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Trust, Confidence, Procedural Fairness, Outcome Fairness, Moral Conviction, and the Acceptance of GM Field Experiments

Michael Siegrist,[1,*] Melanie Connor,[1] and Carmen Keller[1]

In 2005, Swiss citizens endorsed a moratorium on gene technology, resulting in the prohibition of the commercial cultivation of genetically modified crops and the growth of genetically modified animals until 2013. However, scientific research was not affected by this moratorium, and in 2008, GMO field experiments were conducted that allowed us to examine the factors that influence their acceptance by the public. In this study, trust and confidence items were analyzed using principal component analysis. The analysis revealed the following three factors: "economy/health and environment" (value similarity based trust), "trust and honesty of industry and scientists" (value similarity based trust), and "competence" (confidence). The results of a regression analysis showed that all the three factors significantly influenced the acceptance of GM field experiments. Furthermore, risk communication scholars have suggested that fairness also plays an important role in the acceptance of environmental hazards. We, therefore, included measures for outcome fairness and procedural fairness in our model. However, the impact of fairness may be moderated by moral conviction. That is, fairness may be significant for people for whom GMO is not an important issue, but not for people for whom GMO is an important issue. The regression analysis showed that, in addition to the trust and confidence factors, moral conviction, outcome fairness, and procedural fairness were significant predictors. The results suggest that the influence of procedural fairness is even stronger for persons having high moral convictions compared with persons having low moral convictions.

KEY WORDS: Acceptance of technologies; confidence; fairness; gene technology; trust

1. INTRODUCTION

Trust and fairness have been identified as important factors that influence the acceptance of decisions.[1–3] This research shows that when people perceive a decision to be fair, and when they trust the decisionmaker, they are more likely to accept a decision in a risk management context. Recently, however, it has been suggested that fair procedures may be of limited value when a decision threatens important values.[4,5] This research, therefore, implies that for important decisions, procedural fairness may not be important in people's acceptance of a decision. The goal of this study was to examine how important trust and fairness are in the acceptance of genetically modified (GM) field experiments. In Switzerland, the commercial cultivation of GM crops is prohibited, but scientific trials are allowed. In 2008, two scientific field experiments were conducted in Switzerland. Thus, this situation allowed us to test, in the context

[1]ETH Zurich, Institute for Environmental Decisions (IED), Consumer Behavior, Universitätsstrasse 22, 8092 Zürich, Switzerland.
[*]Address correspondence to Michael Siegrist, ETH Zurich, Institute for Environmental Decisions (IED), Consumer Behavior, Universitätsstrasse 22, 8092 Zürich, Switzerland; msiegrist@ethz.ch.

of a natural experiment, the influence of trust and fairness on the acceptance of the decision to conduct field experiments in one's vicinity.

1.1. Trust and Confidence

Several studies have suggested that trust influences people's benefit and risk perception.[6–8] Correspondingly, the people who trusted the institutions involved in using or regulating gene technology judged the benefits to be greater and the risks to be lower for this technology. Acceptance of, or willingness to buy, GM foods is directly determined by the perceived risks and benefits. In other words, trust has an indirect impact on the acceptance of GM foods. Because most people possess only limited knowledge of gene technology,[9] trust becomes an important factor that influences their perception and acceptance of a technology. One way people cope with a lack of knowledge is to rely on trust to reduce the complexity of risk management decisions.[10]

Some authors have questioned the importance of trust in risk management.[11,12] Others have suggested that trust does not influence perceived risks, but that general evaluative judgments influence trust and perceived risks.[13] Therefore, it should be emphasized that the relationship between trust and risk acceptance or risk perception depends on various factors. For instance, it has been shown that trust influences risk and benefit perception in the absence of knowledge, but that knowledge makes trust superfluous.[14] How trust is conceptualized and measured also seems to influence the observed relationship between trust and risk perception.[15] A review by Earle *et al.* showed that general trust in politicians, for example, was only weakly correlated with risk perception. Social trust in scientists and industry, on the other hand, was highly correlated with the risk and benefit perception of gene technology. On the basis of the available research, it can be concluded that trust is an important factor that influences the acceptance of genetically modified organisms (GMO) field experiments.

