# Are Micro-, Small- and Medium-Sized Enterprises Willing to Contribute to Collective Flood Risk Reduction? Scenario-Based Field Experiments from Jakarta and Semarang, Indonesia

**Thomas Neise[1]** (ID)**, Maxensius Tri Sambodo[2],
and Javier Revilla Diez[1]**

## Abstract

In developing countries, micro-, small-, and medium-sized enterprises (MSMEs) often cannot substantially reduce their exposure to floods on their own. As state authorities also have difficulty in providing sufficient flood protection, experts argue that collective adaptation initiated by firms can compensate for these shortcomings. However, private sector engagement in this field remains rare and is mostly dominated by large firms. Our article examines whether MSMEs are willing to contribute to flood risk reduction measures. Based on scenario-based field experiments, 120 participating enterprises in Jakarta and Semarang are willing to contribute to collective adaptation in 43% of all the scenarios we ran. Even though MSMEs often operate under difficult conditions, they are surprisingly often willing to contribute if the costs are distributed fairly. The analysis underlines the importance of social motives in explaining the collective engagement of MSMEs and, thus, provides relevant results for future adaptation policies.

## Introduction

Many coastal cities in developing countries are increasingly exposed to floods. At the same time, the capacity of state authorities is being overloaded by increasing urbanization and high population growth. Hence, they have difficulty in providing basic infrastructure (e.g., sanitation or electricity) and adequate flood risk reduction measures (FRRMs), such as retention zones or early warning systems (Birkmann, Welle, Solecki, Lwasa, & Garschagen, 2016; Sandee, 2016). The Indonesian cities of Jakarta and Semarang are typical examples of such deficiencies.

[1]University of Cologne, Cologne, Germany
[2]Indonesian Institute of Sciences, Jakarta Selatan, Indonesia

**Corresponding Author:**
Thomas Neise, Institute of Geography, University of Cologne, Albertus-Magnus-Platz, Cologne, 50923, Germany.
Email: tneise@uni-koeln.de

Although the city governments—in Jakarta more than in Semarang—have strengthened their focus on flood risk reduction, areas with a high proportion of micro-, small, and medium-sized enterprises (MSMEs) in the manufacturing sector are barely benefiting from the new investments and are still frequently hit by floods. Existing case studies show that MSMEs oftentimes rely on individual flood adaptation, for example, installing pumps and raising the level of their plants. However, these adaptation efforts simply attempt to reduce the immediate inundation, whereas substantial solutions that could diminish the flood risk, in the long run, do not exist or are ineffective (Neise & Revilla Diez, 2019). In principle, large-scale adaptation measures are needed to reduce the flood risks more comprehensively. For instance, a water retention area surrounded by dikes or expanded river capacities can provide more substantial flood risk reduction.

Due to insufficient flood adaptation, experts argue that collective adaptation, including the engagement of firms, can compensate for these shortcomings. For example, the Sendai Framework for Disaster Risk Reduction 2015-2030 stresses that the private sector should be an important player to achieve risk reduction. It is argued that firms are able to support adaptation through their financial power, know-how, and organizational resources (Biagini & Miller, 2013; UNISDR, 2015). This seems to be a very optimistic outlook on the role of the private sector, particularly with regard to MSMEs which normally operate under difficult conditions (e.g., due to low profit margins). To date, private sector engagement is still rare and is generally dominated by large multinational enterprises. Their activities frequently focus on their own interests and often have limited positive impact on risk reduction for local communities. The role of MSMEs with regard to private sector engagement is often neglected in adaptation policies (International Recovery Platform, 2016; Pauw, 2015).

Against this background, this article contributes to the debate on the potential role of MSMEs in supporting the provision of large-scale FRRMs. We examine whether, and under which conditions, MSMEs are willing to participate in collective adaptation. Or to put it another way, whether expectations of private sector engagement as postulated before are exaggerated or realistic regarding MSMEs. From our understanding, collective adaptation means that firms together with other stakeholders (e.g., other firms or residents) collaborate and proactively implement FRRMs. As a consequence, firms can reduce their own business disruptions caused by floods more substantially. At the same time, their engagement supports risk reduction for residents and unburdens the state authorities from providing public adaptation measures (Linnenluecke & Griffiths, 2015; Neise, Revilla Diez, & Garschagen, 2018).

In order to answer our research question, we make use of the burgeoning application of experimental methods in natural hazards research. This research still focuses predominantly on households or the community but neglects the importance of firms. Based on literature from behavioral economics, governance, and adaptation research, we first develop an analytical framework considering which contextual dimensions determine the willingness of MSMEs to participate in collective adaptation at three intertwined levels: the firm, the business owner as the main decision maker, and the institutional environment. At the firm level, we include the impact of flood experience and adaptive capacities. Due to the central role of business owners in MSMEs, we try to understand the risk behavior of MSMEs at the individual level of the decision maker. In addition, MSMEs' willingness might be influenced by the cooperative behavior of other firms or residents and the support or nonsupport of public authorities. We label this institutional environment as the quality of the risk governance system.

In a second step, we applied a novel methodological approach, called scenario-based field experiments, that combines public goods games with vignette studies applied in a field experiment setting. Although quantitative and qualitative studies on private sector engagement are emerging, these studies primarily provide an ex post analysis. Therefore, we complement this emerging debate with a more deciphered perspective through scenario-based field experiments. This enables the analysis ex ante as to why proactive collective adaptation to floods is lacking.

We conducted scenario-based field experiments with decision makers from 120 MSMEs in Jakarta and Semarang. In each experiment, the decision makers were confronted with 15 scenarios. These scenarios contained three different forms of FRRMs (polder system, river expansion, and education program) and five different actor constellations (e.g., equal payment by other firms, contribution by the community, and political pressure) to examine the impact of these contextual dimensions on firms' willingness to contribute to collective FRRMs. In addition, we conducted a short survey. The survey generated firm-specific factors, which we considered as additional contextual dimensions in our multilevel regression analysis. The result demonstrates that the engagement of MSMEs differs from large multinational firms. Instead of their pure self-interest (e.g., reputational benefits through corporate philanthropy), MSMEs are much more driven by social motives, such as a fairly distributed investment between firms and the support of the community within a good risk governance system.

The article continues as follows: the second section presents the literature review from which we deductively derived four hypotheses. The third section reviews methodological approaches in public goods games, vignette studies, and field experiments that were adopted into our scenario-based field experiments. This is followed by a section that describes the empirical procedure of the scenario-based field experiments and the variables for our multilevel regression analysis. The penultimate section presents and discusses the results of our analysis. The sixth section provides a summary of the main results, derives policy implications, and discusses the limitations of our research, as well as the way forward for future research.

## Literature Review and Hypotheses

The call for private sector engagement is gaining increasing attention in disaster risk reduction. However, studies on private sector engagement have, so far, focused primarily on how large multinational firms see investments in disaster risk reduction as a business opportunity (e.g., Biagini & Miller, 2013; Izumi & Shaw, 2015) or how they demonstrate a philanthropic commitment to natural hazards (e.g., Tilcsik & Marquis, 2013). In addition to this engagement, a greater contribution from the private sector at the community level (i.e. from MSMEs) can be beneficial to assist state authorities in the challenging task of achieving sufficient risk reduction (Izumi & Shaw, 2015; McKnight & Linnenluecke, 2016; Pauw, 2015). However, complete funding by firms is rare, given that FRRMs are often expensive. In addition, providing such measures does not yield an immediate financial payoff, and there is the danger of free-riding behavior. Due to their nonrivalry and nonexcludability characteristic, public goods, such as large-scale adaptation measures, are typically provided by the state (Geaves & Penning-Rowsell, 2016). In developing countries, however, the state is often unable to provide efficient adaptation to natural disasters (Neise et al., 2018). Therefore, experts propose collective action to establish risk reduction measures. However, the risk of opportunistic behavior (i.e., free-riding) from other actors has to be solved in order to motivate MSMEs.

Against this background, the literature from behavioral economics and governance studies provides valuable insights into how the collaborative engagement of affected actors (e.g., firms, residents) can be developed. Here, the engagement of MSMEs seems to be very promising although they often operate at low profit margins (International Recovery Platform, 2016). MSMEs are the most common form of firms in developing countries and are usually more integrated into local governance systems. Accordingly, it is argued that, besides their business interest in adaptation, the enterprises are simultaneously interested in reducing harm to the community because its members are oftentimes employees or customers (McKnight & Linnenluecke, 2016; Neise et al., 2018).

Therefore, our analytical approach aims to explore the factors influencing the willingness of MSMEs to contribute to collective FRRMs. To do this, we combine three intertwined levels of
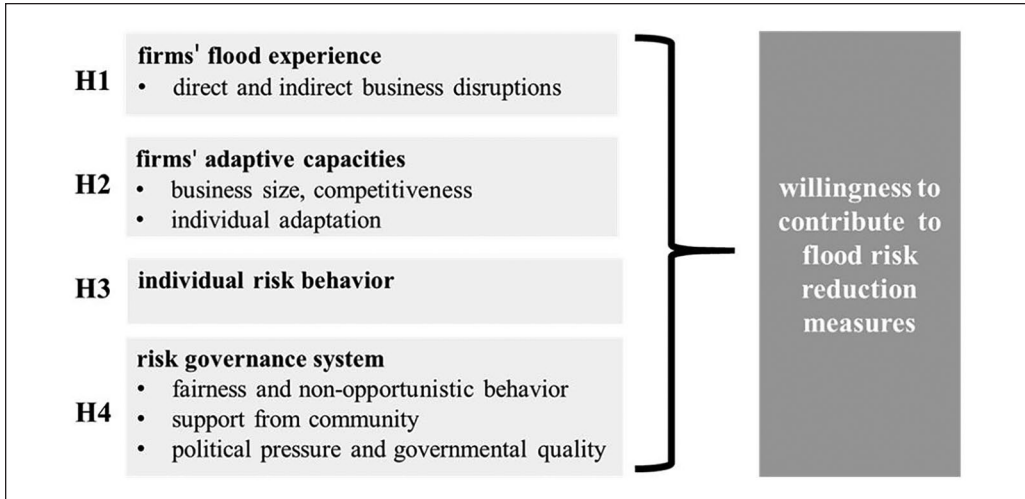
**Figure 1.** Analytical framework.
*Source.* Authors.

analysis (individual, firm, and institutional environment), which are often analyzed independently. Normally, the focus of adaptation studies is on the firm level and provides rationales why firms need to adapt. Our analysis goes beyond this and includes the individual perspective because decision making in MSMEs is directly linked to the owner who has to deal with everyday problems and strategic decisions. To achieve this, we refer to empirical evidence from behavioral economics on risk behavior. Furthermore, we integrate the institutional environment because, as elaborated in governance studies, the collaboration of MSMEs is also determined by the quality of the risk governance system. In order to analyze these different levels, we develop four hypotheses (see Figure 1).

