

## ORIGINAL ARTICLE

# The Influence of Unrestricted Information Exchange on Willingness to Share Information With Outsiders

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*This study addressed how engaging in different forms of information exchange within a group is related to group members' willingness to share risk information with outsiders. Drawing from social exchange theories, we focused on 3 unrestricted forms of information exchange: pure-generalized, group-generalized, and productive. We hypothesized that individuals' intentions to share information with outsiders would be associated positively with engagement in pure or group-generalized exchanges and negatively with productive exchange. The hypotheses were supported with data from a national survey of U.S. growers (N = 452) that examined their information-sharing behaviors with other parties inside and outside their local region. The findings have broad implications for understanding information sharing within and across groups.*

**Keywords:** Information Sharing, Social Exchange, Social Dilemma, Collective Action, Group Boundary.

doi:10.1111/hcre.12104

Extensive research has examined information sharing within teams, organizations, and communities (e.g., see Wang & Noe, 2010). Relatively less research has involved information sharing with outsiders. In comparison to internal information sharing, external sharing can be even more challenging as a result of potential free-riding problems (Hechter, 1988), a lack of trust for cooperation (Cook, Hardin, & Levi, 2005), or in-group favoritism (Tajfel & Turner, 1986). Such reluctance to share externally becomes especially problematic when collective action across groups is needed to manage communal risks, such as water contamination, disease outbreaks, data breaches, or threats of terrorist attacks.

Research in social psychology, sociology, and political science has examined similar issues involving the general concept of social dilemma, in which individual rational choices (i.e., not to cooperate because cooperation involves expenses) can lead to deficiencies at the collective level (for reviews from respective fields, see Kollock, 1998;

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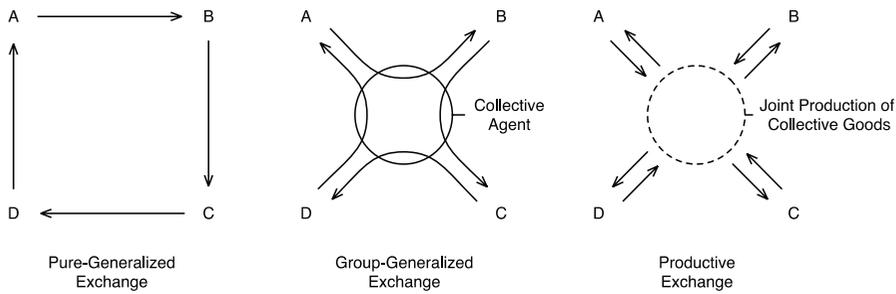
Ostrom, 2014; Van Lange, Joireman, Parks, & Van Dijk, 2013). Scholars have also noticed that, in reality, such dilemmas often entail group boundaries (Van Lange et al., 2013). When boundaries exist that divide a larger social unit into smaller ones, cooperation within and beyond local groups become distinct yet connected phenomena (Lawler, Thye, & Yoon, 2016).

How cooperation within groups influences cross-boundary cooperation is particularly interesting for information sharing because group boundaries can significantly influence people's motivation for sharing. Similar to issues of collective action across boundaries between private and public domains (see Bimber, Flanagin, & Stohl, 2005), that people prefer sharing with in-group members to outsiders is clear; less clear is whether and how information-sharing practices with insiders relate to sharing with outsiders.

In addressing the preceding questions, we focused on the connection between internal communication venues for information sharing and people's willingness to share across group boundaries. Field research has discovered that institutions (e.g., norms) that local people create are often the driving forces behind cooperation involving group boundaries (Ostrom, 1990). We drew from social exchange theories (for reviews, see Cook, Cheshire, Rice, & Nakagawa, 2013; Emerson, 1981) to explore such institutional forces that may link internal and external information sharing. Social exchange theories have long provided the foundation to study structures of payoff interdependence (e.g., Blau, 1964; Thibaut & Kelley, 1959), which is a major factor in cooperative behavior such as sharing information with outsiders. Social exchange theories have also offered a way to study the emergence of institutions (Nee & Paul, 1998), including those that potentially regulate information sharing within and across group boundaries. For example, some scholars have suggested that exchange could enhance solidarity at different levels of analysis, ranging from interpersonal relationships, to groups, to societies (Blau, 1964; Ekeh, 1974). When internal exchange induces greater cooperation, outsiders benefit; however, when exchange induces local cohesion or even in-group favoritism, it may reduce external sharing. A key to this differentiation, according to social exchange theories, lies in the form of exchange that occurred.

Specially, we draw on theories of unrestricted social exchange because while these theories share common conceptual roots with their interpersonal counterparts (e.g., Kelley & Thibaut, 1978), they pay more attention to exchanges that are not restricted to specific dyads. A commonly cited example of unrestricted exchange (i.e., generalized exchange) is that Person A helps Person B change tires alongside a highway, even when A does not know B at all and when A cannot anticipate any direct reciprocation from B. Person A decides to offer his or her help regardless, possibly with the knowledge that, if he or she ends up in Person B's situation, Person C will rise up to help. Such indirect exchanges that are unrestricted by dyadic relationships (e.g., friendships or contracts) are crucial for cross-boundary information sharing.

In this study, we compared three unrestricted forms of social exchange: pure-generalized, group-generalized, and productive (illustrated in Figure 1).



**Figure 1** Forms of unrestricted exchange among actors A, B, C, and D (arbitrarily ordered). (a) Pure-generalized exchange, (b) group-generalized exchange, and (c) productive exchange.

