Progress in Disaster Science 17 (2023) 100278

Contents lists available at ScienceDirect

Progress in Disaster Science

journal homepage: www.elsevier.com/locate/pdisas

Social protection for climate-disasters: A case study of the program Keluarga Harapan cash transfer program for smallholder farm household in Indonesia

Irene Sondang Fitrinitia [a,*], Mihoko Matsuyuki [b]

[a] Graduate School of Urban Innovation, Yokohama National University, 79-5 Tokiwadai, Hodogaya-ku, Yokohama 240-8501, Japan
[b] Institute of Urban Innovation, Yokohama National University, 79-5 Tokiwadai, Hodogaya-ku, Yokohama 240-8501, Japan

ARTICLE INFO

Keywords:
Cash transfer
Social protection
Climate disaster
Program Keluarga Harapan (PKH)
Livelihood capital
Coping strategy

ABSTRACT

Households living in poverty have a double burden when the adverse impact of natural disasters disrupts their livelihoods. Additionally, households relying on climate-sensitive sectors, such as agriculture and natural resources, have fewer resources to cope with climate change. Subsequently, external support, such as social protection, is needed to protect their assets and livelihoods. An example of social protection designed to strengthen the livelihoods of households living in poverty during disasters is the Program Keluarga Harapan (PKH) cash transfer program in Indonesia. This study analyzes how the PKH contributes to disaster management in Indonesia with two objectives: identifying whether the PKH program helps smallholder farm households (SFH) in developing coping strategies for climate change-related disasters and determining which factors of the PKH program enhance coping strategies among SFH. A mixed-method approach using a confirmatory factor analysis and structural equation modeling was applied to a dataset created from SFH questionnaire samples, followed by in-depth interviews. According to the results, the PKH cash transfer program directly impacted the coping strategies and indirectly impacted the livelihood capital of SFH. Furthermore, the results indicated the key factors that support coping strategies, to which PKH contribute through counseling or mentoring sessions and provide access to other assistance and aid.

1. Introduction

1.1. Background and objectives

Climate change adversely impacts many aspects of the livelihoods of people living in poverty, especially those who depend on climate-sensitive sectors such as agriculture. Additionally, smallholder farmer households (SFH) have fewer coping strategies against the negative impacts of climate change because of low levels of savings, lack of property insurance, and poor access to public services [7,45]. However, SFH could improve their coping strategies for climate change if their livelihood capital improved [39].

Coping strategies are linked to smallholder farmers' livelihood capital, which is disrupted by climate change and includes the resources necessary for sustainable livelihoods [19,21]. Livelihood capital can be used to understand whether a household has the strategies to cope with shocks or stress, including those caused by climate change ([35]; Q. [80]). Subsequently, cross-cutting interventions aimed at households living in poverty should support livelihood capital and improve the capacity to withstand climate change [12,23]. Moreover, social protection (SP) is an approach used to reduce poverty by protecting livelihood capital and supporting the income and consumption of households living in poverty [26,72]. As part of SP, livelihood capital including human, financial, social, and physical capital can enhance the welfare of households living in poverty, such as during disasters [32,47], and plays a significant role in adaptation strategies being adopted to cope with climate change [39]. Therefore, livelihood capital is an intermediary determinant of how SP moderates the adverse effects of climate change.

In addition to its original objective of poverty reduction, SP supports adaptation and mitigation strategies in the event of disasters, and

Abbreviations: PKH, Program Keluarga Harapan; SP, Social Protection; SFH, Smallholder Farmer Household; C-RD, Climate Related Disasters; FDS, Family Development Session.

* Corresponding author.
E-mail addresses: irene-fitrinitia-pr@ynu.ac.jp (I.S. Fitrinitia), matsuyuki-mihoko-ht@ynu.ac.jp (M. Matsuyuki).

https://doi.org/10.1016/j.pdisas.2023.100278
Received 3 August 2022; Received in revised form 26 December 2022; Accepted 4 February 2023
Available online 10 February 2023

research has revealed the impact of SP's practice in several countries ([27,68]; H. [79]). For example, a study [61] found that SP instruments like access to credit and public works programs were the most effective ways to reduce the impact of climate change and the vulnerability of rural rice-farming households in Java, Indonesia. The Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), India's flagship SP program, contributed to livelihood capital through strategies to deal with extreme weather. Part of its program strengthened crop production and reduced the risk of crop failure [20,47]. However, research on the relationship between SP and farmers' capacity for coping with disasters is still limited.

As a nationwide cash transfer program in Indonesia, the Program Keluarga Harapan (PKH) has the following three advantages for its beneficiaries: it improves their financial status through cash transfers; strengthens human and social capabilities through training and workshops; and enables them to assess other forms of aid, especially from the government. The targets of the PKH are households living in poverty [51], and it is the only nationwide program that provides cash conditional transfer for low-income households in Indonesia. To complement the PKH function as a poverty eradication tool and welfare improvement, the Government of Indonesia also established *Indonesia Pintar* as a cash transfer for education and *Rastra* (now called BPNT or Bantuan Pangan Non Tunai), which provides staple food support for low-income families [78]. PKH positively affects a low-income individual's expenditure levels and was derived from previous research and a welfare approach that looks at income and consumption-based practices [34]. Similar results have emerged from a cash transfer program in Columbia called *Familias de Accion*, which increased the expenditures of low-income households [8]. In terms of expenditures, PKH could increase the spending of its beneficiaries by 4.8% per month. Meanwhile, the *Pantawid Pamilyang Pilipino Program*, a cash transfer program in the Philippines, increases expenditure by 3% per month [46,71]. In terms of school enrollment, however the PKH intervention did not significantly reduce child labor in the short term [41]. The results differ significantly between the household that receives *Oportunidades*, a cash transfer program in Mexico, that increases the number of students enrollment compared to non-beneficiary households [55].

Furthermore, while the PKH is not related to disaster mitigation, previous research has demonstrated that cash transfer can mitigate the vulnerability of households living in poverty when exposed to climate-related shocks and stresses [24]. However, the relationship between cash transfers and climate change adaptation has been insufficiently analyzed [5,23,77].

Therefore, this research explores the relationship between cash transfer programs as part of SP interventions and coping strategies for climate-related disasters (C-RD) using a case study on smallholder farmers' livelihoods in Indonesia's largest rice-producing area. This research assumes that while PKH was not originally designed to address natural disasters, it can improve farmers' coping strategies for disasters. Subsequently, this research has two main objectives: identifying how PKH builds coping strategies for C-RD and determining which factors enhance these coping strategies.

1.2. Implementing program Keluarga Harapan in Indonesia

The Government of Indonesia initiated the PKH through the Ministry of Social Affairs in 2007 to assist households living in poverty that are designated as PKH beneficiary households. PKH is a conditional cash transfer program that provides access to health care, education, and other SP services [46]. As stipulated in the Ministry of Social Affairs Number 1 of 2018, Article 5 regulation, potential beneficiaries of the PKH must meet specific health, education, and welfare criteria.

