coase's article on the lighthouse (1975). His article was in turn inspired by classical theorists who assumed that lighthouse services are an example of a public good that needs public provision. By investigating British maritime history, Coase discovered that lighthouse services were paid by user-fees for docking at ports. In other words, the excludable service of landing rights at ports were used to assess fees for the nonexcludable service of the lighthouses. It should be noted that given Britain's geographical location, large numbers of foreign vessels used its lighthouses in passing-by and thus avoided having to pay. Coase mentions, but does not emphasize, that government had a role in enforcing the property rights for port fees assessment and the assignment of lighthouse shares. The implications of this government authorization are noteworthy because it restricted competition from ports that might have lowered their fees by not including a charge for the use of lighthouse services (Varian). This direction in the theory of private provision of public goods can be called the "government sanctioning approach," for want of a better term.

Another major direction in private provision of public goods is the formation of associations of users who tax themselves and can exclude non-contributors. This is the direction of Olson, and was developed contemporaneously as the Theory of Club Goods

(Buchanan). Yet, its exclusion capability compromises public goods theory so that one might argue that such goods are strictly "club" in nature. Nevertheless, the theory of club goods is derived from public goods theory. Sandler provides numerous examples, but none of them are any better than the example of New Generation Cooperatives or any closed membership cooperative.

An open membership cooperative is another alternative for private provision of public goods. Part of Olson's typology covers this type of association with the term inclusive collective action. Olson defines an inclusive public good as involving jointness of supply, so that per unit contribution declines and benefits are not dissipated as membership increases (p. 37-38 and footnote 58). It is important to emphasize the difference between inclusiveness in production and consumption of public goods. In many cases an inclusive public good can be consumed by non-contributors, i.e., free riders. Non-contributor consumption may not dissipate benefits but insufficient contribution may prevent a critical mass or threshold participation from being achieved.

Commodity grading for producers has the public goods attributes of nonrivalry and nonexcludability in consumption for producers in an industry. In cases where producer commodity grading systems were started by marketing cooperatives, an Olsonian by-product explains the incentives for initiating this type of public good and its benefit/cost structure would have been inclusive. However, a fairly large proportion of industry producers were needed to supply threshold volumes of commodity grading, where benefits would exceed the costs. There is historical evidence of the workings of cooperative principles in achieving this result.

Every product has its own history of how grades and standards were established. In many cases of cooperative involvement, standards were already established in either the merchant or in wholesale-retail trade, so the public goods dimension was achieved by implementation of testing and sorting for producer commodities. This was the case with cotton and other traditional or staple products. In other commodity industries, especially many of the fruits and nuts from California, cooperatives played a major role in defining

the quality standards. In most cases too, where cooperatives initiated producer-grading systems, these programs were shifted over to government at a later stage.[4]

In the early stages of establishing commodity grades or a system for producer grading, costs can override benefits until a threshold volume is reached where consumer confidence and satisfaction is such that benefits will exceed costs. Producers with grading gradually improve the quality of their output, and hence, the average quality of industry supply. In addition, when quality improvements and sorting increase demand for a product in highly visible markets, there often is a spillover effect of increasing demand in markets that do not pay premiums for quality or for information about quality. For example, a group of producers may increase demand in the snack market for raisins because they adopted a program of grading and sorting. An improved snack market may also stimulate demand for raisins as a baking ingredient, although in the short-run, it may reduce demand due to substitution effects of higher prices. Nevertheless, in the long-run, ingredient markets will consume more and pay higher prices to the benefit of producers who do not grade.

Whether a grade achieves industry-wide adoption or declines, depends not only on the extent of potential value that consumers will have for an improved product, but also on industry coordination to offer enough volume of product with a given set of standards to determine benefit-cost comparisons. One method of industry coordination is a producer marketing cooperative that offers a breakeven volume of graded products and is able to expand to a tipping point for industry-wide adoption.