We examined how engagement in these forms of farming information exchanges among local growers is related to their intentions to share information about a particularly virulent crop disease, “late blight,” with parties (i.e., buyers) outside of their geographical region. Because late blight can spread rapidly and cost millions of dollars to agricultural industries, the containment of its spread requires a willingness to share information about its local discovery with not only insiders but outsiders as well. Otherwise, growers will not be able to protect their crops and reduce the redistribution of infected seeds and transplants across regions (Fry et al., 2012). However, because sharing this information with outsiders has few immediate benefits and may even competitively disadvantage local growers, barriers to sharing are high. This dilemma provides a real-world context to examine how unrestricted forms of information exchange, abundant in agricultural communities (see Rogers, 2003), influence the resolution of the tension between sharing information within and beyond a group. We believe our focus on information sharing via different communication venues in this field context complements existing research by exploring how patterns of communication can exert institutional influence on information sharing across group boundaries.

### Social exchange and cooperation at different levels of a social unit

Social exchange theorists note that considerations of exchange, based on dependence of resources among actors, guide human behavior (Blau, 1964; Emerson, 1981; Thibaut & Kelley, 1959). Social structures and exchange practices ostensibly exert mutual influence. On the one hand, social structures, ranging from relationships and small groups (Kelley & Thibaut, 1978; Thibaut & Kelley, 1959) to institutions and culture (Bearman, 1997; Ekeh, 1974), affect exchange practices by influencing who exchanges resources with whom (Emerson, 1981). For example, people are more willing to exchange information with their friends or in-group members because friendship and group membership, as more stable structures of social interaction, induce outcome interdependence among them.

On the other hand, exchange practices can generate and reinforce social structures such as friendships, groups, and networks that support further cooperation. Blau

(1964) observed that although people may initiate an exchange relationship out of self-interest, feelings of obligation, gratitude, trust, friendship, or group identity may also emerge; furthermore the processes can reveal covert common interests and attach intrinsic values to ongoing exchange relationships. Gradually, the exchange relationships can be “crystalized” (e.g., into friendship or group membership, Blau, 1964) and even institutionalized through the reinforcement of informal norms in repeated interactions (Nee & Paul, 1998). As a result, future cooperation can be fostered. When this happens, social exchange can function as an integrative force, not only within local groups but also at a higher level connecting member units. Specifically, Ekeh (1974) stated that the moral principles flowing through “generalized” forms of social exchange can nurture “trust that others will discharge their obligations to the enrichment of society rather than for their exclusive narrow self-interests [and] the willingness to give to others the benefit of the doubt” (p. 59).

In contrast to Ekeh’s (1974) optimism that “generalized” exchange can benefit information sharing across boundaries by having everyone commit to a higher social unit (e.g., society), Blau’s (1964) view of common interests and intrinsic values suggests another possibility: Although information exchange within a group may strengthen within-group cohesion, it may exclude outsiders and create discrete information silos. Below, we discuss in greater depth how various forms of exchange play a critical role in creating such divergent consequences of in-group information exchange.

### **Unrestricted forms of exchange and information sharing with outsiders**

We focus on pure-generalized, group-generalized, and productive exchange because they are unrestricted by dyadic relations (Molm, 2003), which as discussed before, is less relevant to information sharing across group boundaries. Existing research has distinguished three different types of unrestricted exchange. As illustrated in Figure 1, pure-generalized exchange involves a network of indirect exchanges, such as the tire change example discussed earlier. Group-generalized exchange is different in that it entails centralized resource pooling and redistributing (Yamagishi & Cook, 1993), which are often operated by a collective agent in field contexts (Cook et al., 2005). These two generalized forms of exchange are distinguishable from productive exchange in that the latter involves joint activities to produce collective goods, which are not required for pure- or group-generalized exchange (Emerson, 1981). This distinction can induce a fundamental difference in people’s willingness to share with outsiders: As detailed below, various institutional implications of pure- and group-generalized information exchange may promote sharing with outsiders, yet those of productive exchange may curb the sharing.

#### *Pure-generalized exchange*

Early examples of generalized exchange come from anthropological research of the exchange of symbolic gifts or cross-cousin marriages in some societies (Bearman, 1997; Ekeh, 1974), which often resulted in a closed chain (e.g.,  $A \rightarrow B \rightarrow C \rightarrow \dots \rightarrow A$ ;

also see Yamagishi & Cook, 1993). Later research revealed that pure-generalized exchange can have more flexible structures than a closed chain (Takahashi, 2000) and that its defining feature is the *unilateral* and *indirect* flow of resource among individuals (Molm, 2003).

Engagement in pure-generalized information exchange may be associated with a greater willingness to share information with outsiders because it often indicates the existence of some prosocial mechanism that is not too sensitive to the existence of group boundaries. As discussed before, Ekeh (1974) argued that generalized exchanges can take place because certain moral norms are universal across societies (e.g., the norm of reciprocity, Gouldner, 1960). Because these universal moral norms do not discriminate between insiders and outsiders of a particular group, individuals can cooperate with each other even if social groups differentiate them.

Although Ekeh (1974) focused on universal roots and societal implications of generalized exchange, more recent research has suggested that pure-generalized exchange may originate and stay bounded within groups. In their study of pure-generalized behavior, Yamagishi, Cook, and Watabe (1998) noticed that Japanese, who often help strangers out within their own country, do not do so when they are overseas. Putting aside the discussion about the bounded or unbounded nature of pure-generalized exchange, group boundaries for pure-generalized exchange, if they exist, are not impermeable. Research has revealed at least three factors that can help to penetrate such group boundaries. The first is a cultural environment that can function like an institution overseeing individuals' behaviors. Returning to the example above, the cultural environment of Japan may promote pure-generalized exchange across local groups inasmuch as it provides an assurance for trust among people from different subgroups (Yamagishi et al., 1998).