Regarding flood impacts, MSMEs often belong to the most affected firms (Bahinipati, Rajasekar, Acharya, & Patel, 2017; D. Marks & Thomalla, 2017). Empirical studies show that flood experience determines whether firms implement adaptation measures (e.g., Kreibich et al., 2011; Kreibich, Müller, Thieken, & Merz, 2007; Wedawatta & Ingirige, 2012). But, efforts at the individual firm level are often not sufficient to reduce flood exposure substantially. At the same time, state authorities are often unable to provide adequate flood risk reduction (Neise et al., 2018). Forced by circumstances, it is assumed that firms seek to collaborate on providing collective risk reduction because their provision will also reduce individual flood exposure. Based on the findings that flood experiences determine individual flood adaptation, we assume that flood exposure is also an important factor that motivates MSMEs to join collective FRRMs. Hence, we formulate the hypothesis:

**Hypothesis 1:** The more MSMEs are affected by floods, the more willing they are to contribute to collective FRRMs.

Moreover, MSMEs are often plagued by limited adaptive capacities, such as know-how and financial power (Linnenluecke & Griffiths, 2015; Neise et al., 2017). For instance, D. Marks and Thomalla (2017) showed that small and medium-sized enterprises had difficulty recovering from the flood catastrophe in 2011 in Central Thailand. Financial constraints and a lack of insurance cover hampered the rebuilding of their shops. Consequently, many enterprises still struggle even five years after the catastrophe due to their limited adaptive capacities. Research by Sydnor,

Niehm, Lee, Marshall, and Schrank (2017) found that small businesses with less than 100 employees were more likely to close down after Hurricane Katrina. Constraints in adaptation are also linked to low endowments of know-how, technological capacities, and human resources. For instance, a survey among Thai SMEs ($n = 136$) found that the most important reason (58.5%) why firms cannot prepare for disaster was lacking "knowledgeable staff," followed by "lack of understanding" (26.9%) and "lack of tools" (22.3%) (Kato & Charoenrat, 2018). Therefore, sophisticated risk assessment and mitigation strategies were lacking. However, adaptive capacities, such as financial resources or technological capacities, are needed because firms' engagement in collective adaptation requires investing their own resources (Neise & Revilla Diez, 2019). Thus, we derive the following hypothesis:

**Hypothesis 2:** The better the MSME is equipped with adaptive capacities, the more likely the MSME will contribute to collective FRRMs.

Risk behavior is another factor that determines enterprises' willingness to provide funding for joint FRRMs. Empirical studies on households have shown that flood-affected households are more risk-averse than non-affected ones because the households perceive a greater risk of future floods (e.g., Cameron & Shah, 2015; Said, Afzal, & Turner, 2015). Regarding the relationship between risk attitude and willingness to contribute to public goods, Teyssier (2012) points out that participants who are more risk-averse contribute less to a public good due to the uncertainty of the contribution of other players. In analogy to households, we assume that flood-prone enterprises are more often risk-averse, and they are willing to contribute less to collective FRRMs. We come up with the following hypothesis:

**Hypothesis 3**: Risk-averse firm owners and managers are more likely to contribute less to FRRMs.

The literature on governance stated that collaborative efforts, for instance, between firms, state authorities, and the community enable a more effective and legitimized risk reduction (e.g., Folke, Hahn, Olsson, & Norberg, 2005; Lebel et al., 2006). Ideally, all the actors involved (e.g., firms, residents, state authorities) take the initiative to adapt collectively and distribute the investment among all partners (Lebel et al., 2006; Ostrom, 2000). Moreover, governance approaches consider the institutional setting (e.g., power between the actors) and policy frameworks (e.g., land use planning) that enable or limit collective action (Birkmann, Garschagen, Kraas, & Quang, 2010; Djalante, Holley, & Thomalla, 2011). Hence, we assume that the quality of the risk governance system influences the willingness to contribute to FRRMs. Here, we propose two crucial components that we subsume as a good risk governance system. First, MSMEs seek the fair engagement of other firms and/or the community and, second, that the government promotes and enforces laws or regulations.

Regarding the first component (i.e., cooperation and fair distribution), behavioral economic studies provide valuable evidence explaining cooperative behavior. The empirical evidence shows that social motives, such as trust and fairness, increase cooperative behavior in public goods games (see Chaudhuri, 2011; Kocher, Martinsson, Matzat, & Wollbrant, 2015; Ledyard, 1995). In general, these experiments found that people show altruistic behavior, meaning that they are willing to sacrifice their own maximum payoff in order to maximize the joint outcome for all group members (Sturm & Weimann, 2006; Weber, Kopelman, & Messick, 2004). Beside an altruistic attitude, studies confirm that actors expect reciprocal behavior from other actors (e.g., Fehr & Gächter, 2000b). Several studies have revealed that reciprocity determines whether actors will be conditional cooperators. They prefer to cooperate only if they can expect other actors to cooperate, too (Fischbacher, Gächter, & Fehr, 2001; Martinsson, Pham-Khanh, &

Villegas-Palacio, 2013). Accordingly, we consider social motives as having a strong impact on MSMEs' willingness to join collective FRRMs. We assume that participants will increase their contributions if they have information about other contributions and if the contributions are fairly distributed.

Regarding the second component (i.e., the role of state authorities), a good risk governance system includes state authorities that promote and enforce laws and regulations to stimulate the firms' engagement in FRRMs besides their own actions (Agrawala et al., 2011). Linnenluecke and Griffiths (2015) state that government and public agencies, as a third party, can promote the adaptation of firms if they are good role models. In Indonesia, firms are encouraged to engage in providing investment for the society or environment. Law No. 40, Article 74 on limited companies and Regulation No. 93/2010 require that private firms provide funding for disaster relief and that they have social and environmental responsibility. However, the enforcement of the law and regulation is still weak (Gayo & Yeon, 2013). Furthermore, Neise et al. (2017) point out that the unreliability of state authorities limits firms' engagement in collective adaptation. Based on both components, we formulate the hypothesis:

> **Hypothesis 4:** A good risk governance system increases the MSME's willingness to join collective FRRMs.

## Method

Our methodological approach—the scenario-based field experiments—combines the insights on cooperative behavior from public goods games applied in behavioral economics with vignette designs that are typically applied in experimental social and political sciences (Delmas & Aragón-Correa, 2016). The combined methodological approach is implemented in a natural setting through field experiments. In the following section, we outline the underlying rationales of each method that we considered in the conceptualization of the scenario-based field experiments.

### Public Goods Games

To examine whether collective action takes place or not, public goods games rely on the voluntary contribution mechanism. This type of public goods game examines each player's individual contribution (Ones & Putterman, 2007). The players are asked to distribute their endowment between a public good and a private good (Bardsley, 2010). The aim is to examine whether players are willing to contribute to a public good or whether they prefer to free-ride on the contribution of others (Chaudhuri & Paichayontvijit, 2006). A large number of experiments show that the success rate in the provision of public goods is between 40% and 60% (Ledyard, 1995).

For discrete public goods, the provision point mechanism is commonly applied. Discrete public goods, such as FRRMs, are only provided if a contribution threshold, the so-called provision point, is reached. Accordingly, actors are asked to contribute to a public good that cannot be provided solely by one actor alone, thus requiring a joint contribution. If the contribution threshold is not reached, the contribution will be refunded to the actors (Groothuis & Whitehead, 2009; M. Marks & Croson, 1998). According to M. Marks and Croson (1998), the money-back guarantee reduces the players' fear that the contribution may be given to other projects. Therefore, within the scenarios, the focus on the requested contribution to the specific FRRM is strengthened, and any biases toward corruption reduced.

### Vignette Studies

Vignette studies investigate the judgment of respondents. It is a hybrid methodological approach that combines classic experiments with the element of a survey. As a quasi-experiment, the

method permits the collection of data from many respondents in a controlled setting with detailed and specific descriptions. Vignettes are carefully conceptualized descriptions of a scenario that are judged by the respondents (Atzmüller & Steiner, 2010; Oll, Hahn, Reimsbach, & Kotzian, 2018; Wallander, 2009). The scenarios should represent realistic but hypothetical situations. The systematic construction of the scenarios is based on postulated factors that might influence the judgment. Usually, practice-oriented knowledge or former research serves as the foundation for the scenarios (Hox, Kreft, & Hermkens, 1991; Taylor, 2006).

The core of the methodological approach is the experiment. A set of different vignettes is presented to the respondents to examine their intended behavior toward the scenario. An additional survey is used to collect respondent-related information which later will be used as independent variables in the analysis (Atzmüller & Steiner, 2010). The advantage of vignette studies is that they enable researchers to identify simultaneously the importance of the explanatory factors (i.e., scenarios) and the contextual factors (i.e., respondent characteristics) that might determine the individual decision. Besides identifying the causal relationship, this results in more realistic scenarios and a robust experimental situation (Atzmüller & Steiner, 2010; Taylor, 2006; Wallander, 2009).