Different situations in the success or failure of an industry public good such as grading are described using the demonstration method of n-person diagrams (Schelling,1978). The number of producers who adopt grading is presented on the horizontal axis from zero on the left to n on the right (figure1). The vertical axes show rising benefits for all producers that result from increased proportions of those who adopt. Benefits and costs of producer grading are equal at the point where the vertical axes join the horizontal axis. At

Fig. 1 - n-person decisions to adopt grading

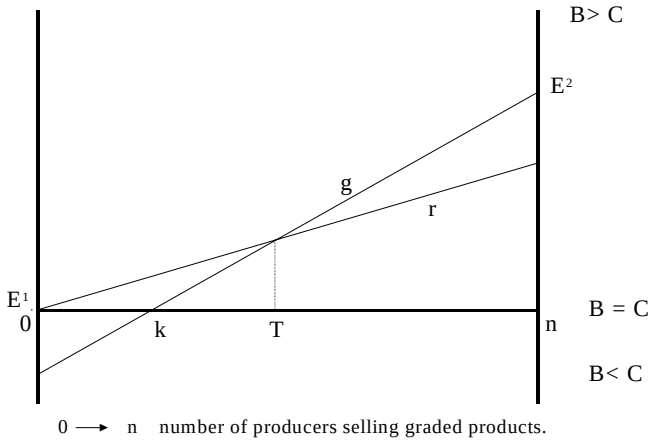


Fig. 2

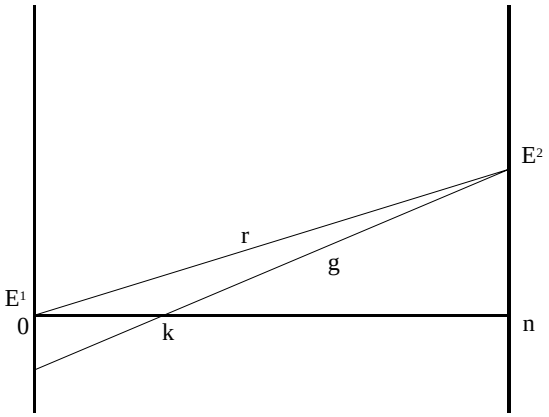
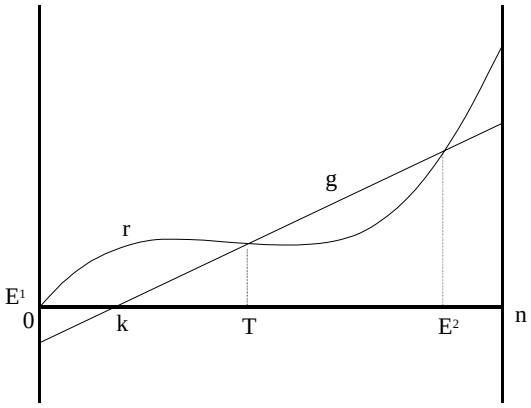


Fig. 3



points below the horizontal axis the costs of producer grading are in excess of benefits. The relative benefits for those who adopt grading are shown by the payoff line labeled g, and for those who avoid grading, the payoff line is r. The r payoff rises as more of the industry adopts grading.[5]

The process of developing an industry public good such as grading begins at "ground zero," identified in figure 1 as equilibrium E^1. Any given number of producers less than k, will not be able to cover costs of grading their products. Forming a cooperative is one way to cover the costs if membership is k in number, the breakeven point for grading. Better yet, if membership can be increased to a tipping point, labeled as T, a self-sustained momentum exists. At T, a small increase or decrease in producers with grading can trigger a cascade, respectively, for more or less participation. Equilibrium for this process is reached at either of the two endpoints, equilibria E^1 and E^2. A cascade for "tipping-in" does not have to be totally carried out by a cooperative. Non-members can negotiate grading arrangements with merchants who normally purchase their products, or an industry association can be established for providing grading services.

Figure 2 shows a process where there is no tipping point. At points beyond k, all producers benefit. Individual incentives are larger throughout for producers who do not grade, as shown by the r payoff above g. This market failure, or what is more accurately an unreachable opportunity, can be changed into a Pareto improvement equilibrium at E^2 if the government requires all producers to have their products graded.