The second factor is the weakened role of group identity. Yamagishi and Kiyonari (2000) determined that although pure-generalized exchange tends to favor in-group members based on social-categorization, this tendency diminished when individuals had opportunities to cooperate repeatedly with others regardless of group identity. This finding suggests that group identification, which is otherwise an important source of in-group favoritism (Tajfel & Turner, 1986), does not always set boundaries for pure-generalized exchange: It can be overridden when exchanges with outsiders repeat or have the possibility of repeating.

The third factor that contributes to penetrating boundaries of pure-generalized exchange is the diffusion of reputation. Takahashi (2000) suggested that although pure-generalized exchanges are likely to originate in groups, a preference for fairness may override group membership as a guiding principle of selecting exchange partners. This preference means that a giver favors a recipient who has a record of benevolent behavior (i.e., a good reputation). Initially, pure-generalized exchange may originate in small groups because the information about reputation is most accessible within such groups. Over time, pure-generalized exchange can emerge across groups as reputation diffuses via overlapping social networks (Takahashi, 2000).

Taken together, the preceding considerations suggest that participants of pure-generalized exchanges in local groups may be less sensitive to the issue of group boundaries and hence become more willing to share information with outsiders. We thus hypothesized:

H1: Engagement in pure-generalized information exchange in one's local group will be positively associated with an individual's willingness to share information with outsiders.

#### *Group-generalized exchange*

Group-generalized exchange can be reduced to resource exchanges between individuals and a collective agent, through which the individuals indirectly exchange with one another (Emerson, 1981). Although lab research presets the pooling–redistributing process (e.g., Yamagishi & Cook, 1993), field examples of group-generalized exchange typically involve interactions with dedicated organizations, such as donating blood to blood banks and food to food drives. Information sharing supported by a centralized information pool, such as a corporate intranet, also resembles this form of exchange (e.g., Cheshire, 2007; Fulk, Heino, Flanagin, Monge, & Bar, 2004).

Having a collective agent facilitates cross-boundary sharing because it can help to align and regulate conflicting interests and, thereby, serve as an institutional alternative to trust (Cook et al., 2005). Typical for sharing beyond one's primary social circles (i.e., families and friends), trust is needed but usually lacking. In such cases, the collective agent can provide organized means to support and facilitate across-boundary information exchange, such as guaranteed anonymity of contributions, specialized usage of the information pool, and active monitoring and sanctioning of conflicts. All these institutional arrangements can help to create a sense of reliability (Cook et al., 2005) that reduces perceived risks in sharing information with outsiders.

A collective agent may also inspire participants with a sense of responsibility for greater goods (Flanagin, Stohl, & Bimber, 2006). Flanagin et al. (2006) observed that many contemporary organizations take an entrepreneurial mode, as an alternative to institutional interventions, to engage individuals. This mode of engagement can promote cross-boundary collective action because it facilitates the development of a sense of entrepreneurial responsibilities for interests at higher levels. When a collective agent serves the same objective across multiple groups (e.g., a national hotline for crop disease reporting and broadcasting), it is especially poised to inspire this sense of responsibility. As a result, its participants may be less likely to differentiate insiders from outsiders.

We proposed that if individuals frequently engage in such group-generalized exchanges of information, they will also be more likely to share information with outsiders, specifically:

H2: Engagement in group-generalized exchange that disseminates information in one's local group via professional institutions will be positively associated with an individual's willingness to share information with outsiders.

*Productive exchange*

According to Emerson (1981), a key difference between productive exchange and the first two forms of generalized exchange is a joint production of collective goods. At first glance, productive exchange resembles group-generalized exchange. The two forms of exchange are actually quite different, however. Although exchanging resources with a collective agent per group-generalized exchange does not require direct collaboration among participants, productive exchange requires joint efforts from the participants to realize the collective goods. For example, a potluck party entails pooling and redistributing foods to all participants. Although a food bank, as a group-generalized exchange, also pools and redistributes foods, its contributors and beneficiaries are typically two different groups of people who do not need to collaborate with one another. In contrast, a potluck party requires participants' joint activities because the party itself is a collective good to be realized.

The joint activities in productive exchange are interesting in that they may result in a negative association between such engagement in exchange and sharing with outsiders. One reason is an emergent sense of groupness attached with intrinsic values. Blau (1964) has suggested that successful exchange in a group can lead to or reinforce the development of intrinsic values attached to the group. Lawler, Thye, and Yoon (2000) demonstrated that a group of strangers could quickly experience a positive affect and attribute it to the group when they succeeded in jointly producing collective goods. Lawler, Thye, and Yoon (2008) further found that this process was most efficient in productive exchange than other forms of exchange. The emergent sense of groupness may reflect processes of social identification (e.g., Tajfel & Turner, 1986). For example, scholars have found group identity can facilitate in-group cooperation (i.e., via depersonalization, Kramer & Brewer, 1984) yet keep individuals from contributing to higher-order collectives (Wit & Kerr, 2002). Group identification may also trigger intergroup competition (Turner, 1975), leading to intergroup conflict (Bornstein & Ben-Yossef, 1994).

Productive exchange occurring in a corporate group may be even more likely to trigger the in-group versus out-group mentality. In such groups, members do not function as individualistic actors but behave as "prescribed by collective mandates that are more or less consensually valid across the membership of the group" (Emerson, 1981, p. 46). Participants in potluck parties are likely to be friends from a same neighborhood, college, or workplace, with their own attendant norms. So too may be growers who live in the same county and who gather to solve the problem of a local crop disease. While a corporate group can elicit support and trust for in-group members, it can also engender communal norms and control mechanisms to monitor and sanction violators (Coleman, 1988; Hechter, 1988). Ekeh (1974) noted that exchange activities that benefit a group as a whole instead of individuals might propagate behavioral guidelines that prioritize collective over individual rights. As a result, individuals may consider sharing information with outsiders as a threat to their local group, and thus something to avoid.