Researchers who agree that trust is important for the acceptance of a new technology may still disagree on the definition of trust. Several authors have proposed that trust is not a one-dimensional construct. Metlay suggested two dimensions—one representing general trustworthiness and the other representing technical competence.[16] Another study examining the dimensionality of trust in risk regulation unveiled the two factors, "general trust" and "skepticism."[17] Allum found that trust, as well as perceived technical competence, influenced the perception of GM risks.[18] The different studies not only differed in their definitions of trust, but also on the items used for measuring the constructs. Thus, making a comparison across studies is not an easy task.

On the basis of a comprehensive review of the trust literature, the trust, confidence, and cooperation (TCC) model of cooperation has been proposed.[15] This model provides a framework within which all expressions of trust and confidence can be interpreted and related to one another. To a greater extent than the available alternatives, it identifies the basic psychological processes involved in judgments of trust and confidence. Although trust and confidence are separate, under some circumstances, they are interacting sources of cooperation. Trust is based on value similarity, and confidence is based on past performance. According to this model, the judged similarity between one's current salient values and the values attributed to others determines social trust.[10,19] Thus, the basis for trust is the belief that the person to be trusted would act as a trusting person would in the same situation. Shared values can be measured in different ways. In empirical studies, trust can be indicated variously by measures of ingroup membership, morality, benevolence, integrity, inferred traits and intentions, and caring. Furthermore, all of these can be taken to mean good intentions relative to those of the trusting person. Confidence, on the other hand, is related to factors such as competence or past performance. This construct encompasses various aspects of ability, but not intentions. There is not only support based on correlation data,[19,20] but also on experimental studies[21] for the TCC model.

On a conceptual level, it is logical to distinguish between trust and confidence. In past studies, however, the two concepts have been highly correlated.[19,20] Another weakness of past studies is how they have measured value similarity. In most of these studies, the participants were asked to indicate their value similarity or dissimilarity with another entity.[20,22] On the basis of this measurement, the salient values on which the participants' judgments were based are unclear. It is important, therefore, to be specific about the values that the participants use to assess their value similarity with another person or organization. Such a measurement approach results in more specific results and, consequently, in deeper insight.

1.2. Fairness and Acceptance of New Technologies

The decline of trust and the opposition to gene technology, and to the field release of GM plants, has been fruitful ground for public participation processes, such as the British GM Nation public debate.[23] An important reason for the increased public participation has been a desire for fairer processes, representing a broader range of interests, and, ultimately, achieving higher acceptance of decisions. Among the specialists in risk communication and public involvement, there is a strong belief in the efficacy of fair procedures.[24,25]

How important are fair procedures in solving real-world problems? There is disagreement among fairness researchers about how important procedural fairness is for issues with outcomes about which people have strong moral convictions. Tyler *et al.* argued, on the one hand, that fair procedures positively influence the acceptance of a decision, even when people's moral convictions are threatened.[3,26] On the basis of this view, fair procedures can be regarded as a means for increasing public acceptance of new technologies. According to Skitka *et al.*, on the other hand, the usefulness of fair procedures is rather limited.[5,27,28] They argued that decision acceptance is primarily shaped by the decision outcome when people have strong moral convictions about outcomes. In such a situation, moral convictions have a stronger effect on decision acceptance than procedural fairness. On the basis of this view, fair procedures are fairly negligible in terms of increasing public acceptance of technologies concerning which people have strong moral values.

The fairness research has mainly focused on the acceptance of decisions in an organizational context[29,30] and on the acceptance of political decisions related to issues like abortion or civil rights.[5,26–28] The importance of outcome fairness has not been questioned, but its usefulness in resolving social conflicts has.[3] Only a few researchers have examined the impact of procedural fairness on the public acceptance of controversial technologies.[4,31,32] For instance, Besley examined the factors that influenced respondents' willingness to accept a decision-making process for a nuclear power plant expansion in a U.S. state.[31] The results of this study suggest that outcome as well as nonoutcome forms of fairness influence decision acceptance. This result is in line with the assumption that procedural fairness enhances the acceptance of controversial technologies.