In 2016, the PKH was the third-largest conditional cash transfer program globally, with a large and rapid expansion in coverage from 3.5 million households in 2015 to 6 million households by the end of 2016 and 10 million households in 2018. PKH beneficiaries are poor households, including 9.22% of Indonesians living below the poverty threshold of Rp.370,910 (USD 27) per month per capita based on the year [28,66]. This is a household poverty threshold of Rp.1,483,640 per month (USD 106). Each PKH beneficiary household receives a fixed monthly cash transfer of Rp. 550,000 (USD 39), and household members have additional allowances depending on their children's education and health status. Subsidies are given to a maximum of four people in one family, and total grants can reach Rp. 7,350,000 (USD 525) per year or around Rp. 612,500 (USD 44) per month [46].

The average nominal wage of agricultural laborers is Rp. 49,500 (USD 3.5) per day or around Rp.1,188,000 (USD 85) per month (UNESCAP [28]), which is below the poverty threshold. Hence, the additional cash from the PKH program can boost incomes and the expenditure of poor households above the poverty threshold.

In addition to cash transfers, PKH beneficiaries also receive non-cash components. They receive mentoring assistance from local PKH social workers for Family Development Sessions (FDS), which includes monthly meetings to improve parenting skills, healthy behaviors, and the household's productive economy. They are also provided with free health, education, and social services. The beneficiaries are also part of the Integrated Social Welfare Data and can access additional assistance from other government programs [46,51,78], and PKH beneficiaries are prioritized for access to these SP programs.

1.3. Smallholder farm households and climate change in Indonesia

In 2019, agriculture production accounted for 13% of the Indonesian GDP and provided a livelihood for 25 million farming households [56]. Additionally, Indonesia is one of the world's most active disaster hotspots [62], with hydrological and climate-related hazards dominating natural disaster events from 2005 to 2019 [48] Therefore, floods and drought greatly impact the agricultural sector [4,73]. The direct impact is a decreased in agricultural productivity resulting from high air temperatures and changes in rainfall patterns (Ananda et al., 2019; Bappenas & Kaji Ulang Ran Api [9]). Among Indonesia's 25 million farm households, 17 million are smallholder rice farmers with average land ownership of 0.6 ha [56]. Since these rice farmers are usually SFH, they are more vulnerable to external shocks, such as floods or drought, as they are usually SFH [56].

2. Literature review and hypotheses

The associations among SP, livelihood capital, and coping strategies are complex. This research examines the direct effect of cash transfers as part of an SP intervention on coping strategies and the effect of SP when using intermediaries like livelihood capital for coping strategies, especially by SFH.

2.1. Social protection influences coping strategies in dealing with disasters

SP was designed to reduce inequality, risks, and vulnerability among low-income households and increase their ability to manage shocks to their income [10,18,26]. However, many studies have acknowledged the role of SP as part of countermeasures implemented to anticipate and absorb the adverse effect of disasters ([1,7]; wood al., 2009a; [40]). Additionally, SP reduces poverty and vulnerability to shocks by increasing incomes and food consumption [22]. Several studies have demonstrated that SP presents an opportunity to develop comprehensive risk management strategies to address loss and damage from climate change, including those related to the agriculture [24,74]. Moreover, Davies et al. [24] linked SP to climate change and disaster risk reduction as component of adaptive social protection, focused on agricultural productivity.

Additional empirical studies have been conducted on the agricultural sector [31,69]. For example, Tirivayi et al. [69] demonstrated that SP increases the flexibility of risk-coping strategies, and that cash transfers

are significant income multipliers across local economies. Meanwhile, some scholars have argued that SP instruments such as cash transfers, insurance, social assistance, and public works reduce the negative effects of disasters [36,58,59,75].

Cash transfers provide direct assistance to people living in poverty and encourage them to invest as ex-ante action rather than rely on ex-post emergency measures in response to natural disasters [75]. However, previous studies have indicated that SP projects, such as the Productivity Safety Net Program (PSNP) in Ethiopia (cash transfers, public works, and nutritional feeding programs) and Malawi's Social Action Fund in Malawi, cannot improve agricultural productivity while dealing with natural disasters with additional measures [11,15,20]. For cash transfer to have a direct and significant effect, they should be administered along with other instruments designed to strengthen income-generating capacities or to provide access to financial services [15,16,36]. Even though several previous studies have exposed the positive influence of SP programs on disaster mitigation, there is little empirical evidence on the determinant factors of these programs.

2.2. Livelihood capital as intermediary social protection

SP is used to leverage assets as well as to protect, promote, and transform livelihoods [25]. Several studies have demonstrated that livelihood capital as part of SP can improve the quality of life, especially for households living in poverty [32,47,76]. Additionally, SP also has a long-term effect on human capital by improving the education and health of household members as well as a short-term effect by strengthening the financial capital through goods or cash [29,37,50].

However, as climate change increases stress on livelihoods [6], livelihood capital has become essential as it determines the capacity to cope with major disaster shocks [2,49]. Livelihood capital is necessary to achieve sustainable livelihoods [19,21], and previous authors have defined five types of livelihood capital—financial, social, human, physical, and natural capital—that play a key role in implementing adaptation strategies for natural disasters [39,42,57]. Natural capital includes natural resources, such as land and access to water, and financial capital includes assets with economic value, such as cash and savings. Additionally, human capital refers to knowledge and information, social capital refers to vertical and horizontal relationships among society, and physical capital refers to infrastructure that belongs to the household.

Since households living in poverty have limited livelihood capital and resources for responding to disasters, external interventions such as SP instruments are necessary for developing coping strategies. Additionally, studies on SP also reveal that cash transfers improve livelihoods by absorbing the negative impact of natural disasters [33,40]. However, few studies have examined the effects of SPs that can moderate the adverse impacts of natural disasters. For example, an evaluation of the MGNREGS, an SP package in India, found that the programs contribute significantly to enhancing absorptive, adaptive, and transformative resilience in agriculture by changing the livelihood capitals of the recipient's household [47] but focuses only on the changes in capital caused by SP programs that contribute to household resilience. Moreover, there is insufficient research on how cash transfers can support livelihood capital and develop off-farm coping strategies for SFH.

3. Research hypothesis

Following the previous studies mentioned above, this research makes an assumption regarding the connection between SP and coping strategies for C-RD. In the context of agriculture and SFH, some scholars argue that SP influences coping strategies both with and without intermediary elements [1,24,69]. Having the original purpose of enhancing wellbeing and livelihood, SP intermediary determinants are defined as livelihood capital to boost coping strategies [39,42]. Furthermore, some scholars argue that several types of SP have direct benefits and reduce the adverse impact by increasing coping strategies [24,40,75]. However, the relationship between SP and coping strategies has not been extensively explored. Therefore, this research develops the hypothesis that SP for coping strategies can exist with or without intermediary determinants, such as livelihood capital consisting of financial, social, physical, and human capital [39,54,60] (see Fig. 1).