## Field Experiments

Laboratory experiments continue to dominate the empirical field of behavioral economics. They aim primarily to detect the social motives behind cooperation in a controlled setting. In contrast, studies of common pool resources rely more on field experiments, mostly conducted in developing countries to investigate collective action and power distribution among common goods (e.g., irrigation systems or fish populations; Carpenter & Cardenas, 2011). Field experiments with firms are still relatively underemphasized, especially with regard to public goods games (Delmas & Aragón-Correa, 2016). We decided to conduct the scenario-based field experiments with real decision makers, namely, the owners of MSMEs in their natural environment (i.e., in the place where their firm is located), instead of using students as role-playing decision makers in a laboratory experiment (Bardsley, 2010; Harrison & List, 2004).

Experiments have the advantage of allowing a deeper understanding of the contextual dimensions underlying decision-making (e.g., risk attitude, trust) that determine the willingness to participate in collective action (Ehmke & Shogren, 2009). By comparing various experimental rounds with different interventions (i.e., manipulated scenarios), experiments make it possible to examine the effect of different natural, social, economic, and institutional variables (Cardenas, 2011; Duflo, 2006). Laboratory experiments can deliver useful findings, but their generalization in a natural setting is questionable (Croson, Anand, & Agarwal, 2007; Levitt & List, 2007). In contrast, field experiments increase the probability of obtaining more realistic results. The results can, therefore, easily be put into practice by the participants themselves, policymakers, and non-governmental organizations (Delmas & Aragón-Correa, 2016).

However, field experiments lack external validity, which is a major concern regarding their usefulness. Although field experiments reveal insights into behavioral responses to the conceptualized treatments and interventions in a distinct population of participants, the results cannot be transferred automatically to different conceptualizations and/or participant groups. This weakness is due to the local-specific context (e.g., economic and cultural factors) where the field experiments take place and where the participants belong. The field setting of the experiment can create uncontrollable, unconsidered factors that might influence the responses. But the external validity can be improved if they are replicated with the same parameters under different local conditions and with different participant groups (Bardsley, 2010; Duflo, 2006; Harrison & List, 2004). The twofold approach of vignette studies (experiment and survey) makes it possible to include many control variables, such as location, competitiveness, or risk behavior to detect heterogeneities among the participants.

# Empirical Framework

## Research Design

Our scenario-based field experiments consisted of three phases: explorative phase, design phase, and implementation of the field experiments. In the explorative phase, we conducted 67 in-depth interviews with manufacturing firms (MSMEs and large enterprises) affected by flooding and interviewed 13 experts in public agencies (e.g., the spatial planning and disaster management agency), nongovernmental organizations (e.g., Mercy Corps) and business associations in Jakarta and Semarang between April 2015 and May 2017. The in-depth interviews centered on the impact of flood events on the manufacturing firms and their implemented or envisaged adaptation measures. Overall, the interviews showed that particularly MSMEs barely participate in collective adaptation measures. The expert interviews with the public authorities confirmed the—often lacking—cooperation of public authorities with firms on flood adaptation and on respective regulations that facilitate or hamper collective adaptation. During the interviews and additional field trips, we also gained an overview of the in situ natural settings and which FRRM the MSMEs prefer. In the design phase, we developed realistic scenarios based on the interviews and impressions gained. Finally, we pretested the scenarios in the field and adjusted the design and content slightly. We conducted the scenario-based field experiments in the implementation phase between September and December 2016.

The field experiments consisted of three parts. In the first part, information about the participants' risk attitude was gathered. To detect whether the owner or business director of the particular MSMEs are risk-seeking or risk-averse, we applied the following game: A hypothetical garment business only sells on the domestic market and is facing decreasing domestic demand and increasing domestic competition. The current business strategy is leading to losses, and the survival of the firm is at risk. Accordingly, the participants were given two options. Option A (i.e., risk-seeking option) includes exporting the product, which entails not only a 50% chance of increasing revenues but also a 50% chance of increased losses. In Option B (i.e., risk-averse option), the hypothetical firm continues its domestic selling strategy and, thus, continues to generate losses, although these will be lower than the probable losses in Option A.

In the second part, we ran a one-shot public goods game with the assumptions of the provision point mechanism and a money-back guarantee (see "Public Goods Games" section) to detect whether firms are willing to contribute to FRRMs and, if so, under what conditions. The conceptualization of a one-shot game means that the participants played each scenario once. Therefore, the participants could not be influenced by the decisions of other players (Engel & Zhurakhovska, 2014).

We conceptualized a restricted natural environment to limit possible external effects and not overburden the participants. The natural environment was based on a setting that we observed during field trips as a typical flood-prone urban neighborhood (see Figure 2). The neighborhood designed consisted of residential buildings and five small manufacturing firms. We included small drainage canals between the main road and the buildings. The canals are typical of Indonesia, and their clogging by garbage often causes flooding. Additionally, we added a lake and river behind the buildings. The water architecture was important for our illustration of the scenarios. Of the five firms in each of the settings, one firm belonged to the participants, the other four firms (A, B, C, and D) represented the imaginary actors in the scenarios.

We designed 15 different scenarios on the basis of the information from our explorative phase (see Table 1). First, we aimed to find out which FRRMs options are preferred by the MSME to join a collective adaptation. Therefore, the scenarios contained three different FRRM options: (1) a polder system, (2) an expansion of river and drainage canals, and (3) the funding of an education program on flood awareness. Second, we aimed to examine whether joint contributions by
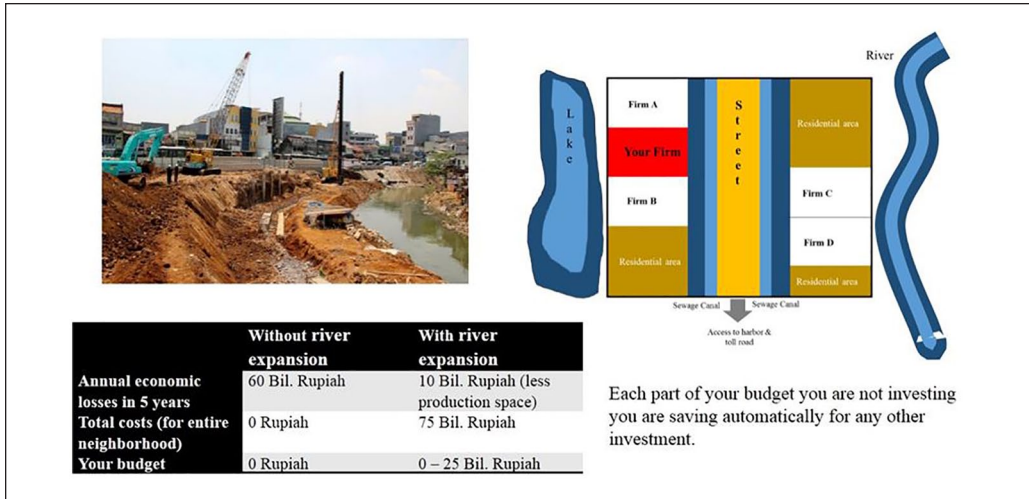
**Figure 2.** Example of scenario-card (river expansion) with the natural setting in the left corner.
*Source.* Authors.

**Table 1.** Overview of Scenarios.

| | 1. Community contribution | 2. Fair contribution | 3. Self-interest | 4. Non–fair contribution | 5. Political pressure |
|---|---|---|---|---|---|
| A. Polder System | A1 | A2 | A3 | A4 | A5 |
| B. River expansion | B1 | B2 | B3 | B4 | B5 |
| C. Education program | C1 | C2 | C3 | C4 | C5 |

*Note.* Own illustration based on field experiments.

other firms or the community and how pressure from governmental authorities on providing adaptation measures determine the willingness of MSMEs to participate in collective action. Therefore, five different actor constellations were designed. In the first actor constellation, the community makes a contribution. In the second, the other four firms contribute the same amount to reach the provision point. In the third actor constellation, nobody else contributes. In the fourth constellation, the other firms contribute less than the necessary provision point. The last constellation includes state authorities forcing MSMEs to contribute to FRRMs or fining them for not contributing. For the first three actor constellations, information was provided on the amount contributed by the other players. In the case of constellations 4 and 5, no information on the other actors' contributions was provided. The rationale behind each specific scenario is explained in more detail in the next section.

A total of 120 manufacturing MSMEs, 60 each in Jakarta and Semarang, participated in the scenario-based field experiments. Because each decision maker of an MSME had to play each of the 15 scenarios, 1,800 observations (120 firms × 15 scenarios) were gathered. The participants were selected randomly on the basis that they had no more than 250 employees, and their business had been disrupted by floods within the past 5 years.

The participants were mainly business owners or at least operational managers of the business. Our prior in-depth interviews with MSMEs found that strategic decision making is mainly top-down and decisions are predominately made by the business owner or operational manager. The participants were very experienced in running a business and mostly male and were instructed

to make their decisions in respect of their own experience in the firm. Thus, it can be assumed that their individual judgments represent to a large extent the MSME's willingness to cooperate or not. The participants' enterprises have, on average, 37.4 employees and 18 years of business experience. The majority of the firms belong to the metal production, food processing, or furniture industries. The firms had experienced at least one flood event that had disrupted their business per year.

The experiments were conducted jointly by Indonesian and German researchers. The procedure of the field experiments and the information given to the participants were carried out strictly according to predefined and standardized guidelines. Only the order of the scenarios was constantly changed at random so as to prevent order bias. To ensure that the participants understood the experiments, the procedure was carefully explained. Once a participant was able to play the test game successfully, the real experiment started. Additionally, illustrations of the FRRM option and a table containing the budget, costs, the amount by which the inundation level could be reduced, and economic losses with and without the option were drawn on "scenario cards" (see Figure 2). It was always mentioned that the remaining budget that the participants did not contribute to FRRMs could be used for other business-related investments. In contrast to many other field experiments, we decided that the participants should not receive a monetary payoff. The pretests showed that a monetary payoff confused the participants. Furthermore, particularly in medium-sized firms, the payoff was refused because the actors were afraid to violate their firm's anticorruption policy.