In a recent study, the dominant view in the fairness literature, which holds that procedural fairness is more important than outcome fairness, was compared with the TCC model to explain the acceptance of GM foods.[4] The results suggest that procedural fairness affects judged fairness, but not trust or cooperation. On the basis of the results, it may be concluded that the efficacy of fair procedures in the management of controversial environmental hazards may be limited. However, it should be noted that this study examined a hypothetical problem, not an existing risk management problem.

1.3. Rationale for this Study

In 2005, Swiss citizens voted on a gene technology moratorium, and the majority of voters were in favor of the moratorium. As a result, the commercial cultivation of GM crops and the growth of GM animals are prohibited until 2013. Nevertheless, it is possible to conduct scientific GMO field experiments during the moratorium; they need only be approved by the responsible governmental agencies. Furthermore, the public in the vicinity of where the field experiments are being conducted must be informed about the experiments. In 2008, a field experiment by scientists from the University of Zurich and ETH Zurich was conducted on the outskirts of Zurich. Thus, in our study, we focused on people living close to where the field experiments were being conducted. Our aim was to examine how trust, confidence, and fairness influenced the participants' acceptance of the field experiments.

The TCC model has yet to clarify what specific values and past performance aspects are important for cooperation. Therefore, one goal of this study was to unveil the values that are important in influencing the acceptance of GM field trials. In addition, we tested the impact of procedural and outcome fairness on the acceptance of the field trials.

Procedural fairness was defined as how fair people perceived the decision-making process to be in the selection of their vicinity as the site to conduct the field experiment. The participants' perception that public opinion was taken into account served as an indicator of procedural fairness. The goal of this study was to examine whether perceived procedural fairness influenced the acceptance of the GM field trials. People may differ when it comes to moral convictions. In other words, for some people, gene technology may threaten important values, and the

technology may bother them significantly (i.e., high moral conviction), whereas for other people, this may not be the case (i.e., low moral conviction). If procedural fairness is important, independent of people's moral conviction, then we expect procedural fairness to be a positive predictor of acceptance, but we expect no substantial interaction between moral conviction and procedural fairness. In that case, a fair procedure would be a promising approach for increasing the acceptance of controversial technologies. If procedural fairness is only of limited value, and it is only important to people for whom gene technology is not an important issue, then we would expect an interaction between moral conviction and procedural fairness. In that case, a fair procedure would not be a promising approach for increasing the acceptance of controversial technologies.

We defined outcome fairness as how fair people perceived the decision to conduct the GM field trials in their neighborhood to be. Outcome fairness was expected to be a positive predictor of acceptance. In addition, an interaction effect between outcome fairness and moral conviction seems plausible. For people with a low moral conviction about gene technology, outcome fairness may have a stronger effect on acceptance because these people may not be concerned about GM field trials *per se*, but they may not like to be confronted with the negative effects of a trial (e.g., a stigma effect). Conversely, for people for whom gene technology is a highly important issue, it may not matter whether the field trials are conducted in their vicinity or somewhere else in Switzerland. Therefore, outcome fairness may be less important in the acceptance of GM field trials for these people.