4. Materials and methods

4.1. Survey location

The data for this research was collected in Cilacap, a city in the Central Java province of Indonesia with a population of around 1.9 million people. The majority of Indonesia's paddy fields with reservoir-based irrigation (60%) are in Java, and Cilacap is one of the top-five rice producers in Java. These paddy fields have been severely affected by climate change [17], and as a result of the unpredictable and erratic rainy season in 2019, Cilacap recorded a decrease in its annual production by 699,965 tons [53]. The rice fields in Cilacap were flooded in October 2019, and a flood in Cilacap inundated 45 villages spread across 15 sub-districts at the end of [38] (Kompas.com, 2020).

4.2. Data collection

A questionnaire survey was conducted in Cilacap in November [38] with 300 respondents. The survey targeted SFH that were affected by the flood in October 2019. Among the 300 respondents, 150 were PKH beneficiaries and 150 were non-beneficiaries. Local enumerators were hired and trained to conduct the survey. First, we selected flood-affected sub-districts (Kecamatan) as the research locations based on the recommendations a local community leader and secondary data. As a flood-affected location, Kecamatan Nusawungu was selected since it had the highest number of households living in poverty and the highest levels of rice productivity in [9] [63,64]. Second, a snowball technique was used in Kecamatan Nusawungu to select respondents for the questionnaires. Finally, we selected 150 SFH who were PKH beneficiaries and 150 SFH who had not received PKH assistance. The questionnaire to determine livelihood capital and coping strategies related to floods consisted of six sections: (1) demographics (e.g., sex, age, number of household members, number of children of school-going age), (2) social capital (e.g., interaction in neighborhood and government association membership), (3) financial capital (e.g., income, savings, and assets), (4) human capital (e.g., worki-related experience and knowledge about disasters), (5) physical capital (e.g., house status and house construction material preparedness), and (6) coping strategies (e.g., preparedness and response and recovery activities). The questionnaire focuses only on the off-farm (not on-farm activities or specific activities related to farming and agricultural production) activities of SFH that are related to daily activities in the families to represent each type of capital; for example, interaction in the neighborhood, saving status, knowledge about disasters event, and house construction material preparedness.

In-depth interviews were conducted with representatives from the SFH that were PKH beneficiaries during February and March 2022. All participants gave consent to participate and were informed that the interview results would remain anonymous and would only be used for research purpose. We conducted three interviews with three smallholder farmer's spouses who had responded to the questionnaire during the previous stage in order to to confirm and explore the results from the questionnaire. One of the interviewees also worked as a smallholder farmer, and two were full-time homemakers who managed the daily household affairs. They were selected through snowballing among the PKH beneficiaries who were also SFH. The open-ended interviews focused on the PKH advantages and its relationship to participants' actions when the floods occurred.

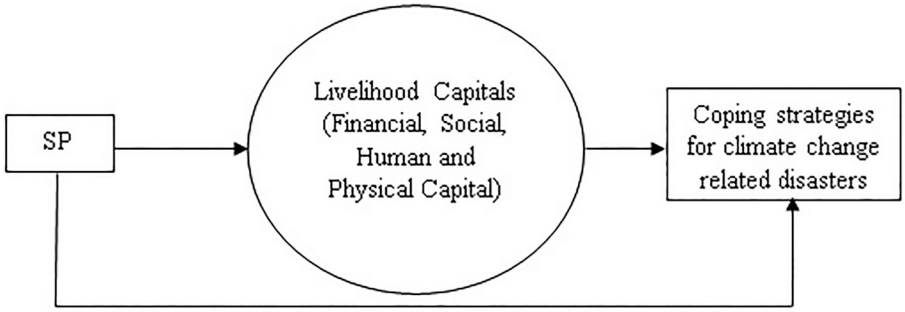

Fig. 1. Hypothesis model.

4.3. Data processing

The data processing in this research was aligned with the objectives of identifying how PKH develops coping strategies and determining which factors enhance these strategies. The first objective was achieved by performing two steps to demonstrate the complex relationships among PKH, livelihood capital, and coping strategies. The observed variable was selected as the composer of the latent variable using a confirmatory factor analysis (CFA). Following that, the latent and observed variables were incorporated into a model using structural equation modeling (SEM). The data analysis considered the relationship among PKH, livelihood capital, and coping strategies, and it does not consider the influence of livelihood capital as an intermediary determinant.

All data processing in CFA and SEM was conducted using AMOS (Ver. 27). For the first objective, the questionnaire results from all 300 participants were used, and for the second objective, the interview data were used.

4.4. Characteristics of the respondents

The demographic characteristics of the 300 respondents are typical of SFH households. Among the respondents, 90.7% were females, and the 9.3% were males. This is because the PKH targeted farmers' spouses as they are the "household managers" and arranged the distribution of household resources. The average age of the respondents was 47.5 years, and the average household size was 3.6, which is below the national average of 3.9 [65]. Approximately 74.0% of respondents had reported having children in their households, and the average number of children was 1.2, as illustrated in Table 2. Furthermore, approximately 75.3% of the respondents had a monthly income under USD 69, and 22.0% had between USD 69–USD 103. Cilacap's minimum wage is USD 154.17, and 99.7% of respondents have incomes below the regional minimum wage.

4.5. Analytical methods

The CFA results were used to analyze the significant observed variables. This analysis used standardized factor loading values with an acceptable cut-off point of 0.60 [3]. This allowed for complete livelihood capitals as latent variables in the SEM analysis. Following this, incremental fit measures and absolute measures were used to justify the model fit in the SEM model analysis [30,52,67]. For incremental fit measures, a comparative fit index (CFI) with a value >0.95 and a Tucker-Lewis Index (TLI) with a value higher than 0.90 were used for a good model [30]. Moreover, for absolute fit measures, the model was evaluated by the Goodness of Fit Index (GFI) with a value higher than 0.90 and Root Means Square Error of Approximation (RMSEA) lower than 0.07 [67]. Then, a path analysis was performed to identify the direct and indirect effects of the variables [52]. Moreover, the in-depth interview results were assessed by comparing the similarity of the answers.

5. Results and discussion

5.1. Explanation of livelihood capitals as latent variables

Table 1 illustrates the latent and observed variables used in the SEM. The model was developed using four latent variables ("social capital," "human capital," "financial capital," and "physical capital").

The latent variable "Social Capital" is composed of four observed variables: "Ronda participation (RonPar)," "religious participation (RelPar)," "participation types (VarPar)," and "frequency of participation activities (FrePar)." Approximately 46.7% of households have participated in ronda, community night patrol activities, and 57.5% have participated in religious activities. The average number of participation types is 3.2 in each household, and the frequency of membership activities is 7.7 times per month. Cilacap, especially Kecamatan Nusawungu, still has a rural culture with a focus on togetherness and collective action. Therefore, participation in collective action such as "ronda" is common and part of local wisdom. Moreover, religious activities included reciting the Al-Quran or religious studies.