In light of these considerations, we predicted that engagement in productive exchange with insiders can discourage information sharing with outsiders. Specifically:

H3: Engagement in productive information exchange in one's local group will be negatively associated with one's willingness to share information with outsiders.

## Methods

### Sample and data collection

To test our hypotheses, we conducted a national survey with U.S. tomato and potato growers whose crops are particularly vulnerable to late blight (Fry et al., 2012). We contracted with the commercial survey firm MarketProbe™ to conduct computer-assisted telephone interviews and sampled from 8,273 tomato farms and 6,137 potato farms that produced more than one acre of either crop per the United States Department of Agriculture. Targeting 250 respondents for each crop, MarketProbe™ randomly dialed 6,984 telephone numbers with 4,396 valid numbers and 3,027 answered calls. Among answered calls, 1,595 respondents agreed to proceed to a screening question, which verified their actual acreage of tomato or potato production that year. About a third of these respondents (466) were eligible, and ultimately 452 growers (227 tomato and 225 potato) completed the survey. Based on standards of the American Association for Public Opinion Research (American Association for Public Opinion Research, 2008), the cooperation rate was 97%, and the response rate 22.2% (accounting for eligible respondents in unknown cases,  $e = .29$ ).

### Measures

#### *Intention to share with outsiders*

Interviewers asked respondents to indicate the extent to which they agreed with the statement: "If, in the near future my [crop] were infected by late blight, I would share the news with buyers outside of my county or region of my crops" (labeled as OUT in Table 1). Interviewers substituted "tomatoes" or "potatoes," depending on a respondent's larger production reported in the screening question. We chose *outside buyers* as the outsiders in this context not only because they are critical to stop the spread of the disease to different regions (Fry et al., 2012) but also because growers share less dependence and interdependence with remote buyers compared with local stakeholders (e.g., neighboring farms or local buyers). The options ranged from 1 (*strongly disagree*) to 6 (*strongly agree*).

#### *Engagement in local information exchange*

To measure forms of information exchange in agricultural communities, the survey asked respondents to recall their engagement in three situations of farming information exchange (not limited to late blight) with other local growers during the preceding 12 months: *pure-generalized exchange* (PGE) in terms of how often one has "received

**Table 1** Variable Correlations and Descriptive Statistics

	Attitude			Perceived Norm						Perceived Cost			Intention			Exchange		
	ATT <sub>1</sub>	ATT <sub>2</sub>	ATT <sub>3</sub>	PNM <sub>1</sub>	PNM <sub>2</sub>	PNM <sub>3</sub>	PNM <sub>4</sub>	PNM <sub>5</sub>	PNM <sub>6</sub>	CST <sub>1</sub>	CST <sub>2</sub>	CST <sub>3</sub>	OUT	IN	PGE	GGE	PE	
ATT <sub>1</sub>	1																	
ATT <sub>2</sub>	.65	1																
ATT <sub>3</sub>	.62	.61	1															
PNM <sub>1</sub>	.34	.41	.51	1														
PNM <sub>2</sub>	.29	.36	.44	.56	1													
PNM <sub>3</sub>	.42	.48	.55	.56	.59	1												
PNM <sub>4</sub>	.33	.37	.43	.43	.41	.42	1											
PNM <sub>5</sub>	.33	.36	.39	.44	.41	.44	.49	1										
PNM <sub>6</sub>	.43	.47	.50	.46	.50	.49	.57	.48	1									
CST <sub>1</sub>	-.13	-.12	-.11	-.01 <sup>ns</sup>	.05 <sup>ns</sup>	-.06 <sup>ns</sup>	-.08 <sup>ns</sup>	-.02 <sup>ns</sup>	-.07 <sup>ns</sup>	1								
CST <sub>2</sub>	-.11	-.03 <sup>ns</sup>	-.15	-.04 <sup>ns</sup>	.06 <sup>ns</sup>	-.07 <sup>ns</sup>	-.09	-.11	-.14	.54	1							
CST <sub>3</sub>	-.35	-.28	-.30	-.14	-.10	-.22	-.16	-.23	-.20	.32	.30	1						
OUT	.27	.25	.21	.23	.31	.25	.17	.13	.25	.09 <sup>ns</sup>	.06 <sup>ns</sup>	.01 <sup>ns</sup>	1					
IN	.27	.29	.27	.31	.33	.36	.23	.18	.29	.15	.12	.00 <sup>ns</sup>	.52	1				
PGE	.06 <sup>ns</sup>	.12	.09 <sup>ns</sup>	.04 <sup>ns</sup>	.02 <sup>ns</sup>	.02 <sup>ns</sup>	.04 <sup>ns</sup>	.03 <sup>ns</sup>	.07 <sup>ns</sup>	.05 <sup>ns</sup>	.05 <sup>ns</sup>	-.01 <sup>ns</sup>	.16	.09 <sup>ns</sup>	1			
GGE	.19	.21	.21	.11	.17	.16	.16	.19	.21	-.01 <sup>ns</sup>	.01 <sup>ns</sup>	.01 <sup>ns</sup>	.22	.17	.29	1		
PE	.17	.21	.20	.17	.21	.19	.14	.19	.16	-.02 <sup>ns</sup>	-.01 <sup>ns</sup>	-.01 <sup>ns</sup>	.08 <sup>ns</sup>	.14	.22	.46	1	
M	4.47	4.51	4.70	4.87	4.79	4.82	4.72	4.73	4.51	4.18	4.02	2.63	3.91	4.68	0.14	0.91	1.49	
SD	1.56	1.57	1.23	0.93	1.21	1.18	1.07	1.13	1.32	1.99	2.19	1.72	2.49	1.65	5.97	4.33	2.80	
Skewness	-1.10	-1.16	-1.44	-1.66	-1.79	-1.80	-1.59	-1.60	-1.20	-0.72	-0.58	1.03	-0.40	-1.42	0.31	-0.34	-0.78	
Kurtosis	0.35	0.44	1.85	3.48	3.06	3.19	2.57	2.72	0.69	-0.88	-1.08	0.05	-1.31	1.29	-1.21	-0.46	1.45	
N	436	437	445	440	447	448	441	438	433	441	432	444	439	445	452	452	452	