2. METHOD

2.1. Participants

Data collection for this study was conducted in a Swiss community (Reckenholz) where nearby field trials with GM plants had been carried out. The participants were randomly selected by means of the Swiss telephone book and asked to fill out a questionnaire. The questionnaire was completed and returned by 999 persons. The response rate was 42.5%. To increase the response rate, face-to-face interviews[2] were combined with a mail survey. For both methods, the participants filled out the same questionnaire.[3] Among the participants, 65% ($n = 654$) were administered the questionnaire during a face-to-face interview and 35% ($n = 345$) received the questionnaire by mail. Furthermore, 43% ($n = 429$) of the respondents were female, 52% ($n = 519$) were male, and 5% ($n = 51$) did not report their gender. The mean age was 53 years ($SD = 16$), and only people aged 18 or older participated in the study. The self-reported education level ranged from lower primary school (2%, $n = 19$), secondary school (8%, $n = 76$), professional school (42%, $n = 415$), and high school (19%, $n = 185$) to universities and technical universities (26%, $n = 257$). Forty-seven participants (5%) did not report their education level.

2.3. Questionnaire

For all of the following questions, six response categories were used. The two extreme responses were verbally anchored (1 = do not agree at all, 6 = absolutely agree). Twelve items measuring social trust and confidence were used. These items are presented in Table I. Acceptance was measured using the following three items: "I do not mind that there are field trials near my home"; "field trials with GM plants are important, and therefore, one should accept them"; and "there is no reason to resist the field trials with GM plants." Moral conviction was measured using the following three items: "the field trials with GM plants bother me a lot"; "the field trials with GM plants threaten values which are important to me"; and "my attitude toward the field trials with GM plants is a question of conscience." Outcome fairness was measured using two items, namely, "in my opinion, the decision to conduct the field trials with GM plants in Reckenholz was unfair" and "the field trials with GM plants should not have been conducted in Reckenholz; they should have been conducted elsewhere" (two negative formulated items that were recoded for further analyses). Furthermore, procedural fairness was measured using the following two items: "the people directly affected by the field trials with GM plants should have been allowed to have a say in the determination of the experimental site" (negative formulated item that was recoded for further analyses) and "when deciding on Reckenholz as the site

[2]Face-to-face interviews were conducted in order for the participants to solve an implicit association test (IAT) test and perform a sorting task. The participants filled out the questionnaire on their own, however.

[3]The participants in the mail survey had significantly lower means for acceptance, fairness, and trust, and a higher mean for moral conviction compared with the participants in the face-to-face interviews.

Table I. Results of a PCA with Varimax Rotation for the Trust and Confidence Items (Means and Standard Deviations of the Items are also Shown)

	ST: Honesty	ST: Concern	Confidence	*M*	*SD*
1. Agriculture and food industry value financial gain higher than me.	−0.08	**0.60**	−0.06	4.60	1.35
2. Agriculture and food industry do not consider human health to be important.	−0.21	**0.74**	−0.07	3.64	1.63
3. Scientists dealing with gene technology aim to create better plants and animals without respect for humans and the environment.	−0.22	**0.80**	−0.23	3.36	1.61
4. Scientists dealing with gene technology are only interested in their science and they are not interested in the consequences for the environment.	−0.30	**0.75**	−0.23	3.76	1.59
5. Scientists dealing with gene technology openly communicate the possible risks of gene technology.	**0.73**	−0.11	0.15	2.91	1.43
6. If there was evidence that gene technology is harmful to human health, the agriculture and food industries would inform the public.	**0.80**	−0.23	0.22	3.02	1.46
7. One can trust information from the agriculture and food industry.	**0.80**	−0.24	0.28	2.89	1.33
8. One can trust information from scientists working with gene technology.	**0.70**	−0.31	0.35	3.35	1.39
9. In the past, the agricultural and food industries demonstrated that they judged the risks of foods correctly.	**0.66**	−0.26	0.36	3.07	1.35
10. Agricultural and food industries have the required knowledge to estimate the risks of gene technology.	0.38	−0.15	**0.71**	2.90	1.43
11. Scientists dealing with gene technology have vast knowledge, enabling them to estimate possible risks for humans, animals, and the environment.	0.31	−0.19	**0.84**	3.44	1.41
12. Scientists dealing with gene technology know a great deal about the risks of gene technology.	0.20	−0.15	**0.86**	3.50	1.39
Explained variance	27%	21%	21%	–	–

Note: Loadings greater than 0.40 are printed in bold.

of the field trials, the opinion of the public was also taken into account."