Table 1
Descriptive statistics of livelihood capitals.

Variables	Abbreviation	Unit	Mean	St. dev
Social capital				
Ronda participation (D)	RonPar	Number	3.6	1.2
Religion participation (D)	RelPar	Number	3.5	1.2
Types of participation (numbered)	VarPar	Number of types	3.2	1.4
Frequency of participation	FrePar	(Times/month)	7.7	4.5
Human capital				
Flood prediction information from radio (D)	RaInfo	Have (=1), do not have (=0)	0.3	0.4
Flood prediction information from neighbors (D)	NeInfo	Have (=1), do not have (=0)	0.5	0.5
Flood prediction information from broadcast (D)	BrInfo	Have (=1), do not have (=0)	0.3	0.5
Type of flood prediction information	VarInfo	Number	2.1	1.2
Financial capital				
Have a smartphone (D)	SmpAst	Have (=1), do not have (=0)	1.3	1.0
Have electronics (D)	ElcAst	Have (=1), do not have (=0)	1.7	1.8
Have a motorcycle (D)	MtrAst	Have (=1), do not have (=0)	1.2	0.7
Types of assets	VarAst	Number of types	4.4	1.5
Physical capital				
Existence of mitigation construction	ExCons	Have (=1), do not have (=0)	0.5	0.5
Types of mitigation construction	VarCons	Number of types	1.2	0.4

The concept of human capital refers to households having information about flood predictions. This latent variable is composed of "flood prediction information from the radio (RaInfo)," 'flood prediction information from neighbors (NeInfo)," "flood prediction information from broadcasts (BroInfo)," and "type of flood prediction information (VarInfo)." From the results, 27.7% of households receive flood prediction information from the radio, 31.7% of households from broadcasts, and 48.3% from neighbors. The average types of flood prediction information in each household were 2.1. Regarding human capital, the SFH are concerned about the timeliness of the early warning system since they need to prepare their crops and household necessities in the event of a flood.

Financial capital relates to household assets, and this latent variable is composed of "own a smartphone (SmpAst)," "own electronics (ElcAst), "own a motorcycle (MtrAs)," and "type of asset (VarAst)." The average number of smartphones per household (NumAst) is 1.3, electronics is 1.7, motorcycles is 1.2, and the average number of asset types per household is 4.4. Asset ownership is important for SFH and includes savings reserved for them. The electronic assets have added value since they are easily to resold if the household requires cash.

Physical capital demonstrates construction mitigation to lessen the impact of natural disasters. This latent variable is composed of the "existence of mitigation construction (ExCons)" and "variance of mitigation construction (VarCons)." Approximately 48.7% of households have used mitigation construction, and the average number of types of mitigation construction is 1.2. However, mitigation construction is applied modestly, such as constructing temporary embankments and preparing sandbags for protection. Since Cilacap is prone to flooding, the households store these simple materials.

5.2. *Influence of program Keluarga Harapan on SFH's coping strategies*

Using the CFA results were used to select variables for the SEM to determine the influence of PKH on coping strategies, which are household's responses to reduce the impact of climate change. In this research, the coping strategy variable refers to the number of reactions by SFH to absorb, adapt, and transform in response to the great flood in Cilacap in 2019. The average number of coping strategies is 6.7 and these strategies include cleaning the house, monitoring flood levels, moving assets to safer places, preparing food stocks, and repairing household assets. SEM was conducted to understand the mechanisms used to encourage coping strategies.

The final model illustrated in Fig. 2 fulfills the required values. The saving variable (SAVING) was added to the model as savings are closely related to financial capital. It has been found that all indicators of the model were appropriate for the standard value mentioned above in section 3.4: the CFI value was 0.950 ($\geq$ 0.95), the RMSEA was 0.069 ($\leq$ 0.07), the TLI was 0.928 ($\geq$ 0.90), and the GFI was 0.925 ($\geq$ 0.90), illustrating that this model is a good fit.

According to the model illustrated in Fig. 2, PKH interventions have a direct effect on social capital ($\beta = 0.18$, $p < 0.01$), financial capital ($\beta = 0.114$, $p < 0.05$), and coping strategy ($\beta = 0.16$, $p < 0.01$). It does not directly affect the other two capital types: human and physical capital. Moreover, saving directly affects financial capital ($\beta = 0.165$, $p < 0.01$).

In contrast, coping strategies are influenced by PKH interventions ($\beta = 0.16$, $p < 0.01$), financial capital ($\beta = 0.278$, $p < 0.01$), social capital ($\beta = -0.194$, $p < 0.01$), and human capital ($\beta = 0.357$, $p < 0.01$) directly, as illustrated in Fig. 3. Of the three capital effects on coping strategies, human capital has the strongest effect.

An indirect effect can also be identified from the model. Table 2 demonstrates that PKH has an indirect effect on social capital ($\beta = 0.044$, $p < 0.01$), human capital ($\beta = 0.083$, $p < 0.01$), physical capital ($\beta = 0.021$, $p < 0.01$), and coping strategy ($\beta = 0.018$, $p < 0.01$). Therefore, PKH interventions influence coping strategies both direct and indirectly.

This research explored the relationship between PKH and coping strategies. According to the model results, SP and especially cash transfers are absorbed and reduce the impact either on or off the farm, similar to previous research ([16]; Weldegebriel & Amphune [28] a). As illustrated in Fig. 3, many paths explain the complexity, especially when PKH influences livelihood capital and livelihood capital influences coping strategies.

PKH directly affects financial and social capital, which then form the basis of coping strategies. This result corresponds with results from Aleksandrova [1], Kuriakose et al. [40], Nanki et al. [47], and Wood [77], which demonstrated that SP enhances livelihood capital. Additionally, this finding contributes to the literature by explaining the less understood relationship between cash transfers as a part of SP and natural disaster mitigation [5,13,77].

The financial capability results are very reasonable because PKH is a cash transfer program that delivers financial aid to the beneficiaries for designated purposes. The variable "total assets" is the highest variable of financial capital. This means that the PKH increases financial abilities because the beneficiaries are able to create savings and utilize other important activities, such as coping strategies for C-RD. As demonstrated in previous research [43,44,70], cash transfers help with asset investments, including livestock and agriculture. This research