If demand were heterogeneous in commodity qualities, and grading did not measure an attribute that was important to a particular market, then the r payoffs might take a nonlinear shape, as shown in figure 3. The cotton market is an example of heterogeneous demand. A nonlinear r payoff curve makes more than one intersection with the g payoff line possible. The first intersection in moving left to right is a tipping point because the g line cuts the r curve from below. The second intersection of payoff r by payoff g cuts from above, so an equilibrium is reached. If additional producers at E^2 decide to have grading, such action would create incentives for other producers to not want grading.

Principles in Public Goods Mechanisms

The role of cooperatives in developing various producer-grading systems is an example of principles-as-constraints creating necessary conditions for this type of public good.[6] In the early history of agricultural markets, quality differentiation was only determined for the wholesale or retail trade by merchants who sample tested and sorted commodities after purchasing them from farmers. Prices paid to farmers were on the basis of an expected average quality, in what used to be called a hog round price (Reynolds, 1982). When farmers sold their commodities in discrete units such as barrels, bushels or bails, merchants would generally perceive quality differences. Yet, there was no sustainable incentive to grade for the purpose of paying producers in accordance with quality differences. Competition between merchants prevented any one of them from paying according to quality because such a policy would require covering costs by deducting from bid prices. While the merchants as a group could have improved future earnings in the industry by all agreeing to pay farmers for quality differences, they could not overcome collective action problems for that capability.

The collective action problem for merchants to price on a grade basis is applicable to producers as well. They were unable to overcome collective action problems to present a united front in demanding per unit grade-prices as a condition of sale. In the late 19th century cooperatives began to rapidly form on the basis of the Rochdale principles. These principles did not offer any special incentives but only solidarity and hope that their collective efforts would result in an improvement. Nourse regarded the success of the Rochdale principles with some astonishment. He condensed them into three critical elements and observed:

> However incomplete or confused may have been the thought of the Rochdale weavers on these three points or of any subsequent group of cooperators unversed in the lore of economics, the continued adherence of the older bodies and the constant accession of new converts seem to argue that there is in this cooperative

> philosophy some thing which must be reckoned with as a factor in the future evolution of our economic life. (1922, p.578)

Cooperative principles functioned to commit individuals to group marketing activities in a way analogous to the functioning of self-command principles in avoiding or delaying present opportunities in order to satisfy long-term preferences. The early cooperatives are known for collective commodity marketing and purchasing of inputs for purposes of gaining advantageous prices. However, their institutional work in improving production practices, and in standardizing both product handling and quality sorting, is a more durable achievement. These developments are described in the first volume in the history of cooperatives by Joseph Knapp (1969). There is also an important discussion by Nourse about the impact of cooperatives in regard to producer grading. Again, in his words:

> The whole movement for standardization, grading, and the stabilization of production depends primarily on bringing to the worker the best possible understanding of the complete process of which his labors form the initial step. This, co-operation is designed to do (1927, p.17).

At this point in his text, Nourse discusses in a footnote examples of grading systems in cooperative creameries and in cotton cooperatives. The significance of grading is evident in the early state statutes for cooperative incorporation. Sapiro drafted a cooperative incorporation law for California that became widely adopted and known as the "Standard Act." In this context, it is important to note that the Standard Act included member grading as one of the core activities of cooperatives (Baarda).

The constraints of the principles followed by many of the early cooperatives created a mechanism for getting producer grading established. The two principles with constraints most applicable to the development of producer grading are open membership and one member, one vote (OMOV). Although the practice of pooling creates obvious incentives, producer grading can be avoided with relatively homogeneous production for a closed membership pool. Open membership and OMOV were the driving principles for

achieving a k-group and pushing through the tipping points that made producer grading feasible.