After the scenarios, a survey was conducted as the third part of the scenario-based field experiment. The survey contained questions about the firms' characteristics (e.g., number of employees), their flood exposure, individual adaptation efforts, and evaluation of the institutional environment (see Table 2). The information was used to develop independent variables for our multilevel regression analysis.

### Multilevel Regression Analysis

To analyze the 1,800 observations obtained from our scenario-based field experiments and to identify the contextual dimensions that influence MSMEs' willingness to contribute to collective action, we applied a multilevel regression analysis. Because each participant played all 15 scenarios (i.e., vignettes), the data were characterized by a hierarchical structure. The vignettes were clustered within the higher participants' levels: the firm's and subdistrict characteristics (Rooks, Raub, Selten, & Tazelaar, 2016; Wallander, 2009). Applying a multilevel model allowed us to consider the differences and interdependences between the characteristics of the scenarios, the firms, and the subdistrict level (see Park et al., 2012). Hence, we processed our data taking the hierarchical structure into account and by running a multilevel binary-logistic regression. Many researchers who use vignette studies emphasize that multilevel models provide a more accurate analysis of the hierarchical structure than standard ordinary least-squares regressions (e.g., Hox et al., 1991; Oll et al., 2018). Running an ordinary least squares regression with a clustered data set would have resulted in standard errors being underestimated because the residuals were not independent (Raudenbush & Bryk, 1992; Rooks et al., 2016).

The dependent variable of our analysis is "willingness to contribute to FRRMs." In line with the provision point mechanism, just the given amount that reached the threshold was considered. Accordingly, our dependent variable is a dummy, where 1 means that the threshold was reached and the MSMEs expressed willingness to contribute to FRRMs under the circumstances of each scenario.

Several explanatory variables were derived from the scenarios to detect whether the manipulation of the actor constellations and the different FRRMs (i.e., contextual dimensions) determine willingness to contribute. Table 2 provides an overview of all the variables included in our

**Table 2.** Overview of Independent Variables.

| | Variables | Description | Range Min | Range Max |
|---|---|---|---|---|
| Scenario characteristics[a] | Technological option (1 = yes) | Scenarios with technological measures: polder system or river expansion (Scenarios A, B) | 0 | 1 |
| | Reduction inundation level | Percentage of reduced inundation level (Scenarios A = 100%; B = 83%, and C = 75%) | 75 | 100 |
| | Fairness (1 = yes) | Amount of contribution needed is equally distributed between all five firms (Scenarios A2, B2, C2) | 0 | 1 |
| | Self-interest (1 = yes) | Participants were requested to fund FRRM alone (Scenarios A3, B3, C3) | 0 | 1 |
| | Community support (1 = yes) | Residents also contribute to the FRRM (Scenarios A1, B1, C1) | 0 | 1 |
| | Political pressure (1 = yes) | State authorities demand implementation of flood protection funded by firms (Scenarios A5, B5, C5) | 0 | 1 |
| Firm characteristics[b] | Risk-averse behavior (1 = yes) | Participants do not change their business model and export products during tough market conditions | 0 | 1 |
| | High direct flood exposure (1 = yes) | The firm was affected by floods more than once per year within the past 5 years | 0 | 4 |
| | Business size | Number of employees | 1 | 250 |
| | Good competitiveness (1 = yes) | The firm stated that turnover increased in the past 5 years | 0 | 1 |
| | Individual adaptation (1 = yes) | Firm implemented own flood protection measures | 0 | 1 |
| | Planned relocation (1 = yes) | Firm is planning to relocate business | 0 | 1 |
| | CSR (1 = yes) | Firm supports the local community with ecological or social programs | 0 | 1 |
| | Cooperation (1 = yes) | Firm cooperates with other firms (e.g., sale, product development) | 0 | 1 |
| | Support during floods (6 = *very good* to 1 = *very poor*) | Rating of the support of state authorities during flood incidents | 1 | 6 |
| | Regulatory quality (6 = *very good* to 1 = *very poor*) | Rating of the support of state authorities on obtaining permission (e.g., export licenses) | 1 | 6 |
| Subdistrict characteristics | Indirect flood exposure[c] | Number of flood events in subdistrict 2011-2013 where the firm is located | 0 | 24 |
| | Jakarta (1 = yes)[b] | Firm is located in Jakarta | 0 | 1 |

*Source.* Authors.
Note. FRRM = flood risk reduction measures; CSR = corporate social responsibility.
[a]Derived from scenarios. [b]Derived from survey. [c]Derived from Village Potential Survey, 2014 (Badan Pusat Statistik, 2015).

model. In the following section, we explain which explanatory and control variables we used for each hypothesis.

Regarding Hypothesis 1 (i.e., flood experience), we developed two explanatory variables. First, the dummy variable "high direct flood exposure" means that the firm was affected by floods more than once per year within the past 5 years. Second, the number of flood events between 2011 and 2013 in each of the subdistricts was calculated based on the Village Potential Survey (Badan Pusat Statistik, 2015). This information (variable "indirect flood exposure") serves as a proxy to indicate the indirect flood exposure that hampers the business operation.

Two control variables were included in our data set. To control whether the effectiveness of the FRRM influences willingness to contribute, we developed the variable "reduction inundation level." The variable includes the information given in the scenarios about how much each FRRM option reduces the inundation level. We also controlled for the effect of the type of FRRM. The variable "technological option" includes all scenarios with the FRRM options polder system or river expansion. This control variable has two backgrounds. An experiment by Pillutla and Chen (1999) shows that people act less cooperatively if the contribution is made to an economic public good (here, a joint investment fund) rather than to a noneconomic public good (here, a social event). Accordingly, we assumed that the respondents would be less likely to choose the polder system or river expansion. By contrast, investment in FRRMs is traditionally oriented toward technological measures, such as pump or dike systems in developing countries (Abbas, Amjath-Babu, Kächele, Usman, & Müller, 2015; Amendola, Linnerooth-Bayer, Okada, & Shi, 2008). It was expected that the MSMEs would request more technological options and see them as more effective than soft adaptation measures (e.g., joint cleaning of clogged rivers) that are often already undertaken by firms jointly with the community (Neise et al., 2017).

Hypothesis 2 (i.e., adaptive capacities) was tested with two explanatory variables. First, the number of employees (variable "business size") served as a proxy for the firms' endowment of adaptive capacities. Second, we used the information on the development of the turnover of the MSME as a proxy to detect whether the firm was well-positioned competitively. We assumed that the larger the business and the more competitive, the more adaptive capacities (e.g., financial resources, technological capacities) were possessed by the MSME. Therefore, the enterprises could expand their scope for action to adapt more proactively and take a higher investment risk.

Hypothesis 3 (i.e., risk behavior) was tested by the dummy variable "risk-averse behavior." The variable was derived from the risk game conducted (see "Research Design" section). The results obtained served as a proxy to test whether the participant's risk attitude determined willingness to take the risk to invest in a large-scale FRRM. Thus, Option B (i.e., the risk-averse option) was interpreted that the participant was averse to taking the investment risk.

To verify Hypothesis 4 (i.e., good risk governance), we designed five variables. Regarding the first component of good risk governance (i.e., cooperation and fair distribution), the variable "fairness" indicated that the contribution needed was fairly distributed among all firms, and the variable "community support" demonstrated whether the residents contributed to funding of the FRRMs. The variable "self-interest" served as a control variable to test whether the MSMEs were willing to fund the FRRMs without any support from other firms or the community. The control variables "CSR" and "cooperation" were used as proxies to characterize the MSME as typically cooperative ("cooperation") and/or as a firm that demonstrated corporate philanthropic activities ("CSR") to control whether cooperative and/or philanthropic behavior influences voluntary contribution. The integration of both variables addresses the literature on private sector engagement (see McKnight & Linnenluecke, 2016; Tilcsik & Marquis, 2013).

Regarding the second component (i.e., the role of state authorities), we included three variables in our analysis. The variable "political pressure" tested how the request from state authorities influences willingness to contribute. Moreover, we included an assessment of the governmental quality derived from the survey. First, we asked how MSMEs evaluated the
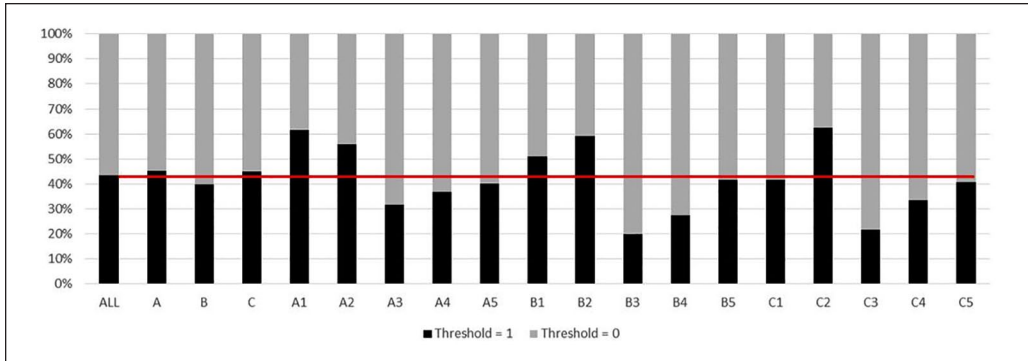
**Figure 3.** Comparison of contribution to flood risk reduction measures (FRRM) in different scenarios (red line = average share of contribution in all scenarios).
*Source.* Authors.

support provided by the government during flood events (variable "support during floods"). Second, we asked MSMEs to assess how easy it is to obtain permissions for construction or export licenses, as a proxy for regulatory quality. Both variables express whether the state authorities are a good role model by supporting flood risk reduction or promoting laws and regulations that might stimulate engagement by MSMEs (Linnenluecke & Griffiths, 2015).