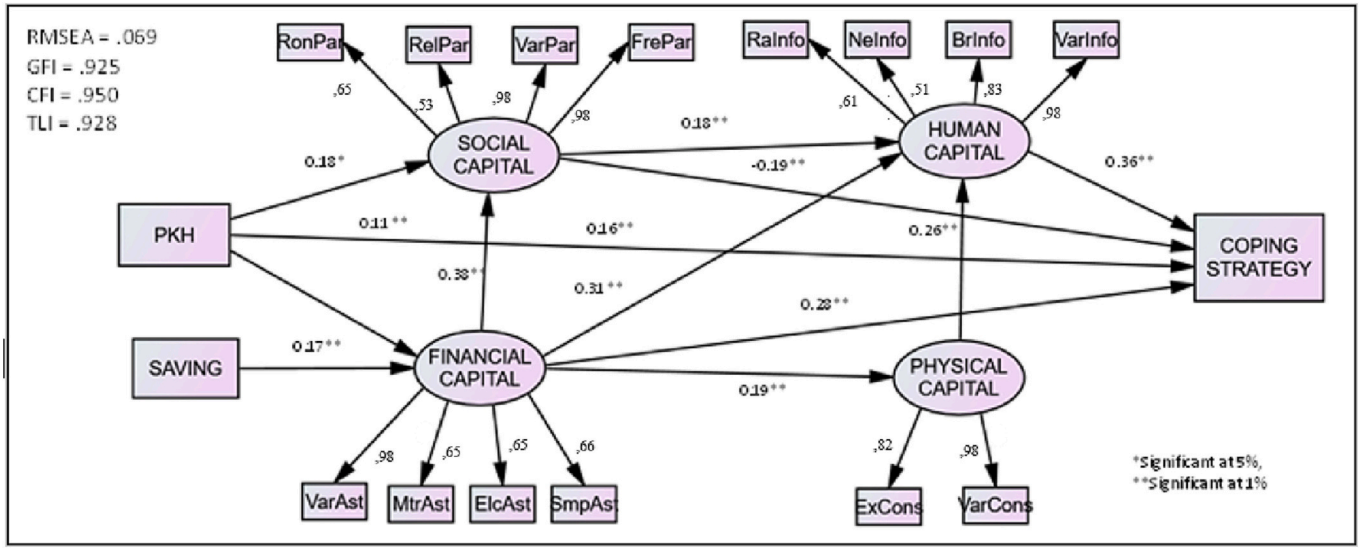

Fig. 2. Model of PKH and coping strategy of SFH.

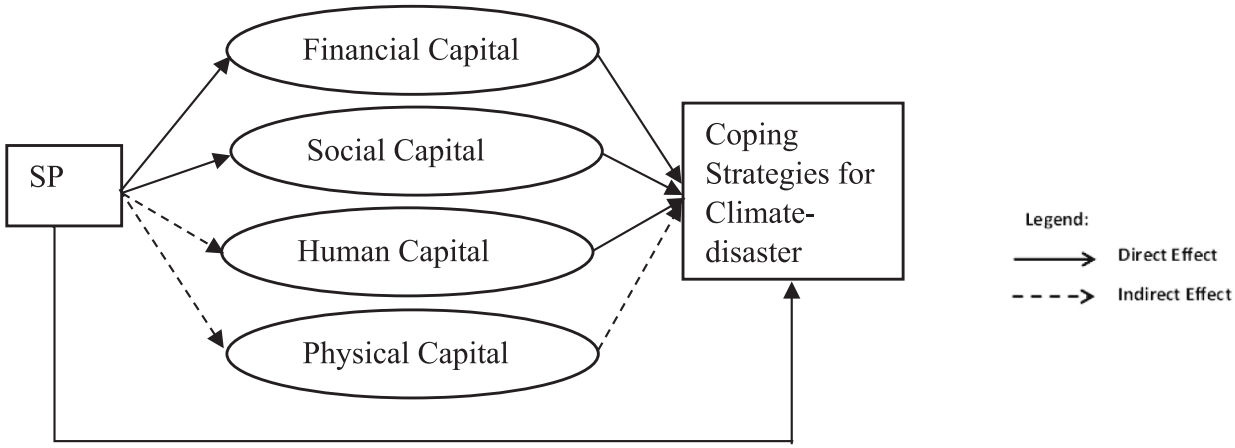

Fig. 3. Findings from the model.

Table 2
Standardized path coefficients of indirect effects in the model.

Variables	PKH	Financial Capital	Social Capital	Human Capital	Physical Capital	Coping Strategy
PKH	–	–	0.044*	0.083*	0.021*	0.018*

Notes: *significant 5%; **significant 1%.

demonstrates that financial capital is a tangible and short-term solution to absorbing the adverse impacts of disasters.

Interesting findings emerge when PKH affects social capital for coping strategies directly. Cash transfer programs usually focus on cash assistance, but this finding provides a new perspective on how they can affect social capacity. Compared to the findings of Wood's [77], when the focus was on financial capability, cash transfers failed to respond to non-generic determinants (such as institutions, knowledge, innovation, or forward-thinking decision-making). However, it already met the basic needs of adaptive capacity. Meanwhile, this finding demonstrates that social ability leads to households developing strategies for C-RD in addition to financial capability. Since PKH includes mentoring and household workshop activities, this program delivers social bonding and interaction among the beneficiaries. The "number of participants" variable is the highest variable for social capital and refers to activities in PKH that enhance social interaction, especially participation in community activities, which can be beneficial in the event of disasters. Within a network that has been built through collective practice helps to find strategies to cope with climate hazards. For example, SFH usually seek additional sources of income after a flood such as helping to harvest other farmers' fields. Detailed information about which fields require extra assistance is derived from the SFH network. The more exposure a smallholder farmer has to collective activities, the more information they have for earning an additional income, especially after crop failures. Additionally, PKH directly influences coping strategies without considering the intermediary factor, livelihood capital. This finding acknowledges that the existing PKH was not originally intended for disaster management but contributes to coping strategies. Similar to research conducted by Vathana et al. [75], this cash transfer program encourages SFH to invest in other activities and income sources when dealing with natural disasters.

Another finding is that PKH indirectly affects human capital and physical capital. Although the SP program aims to enhance human resources, it does not improve human capital directly [50,78]. This is expected because PKH activities are not directly related to disaster risk reduction, and its mentoring programs do not deal with disaster preparedness. While PKH indirectly affects human capital, eventually, human capital strongly influences coping strategies; PKH does not significantly impact human capital but is an important factor in strengthening coping strategies. Moreover, PKH indirectly affects physical capital because it has not relation to physical aid. The indirect effect is also derived from physical capital to coping strategies. This is likely due to the fact that flooding is prevalent in Cilacap and impacts agricultural land, which requires massive infrastructure mitigation efforts to be carried out. Subsequently, individual or household efforts for infrastructure mitigation become less important than the massive efforts of the government to improve the surrounding environment.

5.3. Factors in program Keluarga Harapan that contribute to coping strategies

There is a need to understand the activities that support livelihood capital and promote coping strategies for C-RD. Therefore, the interview data were used to explore this relationship. The PKH does not implement activities directly related to disaster mitigation but provides cash transfers for health care and education as well as counseling between the local facilitator and beneficiaries. Usually, counseling uses the FDS to deliver information about household welfare, which is conducted by the district facilitator or other resource persons/institutions. Additionally, PKH provides access to other government assistance since the beneficiary's information has been included in a unified database. Based on the results of the SEM model, the PKH has both direct and indirect effects on coping strategies. This result is in line with the responses in the interviews.