ATT = attitude; PNM = perceived norm; CST = perceived cost; OUT = intention to share with outside buyers; IN = intention to share with inside buyers; PGE = pure-generalized exchange; GGE = group-generalized exchange; PE = productive exchange. PGE, GGE, and PE were log-transformed; ns = nonsignificant ( $p > .05$ ).

Note. Factor correlations estimated from the corrected CFA are listed in blocks in the matrix upper triangle. N varies due to missing values.

farming information from local farmers to whom you do not give information” (i.e., engaging in unilateral, indirect exchange); *group-generalized exchange* (GGE) as how often one has “shared or reported farming information directly to organizations that help to disseminate this kind of information to local farmers” (i.e., sharing via collective agents); and *productive exchange* (PE) in reference to the frequency with which one “participated in meetings or events where you and other local farmers shared information or jointly worked on common problems you face” (i.e., sharing through joint activities). Because recalling the above events within a year likely trigger respondents’ nonenumeration estimations, the interviewer provided helpful references to facilitate such estimations by repeating six options after each question: “never,” “several times a year,” “several times per season,” “several times per month,” “several times per week,” and “every day” (see Conrad, Brown, & Cashman, 1998). Because these ordinal options are not normally distributed as required by linear models, we recoded them roughly into an interval scale representing *times per year* (see a similar strategy for recoding religious attendance in General Social Survey, Brashears, 2010). We first coded “never” and “every day” as 0 and 365 times per year to represent the end points of the scale. Then, we coded “several times per season,” “several times per month,” and “several times per week” as 8, 32, and 209 times per year, respectively. The three values are rounded middle points in-between 4, 12, 52, 365 times per year, which are the numerical representations of the four semantic anchors (i.e., once a season, once a month, once a week, and everyday). “Several times a year” was coded as 4 (i.e., the middle point between 0 and 8). The variables were later log-transformed to reduce skewness.

#### *Measures for covariate adjustment*

Previous work has identified the following individual reasoning factors that may affect information sharing, including perceived cost, benefit, and social pressure (e.g., Fulk et al., 2004; Wang & Noe, 2010). Because these factors could be common causes of intentions to share information both inside and outside a local community (Fishbein & Ajzen, 2011), they can induce noncausal associations in addition to our hypothesized ones and thus should be controlled (see Pearl, 2000).

Specifically, *attitude* measures the perceived benefits of sharing and was captured with three items asking whether respondents agreed that sharing information with others about late blight detected in their farms would be “good,” “useful,” or “a wise move” (ATT1-3; Cronbach’  $\alpha = .84$ ). *Perceived cost* was measured by agreement with three items: (a) “I may lose business” or (b) “be disadvantaged to other farmers if buyers know my farm has been infected” by the crop disease, and (c) a general statement that sharing this risk information would be “harmful” (CST1-3;  $\alpha = .65$ ). *Perceived norm* includes both injunctive and descriptive norms (Fishbein & Ajzen, 2011, p. 131). Measures of injunctive norm included: (a) “most growers in my county or region” think the aforementioned risk information “should be shared,” (b) “I would be expected” to share the information, and (c) “I would feel obligated” to share (PNRM1-3;  $\alpha = .80$ ). Measures of descriptive norm included: (a) “many growers in my county or

region” would share this information, (b) “growers whose opinions I value” would share this information, and (c) “growers who are important to me” would share this information (PNRM4-6;  $\alpha = .76$ ). For each of these variables, we used a six-item scale, ranged from strongly disagree (1) to strongly agree (6).

#### *Validity check*

To corroborate hypothesis tests, we examined respondents’ agreement with the following: “If, in the near future my [crop] were infected by late blight, I would share the news with buyers *inside* my county or region of my crops.” The term “inside” is the only difference from the measure for sharing with outsiders. Because local growers often share a greater extent of interdependence with inside buyers, juxtaposing intentions to share with both groups of buyers can help to assess the validity of the rationales behind our hypotheses, which are supposed to uniquely apply to sharing with outsiders, instead of insiders or both.