Open membership was regarded as an organizational principle in the early history of many U.S. cooperatives. It has never had legal status in state incorporation statutes or in federal laws that define cooperatives, such as Capper-Volstead. It has more applicability to consumer and farm supply cooperatives than to commodity marketing cooperatives (Schaars). The practical need for open membership in many types of cooperatives possibly influenced its wider application. The International Cooperative Alliance has consistently recognized it as a principle.

Open membership accommodates the public goods attribute of nonexcludability. Note that in contemporary cooperatives, open membership is a source of the internal free rider problem (Iliopoulos). For marketing cooperatives in the early 20th century, open membership without member product grading created disincentives for premium quality production. In fact, in the early years when grading methods were relatively more flawed and inaccurate than current methods, there were powerful incentives to organize cooperatives according to homogeneous production conditions (Keen). Yet, when a cooperative imposes the constraint of open membership, incentives are created to improve accuracy of testing methods. In addition, open membership is a constraint that motivated many cooperatives to reduce per unit testing costs by designing assembly line systems and mechanization. In recent history, cotton cooperatives initiated developments in "high volume instrument testing" technology (Sasser *et al*).

The principle of OMOV also provided an important constraint. Many early grading efforts collapsed from conflict and disagreement over standards or on the accuracy of evaluations (Nichols *et al*, Keen). OMOV contributed to a sense of equal control. The OMOV principle also had some binding power by virtue of its inclusion as a criterion in several state incorporation statutes.

A prevalence of proportional voting would have enabled a faction of large producers to control the board. Even though such power may not have allowed a faction to change standards, which may have been externally determined by the wholesale-retail trade, various biases in testing procedures were possible. Perceptions or misperception of bias would destroy necessary trust and integrity of a grading system. In addition, the development of a consensus norm in director decision-making was also a constraint on bias in producer grading systems. The consensus norm is a constraint that is dependent on the OMOV principle (Reynolds, 2000).

The extent of transaction costs in a producer grading system resulted in a process of shifting its administration over to the public sector. This transition of responsibility does not reveal producer grading to be an inappropriate role for cooperatives. A producer grading system was not the type of public good that government would have incentive and capability to effectively initiate. The role of government in food safety inspections is a different set of circumstances. Its role is motivated by public clamor, and safety standards are not defined by as volatile a process as market determined categories of consumer preferences. Many cooperatives maintain testing activity as markets signal new preferences, and technology enables new measurement capabilities. For example, while USDA graded cotton for color and staple length, micronaire measurements were becoming a critical determinant of value. Cooperatives provided members with micronaire tests until such testing was shifted over to the government.

Open membership and OMOV provided constraints for solving the collective action problems in establishing producer grading. This development required increasing proportions of the industry to adopt a uniform set of standards. Cooperative principles helped orchestrate this process and established sufficient trust in the integrity of the grading procedures.

Property Rights with Principles

The ascendancy of a property rights approach is changing the nature of constraints in cooperatives. Many constraints are being relaxed in, or removed from, cooperative practices and principles, such as adherence to open membership. Property rights constraints will reduce free rider and horizon problems, and may limit in the future the amount and range of public goods cooperatives supplied in the past. Such limitation is justified if supplying public goods conflicts with a cooperative's ability to operate with financial solvency, but not if both objectives are feasible.

Defining and identifying public goods is important in determining whether there exists a feasible role for cooperatives. There is a distinction between services that are Pareto improving and those rationalized on the basis of "the-market-will-not-provide" (Stiglitz). The latter services are often subsidized from other activities and may represent Olson's notion of "exploitation of the great by the small." Property rights assignments that provide transferability of equity may help eliminate such cross subsidization in cooperatives. But if property rights are exclusively applied to allocating voting power, they may produce exploitation of the small by the great in providing services "the-market-will-not-provide" (Reynolds 2000).

The development of producer grading systems by cooperatives in the early 20th century is an example of a Pareto improvement that might be applicable, although in radically different forms, to the challenge producers confront today to maintain some control and involvement of their human capital as input in the evolving food and fiber system. The new industrialization of agriculture is gradually rendering the relatively small and independent business of farm production obsolete. In other words, contractual systems and technology are converting independent farmers into laborers or service contract employees. If cooperatives develop an alternative system that maintains farming and ranching as independent businesses, they will have accomplished a Pareto improving public good for those wanting such independence to be preserved.