In addition, the respondents also answered questions that were not relevant to this article. At the end of the questionnaire, sociodemographic characteristics, such as gender, age, and level of education, were recorded.

3. RESULTS

To evaluate whether people distinguish between the different measures of trust and confidence, a principal component analysis (PCA) with varimax rotation was conducted for the 12 items measuring trust and confidence.[4] On the basis of the scree-plot and interpretability of the solution, we decided that a three-component solution was preferable. This solution explains 68% of the variance. The factor loadings are presented in Table I.

[4] A PCA with oblimin rotation yielded virtually the same results as the PCA with varimax rotation.

The first component of the rotated solution is highly correlated with social trust in the sense of honesty. All four items deal with the honesty and trustworthiness of the scientists dealing with gene technology and the associated industry. The second component is highly correlated with social trust, which is related to a lack of concern for health and the environment. These items deal with health and environmental issues and whether the scientists dealing with gene technology and the associated industry are also concerned about these issues. The third component is highly correlated with the confidence items. The three items measuring confidence deal with the knowledge the scientists and the industry are expected to possess as well as with the ability to handle gene technology as safely as possible. Cronbach's alpha was high for all three components (social trust: honesty $\alpha = 0.77$, concerns $\alpha = 0.87$, and confidence $\alpha = 0.85$). For all three components, the factor scores were computed and used for further analyses. Summative scales were constructed for acceptance and moral conviction

Table II. Results of a PCA with Varimax Rotation for the Fairness Items (Means and Standard Deviations of the Items are also Shown)

	Outcome Fairness	Procedural Fairness	*M*	*SD*
1. In my opinion, the decision to conduct the field trials with genetically modified plants in Reckenholz was unfair (recoded: high value = fair)	**0.82**	0.30	4.28	1.69
2. The field trials with genetically modified plants should not have been conducted in Reckenholz; they should have been conducted elsewhere (recoded: high value = fair)	**0.87**	−0.01	4.84	1.48
3. The people directly affected by the field trials with genetically modified plants should have been allowed to have a say in the determination of the experimental site (recoded: high value = fair)	**0.77**	0.26	3.84	1.87
4. When deciding on Reckenholz as the site of the field trials, public opinion was taken into account as well (not recoded: high value = fair)	0.17	**0.97**	3.12	1.50
Explained variance	51%	27%	–	–

Note: Loadings greater than 0.40 are printed in bold.

Table III. Correlations Among Predictor Variables and Acceptance

	Social Trust: Honesty	Social Trust: Concerns	Confidence	Outcome Fairness	Procedural Fairness	Moral Conviction	Acceptance
Social trust: honesty	–	–	–	–	–	–	–
Social trust: concerns	0.00	–	–	–	–	–	–
Confidence	0.00	0.00	–	–	–	–	–
Outcome fairness	0.25*	−0.33*	0.19*	–	–	–	–
Procedural fairness	0.32*	−0.22*	0.22*	0.00	–	–	–
Moral conviction	−0.22*	0.39*	−0.15*	−0.50*	−0.23*	–	–
Acceptance	0.45*	−0.42*	0.36*	0.58*	0.45*	−0.55*	–
Gender	0.14*	−0.15*	0.05	0.18*	0.13*	−0.18*	0.25*
Age	0.05	0.10*	0.10*	−0.05	0.05	0.19*	0.09*

*$p < 0.001$.
Note: $N = 934$–957; the variable gender was coded 0 = female, 1 = male.

(acceptance: $\alpha = 0.94$, $M = 3.54$, $SD = 1.68$, $N = 957$; moral conviction: $\alpha = 0.75$, $M = 3.44$, $SD = 1.37$, $N = 956$).