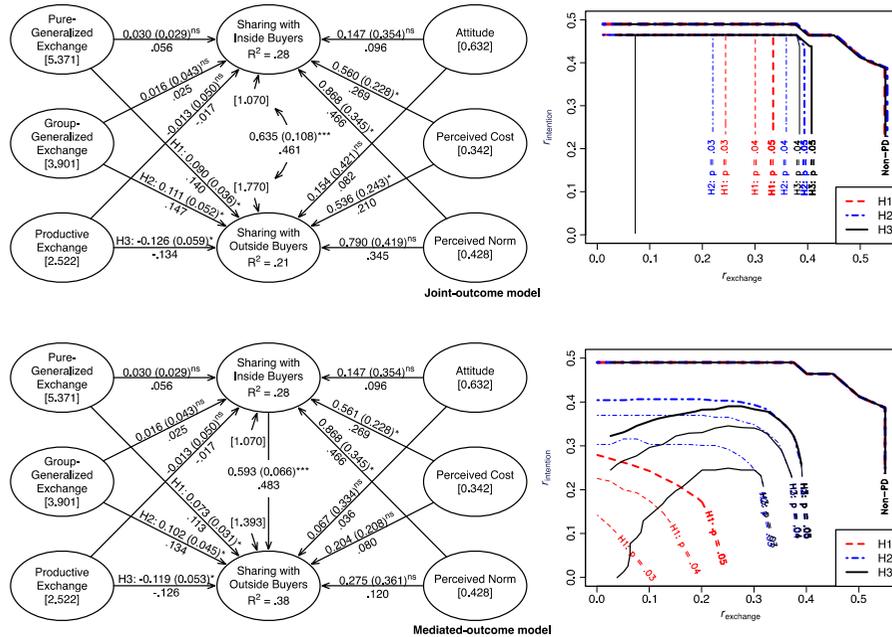
#### **Analytical procedure**

We used structural equation modeling (SEM) to analyze the data instead of ordinary linear regressions for two reasons. First, intentions to share with inside and outside buyers should be jointly modeled to compare effects of information exchange activities and to account for within-subject interdependence (e.g., a respondent may report similar degrees of willingness to share with different recipients). Second, SEM accounts for covariates’ measurement errors and their correlations and can also assess our hypothesis tests’ sensitivities to measurement errors that might have contaminated the single-item measures central to our hypotheses.

#### *Model specification*

Following a two-step procedure (Kline, 2016), we started with a confirmatory factor analysis (CFA) per the designed measurement structure. Descriptive and injunctive norms equally loaded on a second-order factor of perceived norm. Single-item measures were specified as single-indicator factors, with loading fixed at 1 and measurement error fixed at 10% observed variance (i.e., a .9 coefficient of reliability in a 0 to 1 range; Kline, 2016). Together, this *initial CFA model* includes 75 free parameters with  $df = 95$ . Then, we freed justifiable residual correlations to a *corrected CFA model* as the basis for our hypothesis tests.

Two equivalent structural regression models were specified for hypothesis tests (see Figure 2). A *joint-outcome model* correlated residuals of the intentions to share with outside and inside buyers, allowing the two intentions to be jointly affected by unobserved within-subject variables. Effects of exchange on one intention, however, cannot transfer to the other via this correlation. A *mediated-outcome model* allowed the intention to share with inside buyers to mediate the effects of information exchanges on sharing with outside buyers. This model served as a statistical assessment to rule out an alternative possibility, as detailed in the Result section.



**Figure 2** Structural regressions (left column) and sensitivity analyses (right column). In path diagrams, SEs are parenthesized, variances are bracketed, standardized coefficients are labeled beneath paths, and covariances between exogenous variables are omitted for clarity. For sensitivity analysis, contours denote  $p$ -values of hypothesis tests at various proportions (0–1) of measurement errors. Regions beyond the thickest contours are nonpositive-definite estimations.

*Model estimation and fit criteria*

Given a relatively small volume of missing data (0–4.42% across variables and 0–7.52% across covariances), we assumed these data are missing at random (MAR) and estimated models based on full-information maximum likelihood with all unused measures included as auxiliary variables to explain the missing patterns (Collins, Schafer, & Kam, 2001). To account for nonnormality suggested by univariate skewness and kurtosis (see Table 1), we estimated robust standard errors and scaled  $\chi^2$  statistics using the MLR estimator implemented by *Mplus 7*. We retained models that satisfied these criteria: (a) The model  $\chi^2$  is nonsignificant ( $p > .05$ ), (b) RMSEA  $< .05$  with a 90% confidence interval (CI) within  $[\.00, \.10]$  and a nonsignificant test of close-fit ( $H_0: \text{RMSEA} \leq .05$ ), (c) CFI  $> .95$ , and (d) SRMR  $< .10$  (Kline, 2016). Our sample size ( $N = 452$ ) was more than five times the number of parameters and, thus, satisfied the minimum requirement for estimation (Bentler & Chou, 1987).

*Sensitivity analysis*

Because single-item measures had unknown reliability, we simulated how varying reliabilities of these measures could affect hypothesis tests (suggested by Kline, 2016).

Specifically, we jointly varied the measurement errors of the three forms of exchange (denoted as  $r_{\text{exchange}}$  in Figure 2) and the intentions to share (denoted as  $r_{\text{intention}}$ ).

## Results

### Measurement models

The initial CFA model did not fit the data well as  $\chi^2(95) = 161.63$  ( $p < .001$ ). Iterative inspections of modification indices suggested five pairs of correlated measurement errors—all from measures of attitude and perceived cost. We considered the correlated errors for the same factor justifiable in view of potential method effects induced by similar phrasing. We also considered residual correlations between attitude and perceived cost justifiable because the two constructs were also similarly phrased and might have shared a common cause as being both attitudinal evaluations (see Fishbein & Ajzen, 2011, Chapter 3). Iteratively freeing these correlations improved the model fit by  $\chi^2(5) = 45.53$ ,  $p < .001$ . This corrected CFA model fit the data well with  $\chi^2(90) = 105.38$  ( $p = .128$ ), RMSEA = .02 in 90% CI [.00, .03] with the test of close-fit accepted ( $p = 1.000$ ), CFI = .99, and SRMR = .05.