According to the interview data, the counseling sessions, including FDS, improve coping strategies. However, this is not because of the content of the counseling sessions, but because it expands the beneficiaries' connections with other people or institutions. The counseling, mentoring, or workshop sessions become a "means to an end," enhancing networking ability to improve their capability and reduce the adverse impact of disasters. For example, the PKH beneficiaries gained additional income opportunities after interacting with local businesspeople in the PKH workshops. According to a PKH beneficiary who works as a smallholder farmer and food seller:

> *When I attend the PKH meeting, I will make new friends from other villages, including those from formal institutions like local government offices. I can get another source of income. Several times there are small business opportunities that I have received after the meetings. Or I have been invited to help them by providing food and cooking for their events.* (W, March 5, 2022)

Another interviewee also described her experience when the flood occurred in her area:

When our family income is reduced because my husband cannot work in the rice field, I try to sell food to customers. I offered it to friends, including those I know from the meeting at the PKH, and it sold out. I have advantages because I know the network and will sell my cooking as a result. (V, March 5, 2022)

In the case study, especially in the rural farmer context, the counseling facilitator attends the FDS events and is available in the community daily, improving the community's exposure to the external world and amplifies its capabilities.

Another finding also revealed that as the PKH beneficiaries are registered on the national welfare database, they also have access to other government and institutional aid. One of the interviewees said:

Floods have occurred in our village like five to seven years ago, so I experienced the impact before and after I became a PKH recipient, and it's very different! Before, I only got help or food assistance once or twice, but after I became a PKH beneficiary, the assistance from many institutions doubled. (S, February 27, 2022)

Counseling or mentoring activities and data registration are likely the main ways the PKH influences coping strategies. This is consistent with the finding on the first objective that PKH provides financial and social capital, which also influences coping strategies. Johnson et al. and Berhane et al. have argued that cash transfer programs should include other activities that strengthen income-generating capacities and future resilience [15,16,36]. This finding demonstrates that FDS can be used to mainstream climate change knowledge to enhance capability and expand networks as part of social capacity.

6. Conclusion and recommendation

Although SP can contribute to climate resilience [1,24,40], a conceptual link has been demonstrated, it is less clear how SP, especially cash transfers, can reduce or mitigate the impact of environmental shocks [5,14,77]. This research increases this understanding as it reveals that the PKH's cash transfers contribute to the development of coping strategies for SFH in dealing with C-RD.

PKH has two main effects. First, PKH leverages welfare, influencing livelihood capital, which in turn affects coping strategies. The PKH's effect occurs through financial capital from assets and social capital from participation in the community, which then significantly contribute to coping strategies. This finding demonstrates that PKH enhances the financial and social capabilities that can be linked to SFH's capability to develop strategies for climate change.

Moreover, PKH indirectly affects human and physical capital as short-term tangible impacts. However, unlike physical capital, which indirectly affects coping strategies, human capital has the strongest direct effect on coping strategies. This is the entry point for enhancing the PKH by linking it to climate change-related disaster adaptation and mitigation programs in the context of agriculture.

Second, PKH activities can help SFH in developing strategies for climate change directly. This finding demonstrates that PKH contributes to coping strategies without intermediary determinants such as livelihood capital. This finding acknowledges that PKH was not originally intended for disaster management, but it can provide assistance in developing coping strategies. This reveals the opportunity to link disaster management and climate adaptation to SP programs.

PKH, as a cash transfer program, consists of several activities other than financial assistance. The counseling session in FDS between PKH facilitators and beneficiaries were held collectively to support the PKH. Intense and frequent meetings provided participants with the opportunity to establish extended networks. As they gain a wider network, they will have more opportunities to scale up their economic abilities as complementary income sources when stress occurs. Consequently, counseling or workshop are important factors in the PKH influencing livelihood capital, which is affected by coping strategies. This finding indicates that counseling, workshops, and FDS can improve skills and networking with other institutions to mainstream climate change knowledge, enhance capacity, and expand networks as part of social capacity. Moreover, a comprehensive database of registered beneficiaries for disaster risk management acted as a complementary assistance for providing targeted support.

As this study describes the relationship between SP and natural disaster countermeasures, including climate change adaptation, it also has certain limitations. First, this research applied only to a narrow and specific population, risk-prone farming in a developing country context. Second, in the context of agriculture, this research was limited to off-farm strategies and only included activities that are less related to technical agriculture and did not include specific activities related to farming and agricultural production. Additionally, the interplay among the livelihood capital as an intermediary determinant was not explored in detail. A more dataset and explorative method to describe the influential factors of SP on coping strategies is also needed for more comprehensive results.

Based on the findings, the main recommendation is to strengthen the impact of PKH by supporting the adaptation of SFH to cope with C-RD, especially in risk-prone areas. For example, training or workshops addressing climate disaster awareness knowledge could be included in regular meetings such as FDS. Another option is to encourage skills and training in certain aspects of SFH's livelihoods, such as microeconomic practices, to gain alternative income for SFH.

CRediT authorship contribution statement

Irene Sondang Fitrinitia: Conceptualization, Methodology, Software, Writing – original draft, Visualization, Investigation. **Mihoko Matsuyuki:** Conceptualization, Methodology, Validation, Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

References

[1] Aleksandrova M. Social protection as a tool to address slow onset climate events: Emerging issues for research and policy (issue 16/2019). 2019.
[2] Alemayehu A, Bewket W. Determinants of smallholder farmers' choice of coping and adaptation strategies to climate change and variability in the central highlands of Ethiopia. Environ Dev 2017;24(November 2016):77–85. https://doi.org/10.1016/j.envdev.2017.06.006.
[3] Alrwashdeh M, Emeagwali OL, Aljuhmani HY. The effect of electronic word of mouth communication on purchase intention and brand image: an applicant smartphone brands in North Cyprus. Manag Sci Lett 2019;505–518. https://doi.org/10.5267/j.msl.2019.1.011.
[4] Ananda R, Rima Restu Ananda B, Widodo T. Munich personal RePEc archive a general assessment of climate change-loss of agricultural productivity in Indonesia. 2019.
[5] Arnold C. Cash transfers: Evidence paper. 2011.
[6] Asian Development Bank. Our framework policies and strategies social protection. https://www.adb.org/sites/default/files/institutional-document/32100/social-protection.pdf; 2003.
[7] Asian Development Bank. Strengthening resilience through social protection programs: Guidance note. 2018.
[8] Attanasio O, Mesnard A. The impact of a conditional cash transfer programme on consumption in Colombia. Fiscal Stud 2006;27(4):421–42.
[9] Bappenas, Api Kaji Ulang Ran. Kajian Basis Ilmiah Bahaya Perubahan Iklim. https://lcdi-indonesia.id/wp-content/uploads/2020/10/Kajian-Bahaya.pdf; 2018.
[10] Barrientos A, Møller V, Saboia J, Lloyd-Sherlock P, Mase J. 'Growing' social protection in developing countries: lessons from Brazil and South Africa. Dev South Afr 2013;30(1):54–68. https://doi.org/10.1080/0376835X.2013.756098.