The general control variables "individual adaptation" and "planned relocation" aimed to indicate that the MSME was not willing to contribute because they already implement individual options ("individual adaptation"), such as own pump systems, or envisage leaving the flood-prone location in the near future ("planned relocation"). The control dummy variable "Jakarta" was included in the analysis to compare the MSMEs' willingness to contribute between Jakarta and Semarang.

## Results and Discussion

### Discussion of Descriptive Results

The analysis shows that in 43.3% of all 1,800 observations, respondents are willing to contribute to the presented FRRMs, irrespective of the actor constellations (see Figure 3). This is already a clear indication that firms are willing to participate in collective action. The polder system (Scenarios A1-A5) and the education program (Scenarios C1-C5) are favored over river expansion (Scenarios B1-B5). However, the difference between the three options is not very large.

An analysis of each scenario shows a more differentiated picture. In the scenarios where either the community or other firms will contribute, willingness to engage in FRRMs increases above the average level. The scenarios (A5, B5, and C5), in which state authorities put pressure on the MSMEs, deliver below-average willingness. In the scenarios where no other actor contributes (i.e., self-interest) or the contribution by the other firms is below the provision point threshold (i.e., non-fair contribution), the share of contributing participants falls below the overall average. Especially in the self-interest scenarios, the willingness to engage in collective action is very low. Therefore, it can be indicated: First, that actor constellations have an impact on the participants' willingness to contribute and, second, that scenarios with a fair contribution between other actors (firms or community) lead to a higher share of contributing firms (Hypothesis 4).

With respect to firm-level characteristics, the expected results were obtained (see Table 3): more competitive and successful firms demonstrate higher willingness to contribute voluntarily than less competitive firms (48.5% vs. 42%). These results seem to prove Hypothesis 2. Likewise,

**Table 3.** Impact of Independent Variables on Willingness to Contribute (Share as %).

| Independent variables | If independent variable = yes | | | If independent variable = no | | |
|---|---|---|---|---|---|---|
| | Contributing | Not contributing | Observations | Contributing | Not contributing | Observations |
| Scenario characteristics | | | | | | |
| Technological option | 42.5 | 57.5 | 1,200 | 45.0 | 55.0 | 600 |
| Fairness | 59.2 | 40.8 | 360 | 39.4 | 60.6 | 1,440 |
| Self-interest | 24.4 | 75.6 | 360 | 48.1 | 51.9 | 1,440 |
| Community support | 59.7 | 40.3 | 360 | 39.2 | 60.8 | 1,440 |
| Political pressure | 40.8 | 59.2 | 360 | 44.0 | 56.0 | 1,440 |
| Firm characteristics | | | | | | |
| Risk-averse behavior | 32.4 | 67.6 | 525 | 47.8 | 52,2 | 1,275 |
| High direct flood exposure | 42.8 | 57.2 | 600 | 43.6 | 56.4 | 1,200 |
| Good competitiveness | 48.5 | 51.5 | 375 | 42.0 | 58.0 | 1,425 |
| Individual adaptation | 42.5 | 57.5 | 1,455 | 47.0 | 53.0 | 345 |
| Planned relocation | 35.9 | 64.1 | 435 | 45.7 | 54.3 | 1,365 |
| Corporate social responsibility | 42.0 | 58.0 | 1,425 | 48.5 | 51.5 | 375 |
| Cooperation | 43.4 | 56.6 | 1,590 | 42.9 | 57.1 | 210 |
| Subdistrict characteristics | | | | | | |
| Jakarta | 36.9 | 63.1 | 900 | 49.8 | 50.2 | 900 |

*Note.* Own calculation based on experiments.

risk-averse MSMEs are willing to contribute less than risk-seeking MSMEs (32.4% vs. 47.8%). This seems to verify Hypothesis 3. Interestingly, MSMEs in Jakarta (36.9%) show a considerably less positive attitude toward collaborative action than those in Semarang (49.8%).

For the numeric independent variables, the mean was calculated for the case that the participant is willing to contribute and for the case that he/she is not (see Table 4). Contributing MSMEs are exposed to floods on average one time more than noncontributing MSMEs. This gives a first indication to confirm Hypothesis 1. MSMEs that contribute to FRRMs have fewer employees on average (31.3) than those that do not contribute (42 employees). The result does not seem to support Hypothesis 2.

These descriptive results provide a first insight into the contextual dimensions influencing the willingness of MSMEs to participate in FRRMs and provide preliminary assessments with respect to our hypotheses. In the next section, we applied a multilevel binary logistic regression to examine the importance of independent variables in determining the likelihood of participating in collective action.

## Discussion of Analytical Results

First, we estimated the intercept null model to test whether a multilevel analysis is appropriate. The intercept null model contains no independent variable but decomposes the variance

**Table 4.** Mean and Standard Deviation of Independent Variables.

| | If, willingness to contribute | | | |
| --- | --- | --- | --- | --- |
| | = yes (*n* = 780) | | = no (*n* = 1,020) | |
| Variables | *M* | *SD* | *M* | *SD* |
| Scenario characteristics | | | | |
| Reduction inundation level | 86.1 | 10.6 | 85.9 | 10.3 |
| Firm characteristics | | | | |
| Business size | 31.3 | 55.8 | 42.0 | 65.8 |
| Support during floods | 4.2 | 1.4 | 4.1 | 1.5 |
| Regulatory quality | 4.8 | 1.0 | 4.8 | 1.2 |
| Subdistrict characteristics | | | | |
| Indirect flood exposure | 6.1 | 5.4 | 5.1 | 3.9 |

*Note*. Own calculation based on experiments.

separately into the three independent parts (scenario, firm, and subdistrict characteristics; Hox, 2010). After that, we examined the intracluster correlation. The results show that, in total, 50% of the variance in the likelihood of contributing to FRRMs can be explained by the firm-level and subdistrict-level characteristics. Hence, the scenario characteristics explain 50% whether firms are willing to collaborate. However, the firm-level characteristics have a much stronger effect on the likelihood of participating in FRRMs (46.7%) than those at subdistrict level (3.2%). This result is not surprising because many studies have shown that particularly individual characteristics determine cooperative behavior (for an overview, see Ledyard, 1995). Furthermore, firm-level characteristics are even more important than local flood exposure or the city where the MSME is located to explain willingness to participate in FRRMs.

Taking a closer look at the fixed effects allows the interpretation of the estimated impact of our independent variables on contributing to collective FRRMs. We focus here on Model 3 to discuss the results when all independent variables are included. Table 5 below displays the total results of the analysis.

Regarding Hypothesis 1, it can be stated that the analysis does not indicate any impact of direct' flood exposure to the willingness to cooperate. Surprisingly, direct flood exposure (i.e., variable "high direct flood experience") provides no significant result. However, the number of flood events in the subdistrict increases the likelihood of firms being willing to contribute to FRRMs. But, the impact of local indirect flood exposure is only slightly significantly positive. This shows that general flood proneness matters but does not play a larger role than the firm-level determinants. Hence, Hypothesis 1 can just be confirmed with respect to the indirect flood proneness of the MSME's location, but not with regard to individual flood exposure. It seems that the enterprises are interested in cooperating voluntarily if their neighborhood is inundated. There are two main reasons for this: If the roads are affected by flooding, enterprises suffer from power outages or halted production due to disrupted supply chains. Inundated residential areas also prevent employees from coming to work (Neise & Revilla Diez, 2019).

When it comes to the question of what kind of collective adaptation measures are preferred, the control variable "technological option" indicates that the participants are more likely to fund educational programs than technical solutions, such as the polder system and river expansion. This result confirms the findings of Pillutla and Chen (1999) who showed that people cooperate if the public good has a social purpose. The result also shows that the MSMEs do not feel responsible for providing flood risk infrastructure, but they are encouraged to fund soft adaptation measures.

**Table 5.** Multilevel Binary Logistic Regression Results for Voluntary Contribution to Flood Risk Reduction Measures.

| Fixed effects | Odds ratio (Standard error) Model 0 | Odds ratio (Standard error) Model 1 | Odds ratio (Standard error) Model 2 | Odds ratio (Standard error) Model 3 |
|---|---|---|---|---|
| Scenario characteristics | | | | |
| Technological option | | 0.571*** (0.117) | 0.571*** (0.117) | 0.571*** (0.117) |
| Reduction inundation level | | 1.023** (0.009) | 1.023** (0.009) | 1.023** (0.009) |
| Fairness | | 6.192*** (1.285) | 6.185*** (1.283) | 6.190*** (1.284) |
| Self-interest | | 0.541*** (0.112) | 0.541*** (0.112) | 0.540*** (0.112) |
| Community support | | 6.446*** (1.342) | 6.439*** (1.340) | 6.443*** (1.341) |
| Political pressure | | 1.775*** (0.349) | 1.775*** (0.350) | 1.776*** (0.350) |
| Firm characteristics | | | | |
| Risk-averse behavior | | | 0.237*** (0.109) | 0.298** (0.133) |
| High direct flood exposure | | | 0.978 (0.413) | 1.153 (0.471) |
| Business size | | | 0.992** (0.003) | 0.992** (0.003) |
| Good competitiveness | | | 3.102** (1.674) | 2.966** (1.540) |
| Individual adaptation | | | 0.352** (0.189) | 0.310** (0.163) |
| Planned relocation | | | 0.524 (0.245) | 0.590 (0.268) |
| Corporate social responsibility | | | 0.765 (0.385) | 0.633 (0.308) |
| Cooperation | | | 0.505* (0.209) | 0.582 (0.234) |
| Support during floods | | | 1.192 (0.175) | 1.273* (0.183) |
| Regulatory quality | | | 0.722 (0.145) | 0.704* (0.137) |
| Subdistrict characteristics | | | | |
| Indirect flood exposure | | | | 1.076* (0.044) |
| Jakarta | | | | 0.310*** (0.124) |
| Constant | −0.493** (0.209) | 0.055*** (0.041) | 0.243 (0.350) | 0.316 (0.450) |
| Random effects | | | | |
| Subdistrict (_cons) | 0.212 | 0.299 | 8.66e-13 | 2.00e-33 |
| Subdistrict > firm (_cons) | 3.072 | 4.440 | 3.831 | 3.465 |
| Model fit statistics | | | | |
| Observations | 1,800 | 1,800 | 1,800 | 1,800 |
| ICC subdistrict | 0.032 | 0.037 | 1.217e-13 | 2.966e-34 |
| ICC firm | 0.467 | 0.553 | 0.538 | 0.513 |
| Prob > chi2 | 0.000 | 0.000 | 0.000 | 0.000 |
| Deviance | 2026.457 | 1786.223 | 1763.775 | 1753.423 |

*Source.* Own calculation.
Note. ICC= intracluster correlation.
*Significant at 10% level ($p < .1$). **Significant at 5% level ($p < .05$). ***Significant at 1% level ($p < .01$).