In terms of discriminant validity, all factor correlations ranged from  $-.48$  to  $.58$ , except for that between attitude and perceived norm (.85; see Table 1), which suggested adequate validity. We considered the factor correlation between attitude and perceived norm justifiable, inasmuch as the two constructs have been recognized as often moderately to highly correlated (Park, 2000). Combining them also worsened the model fit by  $\chi^2(1) = 20.12$  ( $p < .001$ ), indicating that it is better to keep the two constructs apart.

### Hypothesis tests

To review, we hypothesized that the willingness to share information with outsiders would be positively associated with frequencies of engagement in pure and group-generalized information exchanges (H1 and H2) and negatively associated with productive information exchange (H3). To test the hypotheses, we estimated two models (see Figure 2) that are mathematically equivalent to the corrected CFA model and, thus, they fit data identically. The joint-outcome model assumes that the intention to share with outside buyers was interdependent from that with inside buyers. On the basis of this model, engagement in pure-generalized information exchange was positively associated with the intention to share information with outside buyers ( $0.09$ ,  $SE = 0.04$ ,  $p = .012$ ), which supported H1. Engagement in group-generalized exchange was also positively associated with this intention ( $0.11$ ,  $SE = 0.05$ ,  $p = .031$ ), which provides support to H2. In contrast, we found a negative association between engagement in productive exchange and the intention to share information with outside buyers ( $-0.13$ ,  $SE = .06$ ,  $p = .031$ ), supporting H3. The above associations were nonsignificant ( $ps \geq .306$ ), however, when inside buyers instead of outside buyers were the target of sharing, which was consistent with our arguments that the differential effects of forms of information exchange are related to group boundaries.

### *Alternative model*

Because statistically, multiple models can fit the data equally well in SEM analysis, it is recommended to assess alternative models to rule out different patterns of relationships among variables (Kline, 2016). Hence, we tested a mediated-outcome model as a likely alternative, which assumes that our respondents were willing to share with outside buyers *because* they were also willing to share with inside buyers. Theoretically, this alternative model could not be deduced upfront, however, because we could not find sufficient theoretical support for the first stage of the mediation model, that is, how the three forms of exchanges could influence intention to share with insiders. Hence, we ran this alternative model purely for the purpose of ruling out alternative empirical explanations.

Were the alternative model true, conditioning on the mediator would significantly reduce the magnitude of the hypothesized effects. However, the hypothesized effects remained significant. Specifically, engaging in pure- and group-generalized information exchange activities were still positively associated with the intention to share with outside buyers ( $p = .019$  and  $.023$ ) with slightly smaller estimates (see Figure 2). Engaging in group-generalized exchange was still negatively associated with the sharing intention ( $p = .024$ ) despite a slight reduction in estimate by  $.001$ . To conclude, the mediated-outcome model could not challenge the conclusions of hypothesis tests based on the joint-outcome model.

### *Sensitivity analysis*

The results reported were based on the assumed 10% of measurement error in both measures of information exchange and sharing intentions. To assess our hypothesis tests' sensitivities to measurement error, we varied these errors until model estimates became nonpositive definite. Figure 2 shows that our hypothesis tests based on the joint-outcome model were robust against measurement errors in measures of the sharing intentions because all test results remained statistically significant ( $p < .05$ ) when these errors were below 45%, which is close to the empirical upper bound (49%). These tests were also moderately robust against measurement errors of information exchange activities because tests of H1, H2, and H3 could tolerate about 33, 39, and 40% errors in measurement, respectively, which were all above the half (i.e., 22.5%) of the upper bound (55%) on this dimension.

## **Discussion**

Information sharing with both insiders and outsiders is vital for cooperation across group boundaries, as in the case of managing communal risks like a highly contagious crop disease. Using a national sample of tomato and potato growers, we compared three forms of exchange—pure-generalized, group-generalized, and productive—to assess how these exchange structures were associated with individuals' willingness to communicate with individuals outside of their region should their farms contract an infectious crop disease, "late blight." As hypothesized (H1 and H2), engagements in

pure- and group-generalized information exchanges were positively associated with growers' intentions to share with outsiders, whereas engagement in productive information exchange was negatively associated with such intentions (H3).

### **Theoretical implications**

The implications of our study are threefold. First, the results suggest the importance of considering both group boundaries and forms of exchange when studying information sharing. We demonstrated that information sharing within and beyond a group were connected phenomena and, additionally, the form of information exchange can alter the connection. The findings were consistent with studies on online information sharing and other cooperative behaviors (e.g., Cheshire, 2007; Fulk et al., 2004; Sohn & Leckenby, 2007; Willer, Flynn, & Zak, 2012). In these studies, the predesigned unrestricted exchange in an information system (e.g., corporate database or virtual community) promoted cooperation within the system. It is possible that unrestricted exchange, especially generalized exchange, in such a system helped to overcome the boundaries between not only private and collective interests (Bimber et al., 2005) but also local groups inside a system; however, the latter type of boundaries was often not explicitly examined in previous studies. In comparison, our findings suggested that when taking into account local group boundaries, unrestricted information exchange does not consistently promote information sharing, especially when cooperation across group boundaries is needed. A decreased willingness to share was most likely to occur when information exchange involved joint activities, which may induce a sense of local group-ness and, thus, restrict information flow.