[11] Béné C. Social protection and climate change. 2011. https://doi.org/10.1111/j.1759-5436.2011.00275.x.
[12] Béné C, Cornelius A, Howland F. Bridging humanitarian responses and long-term development through transformative changes-some initial reflections from the World Bank's adaptive social protection program in the Sahel. Sustainability (Switzerland) 2018;10(6). https://doi.org/10.3390/su10061697.
[13] Béné C, Devereux S, Sabates-Wheeler R. Shocks and social protection in the horn of Africa: analysis from the productive safety net Programme in Ethiopia (Vol. 2012). 2012.
[14] Béné C, Wood RG, Newsham A, Davies M. Resilience: new utopia or new tyranny? Reflection about the potentials and limits of the concept of resilience in relation to vulnerability reduction Programmes. In: IDS working papers (Vol. 2012, issue 405); 2012. https://doi.org/10.1111/j.2040-0209.2012.00405.x.
[15] Berhane G. Can social protection work in Africa? The impact of Ethiopia's productive safety net Programme. Econ Dev Cult Chang 2014;63(1):1–26. https://doi.org/10.1086/677753.
[16] Berhane G, Hoddinott J, Kumar N, Taffesse AS. The impact of Ethiopia's productive safety nets and household asset building Programme: 2006–2010. 2011.
[17] Boer R, Suharnoto Y. Climate change and it's impact on Indonesia's food crop sector. In: Sixth executive forum on natural resource management: water and food changing environment, April, 1–18; 2012.
[18] Borga LG, D'Ambrosio C. Social protection and multidimensional poverty: lessons from Ethiopia. India Peru World Dev 2021;147:105634. https://doi.org/10.1016/j.worlddev.2021.105634.
[19] Bourdillon M, Hebinck P. Women, men and work: rural livelihoods in south-eastern Zimbabwe. https://www.researchgate.net/publication/261877529; 2002.
[20] Browne E. Social protection, climate change adaptation and disaster risk reduction: Rapid literature review. 2014. October 29.
[21] Carney D. Chapter 1. Implementing the sustainable rural livelihoods approach. In: Sustainable rural livelihoods: What contribution can we make? Department for International Development; 1998.
[22] Costella C, McCord A, van Aalst M, Holmes R, Ammoun J, Valentina Barca W. Social protection approaches to COVID-19: expert advice social protection and climate change: scaling up ambition. 39. 2021.
[23] Davies M, Béné C, Arnall A, Tanner T, Newsham A, Coirolo C. Promoting resilient livelihoods through adaptive social protection: lessons from 124 programmes in South Asia. Dev Policy Rev 2013;31(1):27–58. https://doi.org/10.1111/j.1467-7679.2013.00600.x.
[24] Davies M, Guenther B, Leavy J, Mitchell T, Tanner T. Climate change adaptation, disaster risk reduction and social protection: complementary roles in agriculture and rural growth?. In: IDS Working Papers. 2009(320); 2009. p. 01–37. https://doi.org/10.1111/j.2040-0209.2009.00320_2.x.
[25] Devereux S. Cash transfers and basic social protection (Issue January). 2006. https://doi.org/10.1057/9781137505699.
[26] Devereux S, Sabates-wheeler R. Transformative social protection. In: IDS working paper 232 (Vol. 232); 2004.
[27] Drolet JL. Julie L. Drolet: Springer; 2014.
[28] ESCAP U. Understanding poverty and poverty data in Indonesia. 2017.
[29] Fisher E, Attah R, Barca V, O'Brien C, Brook S, Holland J, et al. The livelihood impacts of cash transfers in sub-Saharan Africa: beneficiary perspectives from six countries. World Dev 2017;99:299–319. https://doi.org/10.1016/j.worlddev.2017.05.020.
[30] Gefen D, Straub D, Boudreau M-C. Structural equation modeling and regression: guidelines for research practice. Commun Assoc Inform Syst 2000;4. https://doi.org/10.17705/1CAIS.00407.
[31] Hoddinott J, Berhane G, Gilligan DO, Kumar N, Taffesse AS. The impact of Ethiopia's productive safety net Programme and related transfers on agricultural productivity. J Afr Econ 2012;21(5):761–86. https://doi.org/10.1093/jae/ejs023.
[32] Hulme D, Moore K. Assisting the poorest in Bangladesh: learning from BRAC's "targeting the ultra-poor" programme. Soc Protect Poor Poorest 2008:194–210.
[33] Hussein Elmi O, Minja D. Effects of hunger safety net program on livelihood improvement in Wajir County, Kenya. Int Acad J Law Soc 2019;1(2):435–49.
[34] Hadna AH, Askar M. The impact of conditional cash transfers on low-income individuals in Indonesia. Adv SE Asian Stud 2022;15(1):23–41.
[35] Jakobsen K. Livelihood asset maps: a multidimensional approach to measuring risk-management capacity and adaptation policy targeting—a case study in Bhutan. Reg Environ Chang 2013;13(2):219–33. https://doi.org/10.1007/s10113-012-0320-7.
[36] Johnson C, Bansha Dulal H, Prowse M, Krishnamurthy K, Mitchell T. Social protection and climate change: emerging issues for research, policy and practice. Dev Policy Rev 2013;31(SUPPL.2). https://doi.org/10.1111/dpr.12036.
[37] Khan S. Safety net, social protection, and sustainable poverty reduction: a review of the evidences and arguments for developing countries. IOSR J Hum Soc Sci 2013;15(2):23–9. https://doi.org/10.9790/0837-1522329.
[38] Kompas.com. Banjir Rendam 45 Desa di Cilacap, 2 Orang Tewas. https://regional.kompas.com/read/2020/11/19/19130631/banjir-rendam-45-desa-di-cilacap-2-orang-tewas; 2020.
[39] Kuang F, Jin J, He R, Wan X, Ning J. Influence of livelihood capital on adaptation strategies: evidence from rural households in Wushen banner. China Land Use Policy 2019;89(September):104228. https://doi.org/10.1016/j.landusepol.2019.104228.
[40] Kuriakose AT, Heltberg R, Wiseman W, Costella C, Cipryk R, Cornelius S. Climate-responsive social protection. Dev Policy Rev 2013;31(SUPPL.2):o19–34. https://doi.org/10.1111/dpr.12037.
[41] Lee KW, Hwang M. Conditional cash transfer against child labor: Indonesia program Keluarga Harapan. Asia Pac Educ Rev 2016;17:391–401. https://doi.org/10.1007/s12564-016-9436-7.
[42] Li M, Huo X, Peng C, Qiu H, Shangguan Z, Chang C, et al. Complementary livelihood capital as a means to enhance adaptive capacity: a case of the loess plateau, China. Glob Environ Chang 2017;47:143–52. https://doi.org/10.1016/j.gloenvcha.2017.10.004.