With regard to the expected positive impact of sufficient adaptive capacities, the result shows that the increasing turnover of an MSME enforces its willingness to contribute. The MSMEs clearly recognize their own benefits in participating in collective FRRMs, which increases the likelihood of their willingness to contribute. In this respect, Hypothesis 2 can be confirmed. However, the variable "business size" contradicts the hypothesis. The analysis shows that the smaller the business, the more likely the MSME is willing to participate in collective action. The result is slightly significant. Because of limited resources, smaller firms see the advantages of pooling assets for effective collective FRRMs.

Our result on risk behavior confirms Hypothesis 3. If the firms' decision makers are risk-averse, then they are less willing to invest in collective FRRMs. Risk-averse behavior has the

strongest impact that decreases the willingness to cooperate. This also confirms the results obtained by Teyssier (2012), according to which, risk-averse participants are willing to contribute less to the provision of a public good. The result suggests that the investment risk of FRRMs should be alleviated, for instance, through an insurance scheme to increase the participation of risk-averse owners or managers. Furthermore, the risk might be shared among actors affected within a governance system, as Hypothesis 4 investigates.

Regarding Hypothesis 4, it can be shown that the respondents are more likely to contribute to the provision of FRRMs, either if the contribution is distributed fairly among the firms or if the community also contributes. These two variables are the most significant indicators that increase the likelihood of participating in collective adaptation measures. The control variable "self-interest" decreases the likelihood of participation significantly. The firms do not strive to fund a collective FRRM alone. This result is not surprising and confirms the findings of other studies revealing that players acknowledge reciprocity, that is, conditional cooperation (e.g., Fehr & Gächter, 2000b; Fischbacher et al., 2001). Moreover, these results underpin the fact that the participants seek to collaborate within a good risk governance system where all the affected actors contribute to the provision of the FRRMs.

Compared with the literature on private sector engagement, the result clearly demonstrates that MSMEs are more driven by social motives than their self-interest to strengthen their reputation or purely their competitiveness. This finding contradicts the findings of large and multinational firms that rather see disaster risk reduction as a business opportunity or as a philanthropic purpose (e.g., Biagini & Miller, 2013; Izumi & Shaw, 2015; Tilcsik & Marquis, 2013).

However, we did not find evidence that enterprises' general cooperation behavior and/or their engagement in corporate social responsibility influence their willingness to invest in a collective FRRM. In contrast to large-scale firms, it might also be unlikely that MSMEs are motivated by a philanthropic behavior addressed as an important motivational factor for large-scale firms in the literature (see McKnight & Linnenluecke, 2016; Tilcsik & Marquis, 2013). The control variable "cooperation" provides no significant relationship. It seems that pure business relationships with other firms do not play any role. However, the variable "fairness" demonstrates that MSMEs aim to alleviate the flood risk with their neighboring firms, even if they might be their competitors. Combined with the positive impact of the variable "community support," it can be stated that the enterprises are interested in sharing the costs between all affected firms and residents to improve local conditions together. Our in-depth interviews revealed that the enterprises are highly attached to their location and interested in having a good relationship with their neighbors because the residents are often their employees and the firms help each other in difficult times, for instance, during flood events (see Neise & Revilla Diez, 2019).

Because a good risk governance system also includes the responsibility of the government, the analysis shows that Hypothesis 3 can be partially confirmed. If governmental support during flood events is assessed positively by the MSMEs, then they, in turn, are also more willing to contribute to collective FRRMs. In contrast, the more positively the regulatory quality is assessed, the less likely it is that the MSMEs will contribute. The different results can be interpreted as follows: On the hand, the firms appreciate active governmental flood relief. Consequently, they are also more motivated to contribute to proactive FRRMs and to support the flood mitigation policy. On the other hand, firms are more likely to take the initiative themselves if the state authorities promote private sector development by well-formulated regulations. The result is in line with the ideas of private sector engagement that sound regulatory frameworks can stimulate firms to invest in disaster risk reduction (Agrawala et al., 2011). However, our prior in-depth interviews showed that the firms' engagement is also hampered by very bureaucratic and time-consuming procedures.

Regarding political pressure, the results indicate a significant positive impact on the likelihood of contribution. It can be stated that a good risk governance system that includes law

enforcement by state authorities has a positive impact on the firms' willingness to participate in collective adaptation. This result underpins that the firms comply with the laws and regulations. Hypothesis 4 can, therefore, be verified. However, our interviews revealed that firms are dissatisfied with this policy because they miss a similar engagement of state authorities. As a consequence, in particular, large firms comply with this policy but reduce further engagement on other corporate social responsibility activities (see Neise et al., 2017). As a result, the firms do not engage in polder systems that might reduce the in-situ flood risk and from which society and also the firms could benefit. Hence, it is suggested that the impact of regulations and laws on voluntary contribution should be further examined.

Interestingly, our multilevel analysis confirms that MSMEs in Jakarta are less likely to contribute than firms in Semarang. This result can be explained in two ways. First, firms in Semarang demonstrate a more collaborative commitment than those in Jakarta. This confirms findings according to which collective action can be undertaken more easily in relatively smaller communities (e.g., Curry, 2015). Second, firms in Jakarta do not see a high necessity to fund their own FRRMs. More considerable, state-led, and internationally funded FRRMs have been taking place in Jakarta recently (The World Bank, 2014), whereas the study sites in Semarang have been largely disregarded by such initiatives. In addition, the analysis demonstrates that individual adaptation significantly decreases the enterprises' willingness to cooperate because they perceive their own activities, such as sandbags or a pump system, as sufficient. However, our field study has confirmed that these adaptation measures barely alleviate flood risk (see Neise & Revilla Diez, 2019). Regarding the impact of plans to relocate business activities, the analysis does not reveal any significant relationship.

In sum, the multilevel analysis presents clearly that the scenario and firm-specific explanatory variables explain whether MSMEs are willing to contribute to FRRMs. Especially the firms' adaptive capacities are important contextual dimensions that show whether the participants are willing to contribute or not. Competitive firms are more likely to increase voluntary contributions, whereas risk-averse behavior decreases the likelihood of cooperation. Regarding social motives, it can be stated that voluntary contributions to FRRMs are more likely if the contribution is fair and supported by the community (Fehr & Gächter, 2000b; McKnight & Linnenluecke, 2016). This also stresses that willingness to provide a collective FRRM requires a good risk governance system that includes the engagement of state authorities and apparently a certain pressure on the firms by state authorities. However, our in-depth interviews highlighted that political pressure also frustrates the firms especially if they are dissatisfied with governmental support. Moreover, it decreases the voluntary engagement of the firms (see Neise et al., 2017). Hence, legal obligations should be carefully designed so that they do not discourage the firms' voluntary engagement in disaster risk reduction and other social, ecological, or economic activities. Moreover, the different results between Jakarta and Semarang demonstrate that local characteristics play a crucial role.

## Conclusion

### Summary

Surprisingly, studies on the willingness of the private sector to participate in collective adaptation measures are scarce, particularly regarding the role of MSMEs. This article, therefore, investigated the conditions under which MSMEs are willing to contribute voluntarily to FRRMs. Because of considerable flood exposure and the absence of adequate flood risk reduction, Jakarta and Semarang represent good examples of many flood-prone areas in Southeast Asia were MSMEs are often left alone to protect their businesses and their local environment.

Overall, this article provides four contributions to the literature. First, because MSMEs are generally neglected in the discourse on private sector engagement, this study developed an

analytical framework that aimed to bring MSMEs—the most common form of firms in developing countries—into this debate and to outline how collective adaptation toward FRRMs can arise. Based on the literature from behavioral economics, governance, and adaptation studies, the analytical framework considered contextual dimensions at three connected levels: the firm, the business owner as the main decision maker, and the institutional environment. Theoretically, it was pointed out that collective adaptation is not easily achievable. Public goods are not satisfactorily produced by the state, and firms have no incentive to fund a public good because noncontributors can free-ride. This is particularly relevant for FRRMs because they are typically regarded as public goods. Public goods games examine under which conditions collective action can be achieved. Social motives, such as fairness or trust, play an important role in increasing cooperative behavior.

Second, this article provides a novel approach in methodological terms, called scenario-based field experiments. The basic assumptions of public goods games were combined with the scenario design by vignette studies. This combination made it possible to examine whether firms are willing to contribute to collective adaptation. Based on three different FRRM options (polder system, river expansion, and education program) and five different actor constellations, a total of 15 scenarios were judged by 120 participants from MSMEs, leading to 1,800 observations.

Third, the analysis showed that in 43% of the 1,800 observations, participants would voluntarily contribute to the provision of FRRMs. This result corresponds to the large number of experiments where the success rate ranges between 40% and 60%. Running a multilevel analysis revealed that, primarily, social motives and firms' adaptive capacities have strong explanatory power in explaining the MSMEs' willingness to contribute. This study demonstrates that, in contrast to the results from large firms, MSMEs are less encouraged by their pure self-interest (e.g., reputational benefits through corporate philanthropy) to contribute to the provision of a public good (i.e., large-scale FRRMs). Rather, the enterprises are interested in participating in a joint, fairly distributed collective adaptation that will also substantially reduce their own flood risk (i.e., a good risk governance system). Our results on the importance of social motives correspond with earlier field and laboratory studies and complement the literature on private sector engagement that primarily focuses on large and multinational firms.