To evaluate whether people distinguish between the two measures of outcome and procedural fairness, a PCA with varimax rotation was conducted for the four items measuring outcome and procedural fairness. On the basis of the scree-plot, we decided that a two-component solution was preferable. This solution explains 79% of the variance. The factor loadings are presented in Table II. The first component of the rotated solution is highly correlated with the outcome fairness items. Unexpectedly, item 3, intended to measure procedural fairness, is also highly correlated with the first component. The second component is highly correlated with one procedural fairness item. For the two components, factor scores were computed and used for further analyses.

The correlations between all predictor variables and acceptance are shown in Table III. The results suggest that all predictors are significantly correlated with the acceptance of the field experiments.

To examine how trust, confidence, and fairness influence people's acceptance of field experiments with GM plants, a regression analysis was conducted, the results of which are shown in Table IV.

People's acceptance of GM field trials served as the dependent variable. The factor scores for social trust in the sense of honesty, social trust related to a lack of concern for health and the environment, confidence, outcome fairness, procedural fairness, and the *z*-standardized scores of moral conviction were predictors. This study examined whether the influence of fairness depends on how important an issue is for people. Therefore, the two interaction terms, moral conviction × outcome fairness and moral conviction × procedural fairness, were included in the

Table IV. Results of the Linear Regression Analysis with Acceptance of GM Field Experiments as the Dependent Variable

Predictor	Standardized Coefficient	*t*-Value	*p*
Social trust: honesty	0.24	11.04	0.000
Social trust: lack of concern for health and the environment	−0.20	−8.84	0.000
Confidence	0.22	10.69	0.000
Outcome fairness	0.34	13.55	0.000
Procedural fairness	0.23	10.08	0.000
Moral conviction	−0.18	−7.31	0.000
Moral conviction × outcome fairness	−0.08	−4.07	0.000
Moral conviction × procedural fairness	0.06	3.13	0.002
Age	0.12	6.00	0.000
Gender	0.06	3.00	0.003

Note: $R^2 = 0.695$ (adjusted $R^2 = 0.691$); the variable gender was coded 0 = female, 1 = male.

regression analysis as well. The interaction terms were computed by multiplying the *z*-standardized scores.

The results presented in Table IV show that all predictors were significant, including the interaction terms.[5] Furthermore, the results suggest that people who believe that the scientists dealing with gene technology and the associated industry are honest and have shown that they possess the required knowledge, and can handle the technology as safely as possible, show a greater acceptance of field experiments with GM plants than people who do not have trust in the honesty and ability of these scientists and the associated industry. In addition, social trust related to a lack of concern for health and the environment was also a good predictor of people's acceptance. People who think that scientists and the industry do not show enough concern for human health and the environment were less likely to accept the field trials than people who believe that these are issues of importance for the scientists and industry. Not surprisingly, moral conviction had a negative impact on the respondents' willingness to accept the field trials. The results show that on average (i.e., at the mean level of moral conviction), outcome and procedural fairness positively influenced the acceptance of field trials. The interaction between outcome fairness × moral conviction had a significant negative impact on people's acceptance of the field trials. This result indicates that the impact of outcome fairness on acceptance is higher when moral conviction about gene technology is low (e.g., gene technology does not threaten important values). In contrast, the impact of outcome fairness on acceptance is lower when moral conviction is high. As suggested by Aiken and West, this interaction is depicted in Fig. 1.[33]

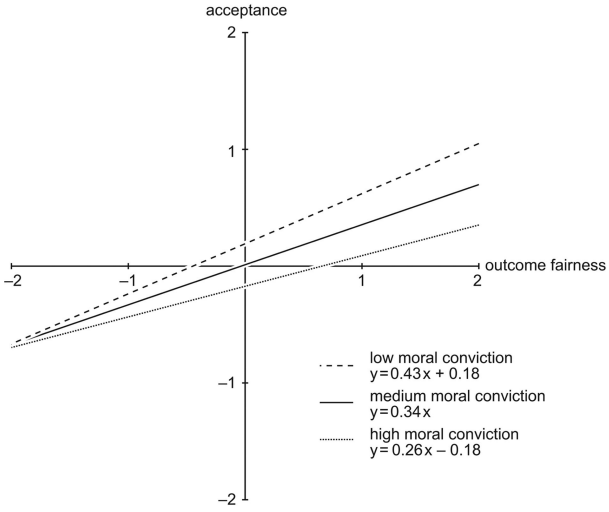

Fig. 1. Interaction between moral conviction and outcome fairness in predicting acceptance of field trials.