The prospects for cooperative capacity to help maintain producer autonomy is going to depend on multiple factors, of which achieving a useful blend of property rights and principles is an important one. Property rights will increase incentives for members to invest in cooperatives and constrain them from directing their cooperatives into cross subsidizing services. In contrast, cooperative principles induce industry perspectives and coordinating mechanisms. Achieving a balance in the use of property rights and principles may offer a direction where cooperatives can operate efficiently while not totally abandoning their role in finding Pareto improving public goods.

Steps to improve the application of cooperative principles have been taken by restating them in a way that removes inessential constraints while not compromising the user basis of cooperatives. USDA Cooperative Services provided a restatement in 1987 with three core principles: user-owner, user-control, and user-benefits (Positioning). One of the purposes of this restatement was to clear up confusions, such as the tendency for some members and directors to interpret institutionalized practices as being principles (Dunn). In contrast to Rochdale Principles, this restatement enables more individual assignment of property rights in ways that will induce members to have a longer-term interest in their cooperatives.

The three user principles leave room for discretion on particular and appropriate choices for policies and strategies, but they constrain cooperatives to adhere to the interests of users. The perennial challenge is in achieving a sufficiently unified understanding of goals. Such unity for contemporary cooperatives may emanate from pressures against autonomy of farm and ranch businesses.

Summary

Opportunities for producers to improve their access to markets in terms of value-added or strategic positioning are often accomplished by organizing cooperatives. However, the workings of individual incentives often pose problems for initiating and sustaining

cooperatives. In the tradition of Olson, the collective action problem is solved either by coercion or by market based incentives that enable public goods to be supplied as by-products.

Another direction for solving collective action problems is in the application of group principles. The power of principles to constrain and coordinate individuals often enables group actions to move beyond local maxima for discovery of Pareto improvements. The history of how principles have worked for accomplishing major structural improvements in agricultural markets, such as the initiation of grading, suggests that addressing many of the current challenges for producers may benefit from application of cooperative principles. Restatements and revisions of cooperative principles are enabling applications of property rights to improve individual incentives for organizing and operating cooperatives. Yet, many types of problems in the workings of markets cannot be addressed by furthering the assignment and marketability of property rights without principles that involve some constraints on individual freedom of choice. Principles are increasingly being analyzed in the field of behavioral economics as having a central role in efficient decision-making. These directions have promise for application in cooperative theory.

Notes

[1] The term collective good is often used to distinguish goods that are only relevant for a distinct group, as opposed to the universe of a pure public good. The term "local public good" was considered for this paper, but it applies to the public services offered by separate communities, where in the Tiebout model, citizens vote with their feet or shop around for preferred tax and services tradeoffs. The public goods of interest in this paper result from mechanisms for unified coordination in producer industries, which is in a sense contrary to Tiebout local public goods.

[2] Austrian economics is one exception, where considerable attention is given to market processes of coordination and innovation. For a review of the different strengths and weakness of neoclassical economics and Austrian economics, see article by Rosen. For coordination mechanisms, see the article by Klein that contrasts what he calls Hayek versus Schelling coordination.

[3] Schelling and Elster have developed a tradition of comparing how behavioral mechanisms may operate similarly and differently for an individual and for a group. There are many others doing similar work, but Elster is pushing this field of study by suggesting the need for a theory of constraints.

[4] A survey of the development of grading, primarily from the perspective of the expansion of the government's role is provided by Nichols *et al*.

[5] The intersection of r with the right vertical axis is a feasible point in the perception of an n + 1 producer who is viewing the situation in order to make a decision about grading.

[6] There are several sources for histories of grading in different commodities. For the cooperatives' role, the American Cooperation Yearbooks for the 1920's-1930s are an excellent primary source, that many later histories of grading had unfortunately neglected as references. A section of the 1928 volume II is dedicated to the topic.

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