In addition, our study indicated unique roles played by social exchange structures beyond individual reasoning. Previous work has demonstrated the importance of cost-and-benefit concerns behind information sharing. Social exchange, especially those in unrestricted forms, received less attention. This might be accountable to the fact in many studies of information sharing (e.g., those in firms, work teams, or virtual communities), unrestricted exchange is often the constant, overarching context per se, which may be less salient to internal sharing. As a result, information sharing may rely more on perceived cost and benefit (e.g., Fulk et al., 2004). This was also true with our data: When sharing with inside buyers (i.e., stakeholders in a local farming community), growers' concerns for economic cost and social pressure, held more weight than engagement in information exchange (see Figure 2). However, the weight of individual reasoning versus engagement in unrestricted information exchange transposed when growers were asked about their willingness to share with outside buyers. Together, our findings suggested that the differential influences of unrestricted information exchange can have parallel effects on individual reasoning of costs and benefits, especially when group boundaries are considered.

Finally, our study explored the role of communication in social dilemmas involving group boundaries. Research in other disciplines has provided insights into the psychological (e.g., social identification; Bornstein & Ben-Yossef, 1994; Wit & Kerr, 2002) and institutional (e.g., local social norms, Ostrom, 1990) forces behind such

dilemmas. Such previous research also acknowledged the role of communication (e.g., as conduits of payoff information or triggers of informal norms; see Ostrom, 2014; Van Lange et al., 2013). Our findings suggested that the role of communication in social dilemmas can be also revealed by directly examining different communication venues through which people share information. As Cooren (2012) pointed out, any efforts to understand systemic effects of patterns of social actions, such as institutions that regulate social dilemmas, “need to show where this systematicity is coming from without ever leaving ground level, the *terra firma* [sic] of interaction” (p. 9). With the help of social exchange theories, we demonstrated the possibility to explain the systemic link between internal and external information sharing by the very patterns of sharing practices among insiders.

### **Practical implications**

Our findings also have implications for risk communication about crop diseases among growers. The most important message is that communication efforts should balance cooperation within and beyond a local community. Within a local community, it makes sense to focus on how growers evaluate the costs and benefits of sharing risk information to promote sharing among stakeholders. Engagement in unrestricted information exchange appeared to be less relevant in this local situation. On the other hand, if the goal is to encourage cooperation across regions, communication practitioners should be aware of the effects of different forms of unrestricted information exchange. When the objective is to prevent a disease from spreading across regions, communication efforts might emphasize pure-generalized exchange (per H1). Nationwide institutions serving and/or supervising information sharing may also promote cross-boundary information sharing (per H2). In contrast, although informal gathering and problem solving among insiders may promote local solidarity, it may also inhibit willingness to cooperate with growers outside a given region (per H3). This inhibition could compromise efforts seeking to manage the spread of a crop disease through broad scale communication about its existence.

### **Limitations and future directions**

Our study had several limitations. First, the cross-sectional data cannot confirm causality underlying the hypothesized associations. It is possible that given the mutual relationship between social structure and exchange practice emphasized by social exchange theorists, the causal directions may go either way. Second, although we tried several means to establish validity and reliability, the quality of the single-item measures of unrestricted information exchange, is unknown. This issue arose partly because previous social exchange research predominantly used lab manipulations and lacked survey measures for different forms of exchange (Cook et al., 2013). Although we conducted a series of post-hoc sensitivity analyses to examine the robustness of our hypothesis tests against measurement errors, future research should explore better measures in uncontrolled, field settings. Third, we chose to focus only on the differential associations between forms of exchange and

the intention to share information. We did not directly study micromechanisms of these associations.

These limitations suggest the following directions for future studies. First, in respect to methods, future field research may try to identify the causal links between unrestricted information exchange and information sharing (e.g., using field experiments). Longitudinal studies of multiple communities can facilitate causal inference as well. Field measurements should include more comprehensive measures of unrestricted exchange. For example, the current study measured each form of the unrestricted exchange from either the giver or the receiver's perspective, depending on whose perspective gives the most conservative estimate of the relationship. Future research can nevertheless include measurements from both the information giver and receiver's perspectives for result corroboration. Second, future work should pay additional attention to group structures in information sharing, especially links between sharing within and beyond local group boundaries. It would be of value to examine in field contexts how individuals recognize and reconcile their multiple, nested affiliations to social groups (Lawler et al., 2016), as well as how they share information across these groups. Finally, we suggest future information sharing research consider micromechanisms that account for the differential consequences of exchange structures on cooperation. Possible topics include the role of individual reasoning per the reasoned action approach (Fishbein & Ajzen, 2011), individual preferences (e.g., fairness, Takahashi, 2000), and emergent properties of social exchange *per se* (e.g., a sense of reliability based on institution; Cook et al., 2005; and affective commitments in productive exchange and pure-generalized exchange, Lawler et al., 2008; Molm, Collett, & Schaefer, 2007). The psychology of social dilemmas involving multiple groups also deserves attention (e.g., intergroup competition, Bornstein & Ben-Yossef, 1994; ingroup favoritism, Kramer & Brewer, 1984; and identity salience in nested groups, Wit & Kerr, 2002) and should be integrated in future work on structural and institutional processes of information sharing.

## Conclusions

This study addressed how information sharing practices inside a community relate to group members' intentions to share local information with outsiders. Our findings revealed that connections between sharing with insiders and with outsiders were contingent on forms of information exchange adopted in local groups. We believe such connections offer insight into information sharing in many situations when social groups intersect with each other, which is a typical scenario in our increasingly connected and globalized societies.

## Acknowledgments

The study used a subset of data from a larger survey project, in which a different subset was published in the following paper: Liao, W., Yuan, Y. C., & McComas, K. A.

(in press). Communal risk information sharing: Motivations behind voluntary information sharing for reducing interdependent risks in a community. *Communication Research*. Funding for this research was provided by USDA NIFA AFRI 2011- 68004-30154. The authors thank Edward J. Lawler, The ILR School, Cornell University, for helpful discussions about social exchange.

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