The interaction between procedural fairness × moral conviction has a significant positive impact on people's acceptance of the field trials. Thus, the impact of procedural fairness on acceptance is higher when moral conviction is high and lower when moral conviction is low (see Fig. 2). However, it is important to note that in conducting a hierarchical regression analysis, the two interaction terms together only explained an increment to R^2 of 1% ($\Delta R^2 = 0.009$; $F(2,856) = 12.27$; $p < 0.001$). Thus, the effect of

[5]Instead of using the factor scores for outcome fairness and procedural fairness, one could compute an outcome fairness scale (items 1 and 2, Table II), and a procedural fairness scale (items 3 and 4, Table II) based on the *a priori* classification of the items. A regression analysis with these measures provided virtually identical results, as shown in Table IV. The only difference was that the interaction term moral conviction × procedural fairness was only marginally significant.

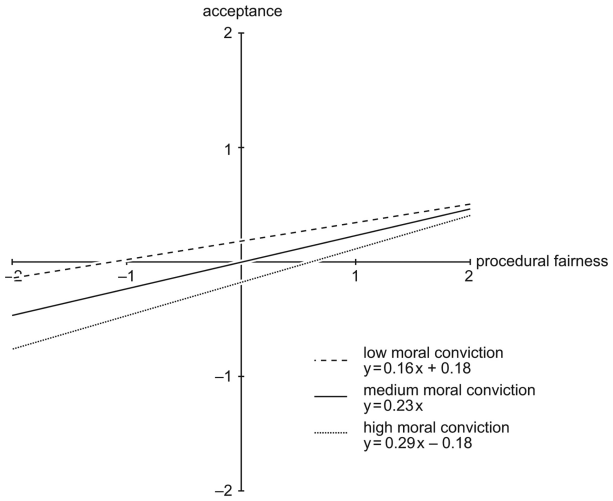

Fig. 2. Interaction between moral conviction and procedural fairness in predicting acceptance of field trials.

these interactions is very small. In sum, the proposed model explains 70% of the variance.

4. DISCUSSION

How controversial risk management issues can be solved is an important and relevant question. Public opposition to building new base stations[34] or nuclear waste repositories,[35] for example, is a challenge for modern societies. In this study, the factors that influence public acceptance of GM field experiments were examined. In Switzerland, the cultivation of GMOs outside a laboratory is prohibited until 2013; however, scientific field experiments can be conducted. This study examined the impact of trust and fairness on the acceptance of a GM field experiment conducted in 2008 by researchers from the University of Zurich and the ETH in a quasi-natural experiment. People living close to the site of the field experiment were interviewed to unveil the factors that determine public acceptance of a controversial technology.

One aim of this research was to determine how important procedural fairness is in the acceptance of GM field experiments. Some researchers have questioned the general importance of fair procedures to the acceptance of a decision.[5,27,28] According to this view, procedural fairness is only important when the decision is not morally relevant. As soon as the outcome is morally important, fair procedures are assumed to be of little or no importance to the acceptance of a decision. The results of this research are not in line with this pessimistic view. We found procedural fairness to be a positive predictor of acceptance. The positive interaction procedural fairness × moral conviction was significant, but the effect was small. This interaction shows that the impact of procedural fairness on the acceptance of field experiments is larger for people for whom gene technology is a morally relevant issue, compared with people for whom gene technology is not a morally important issue. Therefore, our results are in line with the view that in situations where important issues are decided, fair procedures positively influence decision acceptance.[3,26,30] It should be noted, however, that fair procedure was one of six factors that had an impact on the acceptance of GM field experiments in this location. On the basis of the present results, it can be concluded that fair procedure is not the ultimate solution for increasing the acceptance of controversial technologies. Rather, it is but one factor among others.