Fourth, we also show that MSMEs are also more likely to contribute if government support during flood incidents is evaluated positively. Therefore, the voluntary contribution of firms should be seen more as additional support to leverage flood risk reduction but not as a substitute for the duty of the state. Reliable state authorities with sufficient public funding are still crucial to guide, supervise, and maintain FRRMs. Interestingly, the analysis also reveals a locational difference in the willingness to contribute to FRRMs. MSMEs in Semarang are more willing to contribute than those in Jakarta.

In sum, our analysis provided a more deciphered perspective on how MSMEs might be willing to contribute to collective FRRMs. Particularly, we underpin that contextual dimensions (e.g., social motives, firms' adaptive capacities) at three intertwined levels (i.e., firm, individual, and the institutional environment) explain whether MSMEs contribute voluntarily or not. In particular, we attempted to demonstrate the usefulness of linking research on collective adaptation with the methodological considerations of behavioral economics. We pointed out that public goods games through scenario-based field experiments can provide meaningful insights on how MSMEs can be better integrated into collective adaptation. Such engagement is not only missing in the flood-prone cities of Jakarta and Semarang but also in many places in developing countries (e.g., Bangkok, Ho Chi Minh City).

## Policy Recommendations

Because this article addresses the current debate on how firms can support disaster risk reduction, which has attracted considerable attention in political discourse, we derive some policy implications based on our analysis.

First, the engagement of firms, particularly MSMEs, can be a powerful tool to support state agencies with FRRMs. Our analysis underpins the idea that private sector engagement in FRRMs should not focus predominantly on large-scale multinational enterprises. Although their engagement is valuable and should be enhanced, locally embedded MSMEs should be integrated into political programs, encouraging more engagement in collective adaptation directed at the needs of the vast majority of firms in developing countries, namely, MSMEs. In this respect, sound risk governance systems can be a powerful tool to implement and legitimate collective FRRMs. Care should be taken to ensure that the engagement by MSMEs resonates with the needs of the community, civil society, and political will.

Second, policy interventions aimed at increasing the contribution made by MSMEs should be carried out carefully. A large number of experimental studies (e.g., Fehr & Gächter, 2000a; Nikiforakis, 2008) have shown that punishing free-riding can increase the willingness to cooperate. On the one hand, such pressure mechanisms might increase the willingness of firms that do not normally contribute. On the other hand, a reward system should be implemented in addition (e.g., tax reduction) for those firms that demonstrate a cooperative and prosocial strategy. However, policy instruments that publicize prosocial behavior might be a more promising approach to reward firms with a more public reputation (The World Bank, 2015).

Third, a conducive institutional environment that fosters the role of MSMEs as crucial social partners in the local economy should be strengthened. A reliable government or tax reduction programs for social commitment can encourage the firms' willingness to organize their business strategies in line with local needs. For instance, they may launch environmental or education programs that improve environmental protection and the education level of the residents.

Fourth, the focus of disaster risk reduction should also focus on second-tier cities. Compared with large cities, they more frequently lack international and national funding to reduce their exposure to natural hazards (Birkmann et al., 2016). Second-tier cities, such as Semarang, might be valuable places to apply a participatory governance approach for disaster risk reduction, where MSMEs and the community are empowered to choose and implement their own desired adaptation schemes.

## Limitations and Future Research

In this article, we have tried a novel approach that nevertheless has limitations. Overall, the study should not be interpreted such that MSMEs' contributions to FRRMs are the panacea to the challenges of effective disaster risk reduction. Rather, we have attempted to demonstrate whether MSMEs are in principle willing to contribute to collective initiatives.

Our analysis is based on a simplified scenario design with just five firms within a small neighborhood, and it can, of course, be argued that a limited number of players would not be able to take on the burden of a large investment for a polder system. However, our main intention was to examine the underlying circumstances that determine the firms' willingness to engage in collective adaptation. The results should be interpreted accordingly. Future research should attempt to enlarge the setting to conduct the field experiment in a more realistic manner. However, controllability of the setting should always be maintained so as not to blur the results.

Moreover, we have excluded detailed information on the personal participants' characteristics (e.g., personal values, beliefs). Our main interest was in the cooperative behavior of MSMEs, and the scope of the experiments had to be restricted so as not to overload the participants. Thus, we mainly focused on firm-level characteristics. Because our participants were either the owner or operating manager, their personal motives (e.g., risk behavior) also guide, to a large extent, the strategic decisions of the enterprise. However, replicated scenario-based field experiments should focus more on the individual level, particularly personal motives and values. This might reveal a

more deciphered perspective on whether the firms' inherent characteristics or personal motives most influence the cooperative behavior of MSMEs.

Unfortunately, the analysis is unable to examine the impact of the institutional setting in detail as no statistical information was available. Therefore, the results should be interpreted with caution because they are based on the participants' personal assessments. The results might be biased because the participants answered according to general social expectations. Therefore, it is further recommended to carry out the field experiments with a control group and to conduct similar scenario-based field experiments in other natural and cultural settings to improve the external validity that is a typical weakness of field experiments.

## ORCID iD

Thomas Neise  https://orcid.org/0000-0001-6080-6725

## References

Abbas, A., Amjath-Babu, T. S., Kächele, H., Usman, M., & Müller, K. (2015). An overview of flood mitigation strategy and research support in South Asia: Implications for sustainable flood risk management. *International Journal of Sustainable Development & World Ecology*, *23*, 98-111.

Agrawala, S., Maëlis, C., Kingsmill, N., Lanzi, E., Mullan, M., & Prudent-Richard, G. (2011). *Private sector engagement in adaptation to climate change: Approaches to managing climate risks* (OECD Environment Working Papers: Vol. 39). Retrieved from http://dx.doi.org/10.1787/5kg221jkf1g7-en

Amendola, A., Linnerooth-Bayer, J., Okada, N., & Shi, P. (2008). Towards integrated disaster risk management: Case studies and trends from Asia. *Natural Hazards*, *44*, 163-168.

Atzmüller, C., & Steiner, P. M. (2010). Experimental vignette studies in survey research. *Methodology*, *6*, 128-138.

Badan Pusat Statistik. (2015). *Village Potential Survey 2014*. Retrieved from http://microdata.bps.go.id /mikrodata/index.php/catalog/599

Bahinipati, C. S., Rajasekar, U., Acharya, A., & Patel, M. (2017). Flood-induced loss and damage to textile industry in Surat City, India. *Environment and Urbanization Asia*, *8*, 170-187.

Bardsley, N. (2010). *Experimental economics: Rethinking the rules*. Princeton, NJ: Princeton University Press.

Biagini, B., & Miller, A. (2013). Engaging the private sector in adaptation to climate change in developing countries: Importance, status, and challenges. *Climate and Development*, *5*, 242-252.

Birkmann, J., Garschagen, M., Kraas, F., & Quang, N. (2010). Adaptive urban governance: new challenges for the second generation of urban adaptation strategies to climate change. *Sustainability Science*, *5*, 185-206.

Birkmann, J., Welle, T., Solecki, W., Lwasa, S., & Garschagen, M. (2016). Boost resilience of small and mid-sized cities. *Nature*, *537*, 605-608.

Cameron, L., & Shah, M. (2015). Risk-taking behavior in the wake of natural disasters. *Journal of Human Resources*, *50*, 484-515.

Cardenas, J. C. (2011). Social norms and behavior in the local commons as seen through the lens of field experiments. *Environmental & Resource Economics*, *48*, 451-485.

Carpenter, J., & Cardenas, J. C. (2011). An intercultural examination of cooperation in the commons. *Journal of Conflict Resolution*, *55*, 632-651.

Chaudhuri, A. (2011). Sustaining cooperation in laboratory public goods experiments: A selective survey of the literature. *Experimental Economics*, *14*, 47-83.

Chaudhuri, A., & Paichayontvijit, T. (2006). Conditional cooperation and voluntary contributions to a public good. *Economic Bulletin*, *3*, 1-14.

Croson, R., Anand, J., & Agarwal, R. (2007). Using experiments in corporate strategy re-search. *European Management Review*, *4*, 173-181.

Curry, D. (2015). *Network approaches to multi-level governance. Structures, relations and understanding power between levels*. Houndmills, England: Palgrave Macmillan.

Delmas, M. A., & Aragón-Correa, J. A. (2016). Field experiments in corporate sustainability research. *Organization & Environment*, *29*, 391-400.

Djalante, R., Holley, C., & Thomalla, F. (2011). Adaptive governance and managing resilience to natural hazards. *International Journal of Disaster Risk Science*, *2*, 1-14.

Duflo, E. (2006). *Field experiments in development economics* (Working Paper). Retrieved from https://pdfs.semanticscholar.org/7bf1/53f4e0c7480572a01ce00e8c494b4732f9ec.pdf

Ehmke, M. D., & Shogren, J. F. (2009). Experimental methods for environment and development economics. *Environment and Development Economics*, *14*, 419-456.

Engel, C., & Zhurakhovska, L. (2014). Conditional cooperation with negative externalities – An experiment. *Journal of Economic Behavior & Organization*, *108*, 252-260.

Fehr, E., & Gächter, S. (2000a). Cooperation and punishment in public goods experiments. *American Economic Review*, *90*, 980-994.

Fehr, E., & Gächter, S. (2000b). Fairness and retaliation: The economics of reciprocity. *Journal of Economic Perspectives*, *14*, 159-182.

Fischbacher, U., Gächter, S., & Fehr, E. (2001). Are people conditionally cooperative? Evidence from a public goods experiment. *Economics Letters*, *71*, 397-404.

Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources*, *30*, 441-473.

Gayo, S., & Yeon, A. L. (2013). *Mandatory CSR law in Indonesia: New emerging policy* (Working Paper 7th Conference Universiti Utara Malaysia International Legal Conference). Retrieved from http://repo.uum.edu.my/16085/

Geaves, L. H., & Penning-Rowsell, E. C. (2016). Flood risk management as a public or a private good, and the implications for stakeholder engagement. *Environmental Science & Policy*, *55*, 281-291.

Groothuis, P. A., & Whitehead, J. C. (2009). The provision point mechanism and scenario rejection in contingent valuation. *Agricultural and Resource Economics Review*, *38*, 271-280.

Harrison, G. W., & List, J. A. (2004). Field experiments. *Journal of Economic Literature*, *42*, 1009-1055.

Hox, J. J. (2010). *Multilevel analysis: Techniques and applications* (2nd ed.). Quantitative methodology series. New York, NY: Routledge.

Hox, J. J., Kreft, I. G. G., & Hermkens, P. L. J. (1991). The analysis of factorial surveys. *Sociological Methods & Research*, *19*, 493-510.

International Recovery Platform. (2016). *Guidance note on recovery: Private sector*. Kobe, Japan: Author.

Izumi, T., & Shaw, R. (2015). Overview and Introduction of the private sector's role in disaster management. In T. Izumi & R. Shaw (Eds.), *Disaster risk reduction, methods, approaches and practices: Disaster management and private sectors: Challenges and potentials* (pp. 1-10). Tokyo, Japan: Springer.

Kato, M., & Charoenrat, T. (2018). Business continuity management of small and medium sized enterprises: Evidence from Thailand. *International Journal of Disaster Risk Reduction*, *27*, 577-587.

Kocher, M. G., Martinsson, P., Matzat, D., & Wollbrant, C. (2015). The role of beliefs, trust, and risk in contributions to a public good. *Journal of Economic Psychology*, *51*, 236-244.

Kreibich, H., Müller, M., Thieken, A. H., & Merz, B. (2007). Flood precaution of companies and their ability to cope with the flood in August 2002 in Saxony, Germany. *Water Resources Research*, *43*, W03408. doi:10.1029/2005WR004691

Kreibich, H., Seifert, I., Thieken, A. H., Lindquist, E., Wagner, K., & Merz, B. (2011). Recent changes in flood preparedness of private households and businesses in Germany. *Regional Environmental Change*, *11*, 59-71.

Lebel, L., Anderies, J. M., Campbell, B., Folke, C., Hatfield-Dodds, S., Hughes, T. P., & Wilson, J. (2006). Governance and the capacity to manage resilience in regional social-ecological systems. *Ecology & Society*, *11*, 19. Retrieved from http://www.ecologyandsociety.org/vol11/iss1/art19/

Ledyard, J. O. (1995). Public goods: A survey of experimental research. In A. E. Roth & J. H. Kagel (Eds.), *The handbook of experimental economics* (pp. 111-194). Princeton, NJ: Princeton University Press.

Levitt, S. D., & List, J. A. (2007). What do laboratory experiments measuring social preferences reveal about the real world? *Journal of Economic Perspectives*, *21*, 153-174.

Linnenluecke, M. K., & Griffiths, A. (2015). *The climate resilient organization: Adaptation and resilience to climate change and weather extremes*. Cheltenham, England: Edward Elgar.

Marks, D., & Thomalla, F. (2017). Responses to the 2011 floods in Central Thailand: Perpetuating the vulnerability of small and medium enterprises? *Natural Hazards*, *87*, 1147-1165.

Marks, M., & Croson, R. (1998). Alternative rebate rules in the provision of a threshold public good: An experimental investigation. *Journal of Public Economics*, *67*, 195-220.

Martinsson, P., Pham-Khanh, N., & Villegas-Palacio, C. (2013). Conditional cooperation and disclosure in developing countries. *Journal of Economic Psychology*, *34*, 148-155.

McKnight, B., & Linnenluecke, M. K. (2016). How firm responses to natural disasters strengthen community resilience: A stakeholder-based perspective. *Organization & Environment*, *29*, 290-307.

Neise, T., & Revilla Diez, J. (2019): Adapt, move or surrender? Manufacturing firms' routines and dynamic capabilities on flood risk reduction in coastal cities of Indonesia. *International Journal of Disaster Risk Reduction*, *33*, 332-342.

Neise, T., Revilla Diez, J., & Garschagen, M. (2018): Firms as drivers of integrative adaptive regional development in the context of environmental hazards in developing countries and emerging economies: A conceptual framework. *Environment and Planning C*, *36*, 1522-1542.

Neise, T., Revilla Diez, J., Garschagen, M., Djalante, R., Novianti, K., & Syahid, C. N. (2017). Manufacturing firms' adaptations to floods and proposal for integrative adaptive regional development in Jakarta. In R. Djalante, M. Garschagen, F. Thomalla, & R. Shaw (Eds.), *Disaster risk reduction in Indonesia: Progress, challenges, and issues* (pp. 281-305). Cham, Switzerland: Springer.

Nikiforakis, N. (2008). Punishment and counter-punishment in public good games. Can we really govern ourselves? *Journal of Public Economics*, *92*, 91-112.

Oll, J., Hahn, R., Reimsbach, D., & Kotzian, P. (2018). Tackling complexity in business and society research: The methodological and thematic potential of factorial surveys. *Business & Society*, *57*, 26-59.

Ones, U., & Putterman, L. (2007). The ecology of collective action: A public goods and sanctions experiment with controlled group formation. *Journal of Economic Behavior & Organization*, *62*, 495-521.

Ostrom, E. (2000). Collective action and the evolution of social norms. *Journal of Economic Perspectives*, *14*, 137-158.

Park, S. E., Marshall, N. A., Jakku, E., Dowd, A. M., Howden, S. M., Mendham, E., & Flem-ing, A. (2012). Informing adaptation responses to climate change through theories of transformation. *Global Environmental Change*, *22*, 115-126.

Pauw, W. P. (2015). Not a panacea: Private-sector engagement in adaptation and adaptation finance in developing countries. *Climate Policy*, *15*, 583-603.

Pillutla, M. M., & Chen, X.-P. (1999). Social norms and cooperation in social dilemmas: The effects of context and feedback. *Organizational Behavior and Human Decision Processes*, *78*, 81-103.

Raudenbush, S. W., & Bryk, A. S. (1992). *Hierarchical linear models: Applications and data analysis methods. Advanced quantitative techniques in the social sciences: Vol. 1*. Newbury Park, CA: Sage.

Rooks, G., Raub, W., Selten, R., & Tazelaar, F. (2016). How interfirm cooperation depends on social embeddedness: A vignette study. *Acta Sociologica*, *43*, 123-137.

Said, F., Afzal, U., & Turner, G. (2015). Risk taking and risk learning after a rare event: Evidence from a field experiment in Pakistan. *Journal of Economic Behavior & Organization*, *118*, 167-183.

Sandee, H. (2016). Improving connectivity in Indonesia: The challenges of better infrastructure, better regulations, and better coordination. *Asian Economic Policy Review*, *11*, 222-238.

Sturm, B., & Weimann, J. (2006). Experiments in environmental economics and some close relatives. *Journal of Economic Surveys*, *20*, 419-457.

Sydnor, S., Niehm, L., Lee, Y., Marshall, M., & Schrank, H. (2017). Analysis of post-disaster damage and disruptive impacts on the operating status of small businesses after Hurricane Katrina. *Natural Hazards*, *85*, 1637-1663.

Taylor, B. J. (2006). Factorial surveys: Using vignettes to study professional judgement. *British Journal of Social Work*, *36*, 1187-1207.

Teyssier, S. (2012). Inequity and risk aversion in sequential public good games. *Public Choice*, *151*, 91-119.

Tilcsik, A., & Marquis, C. (2013). Punctuated Generosity: How mega-events and natural dis-asters affect corporate philanthropy in U.S. communities. *Administrative Science Quarterly*, *58*, 111-148.

UNISDR. (2015). *Sendai Framework for Disaster Risk Reduction 2015-2030*. Retrieved from http://www.unisdr.org/we/inform/publications/43291.

Wallander, L. (2009). 25 Years of factorial surveys in sociology: A review. *Social Science Research*, *38*, 505-520.

Weber, J. M., Kopelman, S., & Messick, D. M. (2004). A conceptual review of decision making in social dilemmas: Applying a logic of appropriateness. *Personality and Social Psychology Review*, *8*, 281-307.

Wedawatta, G., & Ingirige, B. (2012). Resilience and adaptation of small and medium-sized enterprises to flood risk. *Disaster Prevention and Management*, *21*, 474-488.

The World Bank. (2014). *FAQ: Jakarta Emergency Dredging Initiative Project*. Retrieved from www.worldbank.org/en/country/indonesia/brief/jakarta-emergency-dredging-initiative-project-overall-project-scope-and-implementation

The World Bank. (2015). *World Development Report 2015: Mind, society, and behavior*. Washington, DC: Author.

## Author Biographies

**Thomas Neise** holds a PhD in Geography from the University of Cologne. In his PhD-thesis, he focused on firms′ adaptation strategies to floods in Indonesian cities. His research interests include Economic Geography, vulnerability research, regional development in the Global South, and Behavioral Economics with emphasis on Indonesia.

**Maxensius Tri Sambodo** works as a senior researcher of the Indonesian Institute of Sciences. He is also a visiting fellow alumnus from the Institute of Southeast Asian Studies (ISEAS), Singapore. His research interests are on economic development, energy, environment, and natural resources.

**Javier Revilla Diez** holds a Professorial Chair in Human Geography at the Institute of Geography and is associated with the Global South Study Center at the University of Cologne. He has research interests in the regional outcomes of participating in global production networks, regional impacts of transformation processes induced by political and structural change, and impacts of natural risks on people, firms, and regions.