Outcome fairness was expected to be a significant positive predictor of acceptance. Participants who perceived the decision to conduct the field trials in their vicinity to be fair were more in favor of the field trials as compared to people for whom the decision to conduct the field trials in their vicinity was not perceived to be fair. More interesting is the significant negative interaction term outcome fairness × moral conviction. For persons who have a low moral conviction about gene technology, outcome fairness had a significantly stronger effect on acceptance of the field trials compared with people for whom gene technology is a highly important issue. The first group of people may not be concerned about GM field trials *per se*, but they may not like to have the possible negative effects of a GM field trial in their neighborhood. For example, they may be concerned about possible stigma effects because of the fact that activists may demonstrate at the site where the field trials are being conducted.[36] For persons for whom gene technology is a highly important issue, it may not matter whether the field trials are done in their vicinity or somewhere else in Switzerland. That is why the outcome fairness is less important for this group as compared to persons for whom gene technology is not an important issue.

There is no agreement among researchers about how to define trust and how it should be measured. In many studies, two or three dimensions of trust have been distinguished.[16,17,37] On the basis of a literature review, Earle *et al.* proposed the TCC model, in which the two concepts of trust and confidence are

distinguished. Trust is based on value similarity, and confidence is based on past performance.[15] However, there is some disagreement about how trust and confidence can and should be distinguished from each other.[38–40] Based on the TCC model, we formulated value-related trust items and performance-related confidence items. The results of a PCA suggest that the items measuring trust and confidence can be satisfactorily explained by three factors. Items related to knowledge and competence to assess the risks associated with gene technology had high loadings on one component, which was consequently labeled "confidence." The value-related trust items loaded on two different components. Therefore, the results suggest that different value clusters may be important in the acceptance of gene technology. Items emphasizing a lack of consideration for human health and negative consequences for the environment and items emphasizing financial gains related to the activity loaded high on one factor, which was, hence, labeled "social trust: concern." Items related to honestly informing the public about the risks and research results related to gene technology loaded on a separate component, which was labeled "social trust: honesty." Thus, the results suggest that it is possible to distinguish empirically between trust and confidence dimensions.

Moreover, the results of the regression analysis suggest that both the social trust and confidence components were significant predictors of the acceptance of GM field experiments. People who perceived the industry and scientists to be honest and competent were more likely to accept the field experiments as compared to people who did not perceive the industry and scientists to be honest and competent. People who perceived the industry and scientists to lack concern for health and environmental issues were less likely to accept the field experiments.

On the basis of the present results, a number of practical implications can be deduced for the management of controversial technologies. Procedural fairness is not as useless as suggested by some researchers and may have a positive influence on the acceptance of controversial technologies.[28] We also conclude, however, that the impact of procedural fairness may have been overestimated by other researchers.[26] On the basis of our results, we advocate a more modest position. We believe that it pays off to implement fair procedures, but this variable explains only about one-sixth of our explained variance. Without including social trust, confidence, moral conviction, and outcome fairness, 70% of the variance could not have been explained. Focusing only on procedural fairness would be the wrong approach for increasing the acceptance of controversial technologies.

Some limitations of this research should be addressed. Based on the trust and fairness literature, we proposed a number of causal relationships between the variables. We tested the model using a real risk management issue. Therefore, we did not manipulate procedural fairness; rather, we used participants' perceptions as a predictor. The results of this study should be validated by experimental studies that further explore the impact of procedural fairness on the acceptance of controversial technologies in a given vicinity.

In this study, a cross-sectional design was used. Longitudinal studies would certainly allow for a stronger test of how fair procedures influence the acceptance of a decision. Longitudinal designs are still the exception in fairness research[5] as well as in risk perception research.[41] Future research should use longitudinal designs more frequently. Such designs would allow us to arrive at firmer conclusions about causalities as compared to cross-sectional studies.

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