[43] Maluccio JA. The impact of conditional cash transfers on consumption and investment in Nicaragua. In: Migration, transfers and economic decision making among agricultural households; 2011. p. 25.
[44] Matin I, Sulaiman M, Division E. Working paper crafting a graduation pathway for the ultra poor: lessons and evidence from a BRAC programme. In: Evaluation (issue 109); 2008.
[45] Mekonnen A, Tessema A, Ganewo Z, Haile A. Climate change impacts on household food security and adaptation strategies in southern Ethiopia. Food Energy Sec 2021;10(1):1–14. https://doi.org/10.1002/fes3.266.
[46] Ministry of Social Affairs. About PKH. Retrieved February 18, 2022, from, https://pkh.kemensos.go.id/?pg=tentangpkh-1; 2023.
[47] Nanki K, Arun A, Dave S, Anand P, Sushil S, Celie M, et al. Building resilience to climate change through social protection (issue June). 2019.
[48] National Agency for Disaster Management. Indonesia Disaster Data and Information Database. Retrieved January 6, 2022, from, https://dibi.bnpb.go.id/xdibi; 2023.
[49] Nguyen CD, Ubukata F, Nguyen QT, Vo HH. Long-term improvement in precautions for flood risk mitigation: a case study in the low-lying area of Central Vietnam. Int J Disaster Risk Sci 2021;12(2):250–66. https://doi.org/10.1007/s13753-020-00326-2.
[50] Nyachoti MK. Social protection for improved livelihoods: The older persons cash transfer program in Nyamira County, Kenya. 2017.
[51] OECD. Social protection system review of Indonesia. OECD. 2019. https://doi.org/10.1787/788e9d71-en.
[52] O'Rourke N, Larry H. A step-by-step approach to using SAS system for factor analysis and structural equation modeling. 2013.
[53] Pramukti U, Suryanto, & Gravitiani, E.. Determination of priority locations for the implementation of rice farming insurance: a case study on disaster hazards in Cilacap regency. IOP Conf Ser: Earth Environ Sci 2021;819(1):012042. https://doi.org/10.1088/1755-1315/819/1/012042.
[54] Quandt A. Measuring livelihood resilience: the household livelihood resilience approach (HLRA). World Dev 2018;107:253–63. https://doi.org/10.1016/j.worlddev.2018.02.024.
[55] Rawlings LB, Rubio GM. Evaluating the impact of conditional cash transfer programs: lessons from Latin America (No. 3119). 2003.
[56] Rondhi M, Fatikhul Khasan A, Mori Y, Kondo T. Assessing the role of the perceived impact of climate change on national adaptation policy: the case of rice farming in Indonesia. Land 2019;8(5):81. https://doi.org/10.3390/land8050081.
[57] Sabates-Wheeler R, Devereux S. Social protection for transformation. IDS Bull 2007;38(3):23–8. https://doi.org/10.1111/j.1759-5436.2007.tb00368.x.
[58] Schwan S, Yu X. Social protection as a strategy to address climate-induced migration. Int J Clim Chang Strateg Manag 2017;10(1):43–64. https://doi.org/10.1108/IJCCSM-01-2017-0019.
[59] Scognamillo A, Sitko NJ. Leveraging social protection to advance climate-smart agriculture: an empirical analysis of the impacts of Malawi's social action fund (MASAF) on farmers' adoption decisions and welfare outcomes. World Dev 2021;146:105618. https://doi.org/10.1016/j.worlddev.2021.105618.
[60] Scoones I. Sustainable rural livelihoods: a framework for analysis. In: IDS working paper. 72; 1998. p. 22.
[61] Skoufias E, Katayama RS, Essama-Nssah B. Too little too late: welfare impacts of rainfall shocks in rural Indonesia. Bull Indones Econ Stud 2012;48(3):351–68. https://doi.org/10.1080/00074918.2012.728638.
[62] Skoufias E, Strobl E, Tveit T. Natural disaster damage indices based on remotely sensed data an application to Indonesia. http://econ.worldbank.org; 2017.
[63] Social Services of Central Java. Poor Household Data; 2018.
[64] Statistics Indonesia. Harvest area and production of wetland paddy 2016–2018. https://cilacapkab.bps.go.id/indicator/53/63/1/luas-panen-dan-produksi-padi-sawah-harvest-area-and-production-of-wetland-paddy.html; 2018.
[65] Statistics Indonesia. Households and average number of household members by province. https://www.bps.go.id/indikator/indikator/view_data_pub/0000/api_pub/bmc3elVuWGROc3JRL3RPQTBrU2dadz09/da_03/1; 2019.
[66] Statistics Indonesia. Statistical Yearbook of Indonesia. 2020. p. 2020.
[67] Steiger JH. Understanding the limitations of global fit assessment in structural equation modeling. Personal Individ Differ 2007;42(5):893–8. https://doi.org/10.1016/j.paid.2006.09.017.
[68] Suroso DSA, Sagala SA, Alberdi HA, Wulandari Y. Does social protection on education increase the capacity of communities in facing disasters? IOP Conf Ser: Earth Environ Sci 2018;158(1). https://doi.org/10.1088/1755-1315/158/1/012036.
[69] Tirivayi N, Knowles M, Davis B. The interaction between social protection and agriculture: a review of evidence. Glob Food Sec 2016;10:52–62. https://doi.org/10.1016/j.gfs.2016.08.004.
[70] Todd JE, Winters PC, Hertz T. Conditional cash transfers and agricultural production: Lessons from the Oportunidades experience in Mexico. In: Migration, transfers and economic decision making among agricultural households; 2011.
[71] Tutor MV. The impact of Philippines' conditional cash transfer program on consumption. In: UPSE discussion paper, No. 2014–05; 2014.
[72] UNDP. Leaving no one behind: a social protection primer for practitioners. 1–96. 2016.

[73] Utami AW, Jamhari J, Hardyastuti S. El Nino, La Nina, Dan Penawaran Pangan Di Jawa, Indonesia. J Ekon Pembangunan 2011;12(2):257. https://doi.org/10.23917/jep.v12i2.197.
[74] Väänänen E, Nett K, Costella C, Mendler De Suarez J. Linking climate risk insurance with shock-responsive social protection. https://www.insuresilience.org/wp-content/uploads/2019/03/insuresilience_policybrief_1-2019_190312_web.pdf; 2019.
[75] Vathana S, Oum S, Kan P, Chervier C. Impact of disasters and role of social protection in natural disaster risk management in Cambodia. In: ERIA discussion paper; 2013 [ERIA-DP-2013-10].
[76] Weldegebriel ZB, Amphune BE. Livelihood resilience in the face of recurring floods: an empirical evidence from Northwest Ethiopia. Geoenvironmental. Disasters 2017;4(1). https://doi.org/10.1186/s40677-017-0074-0.
[77] Wood RG. Is there a role for cash transfers in climate change adaptation? IDS Bull 2011;42(6):79–85. https://doi.org/10.1111/j.1759-5436.2011.00277.x.
[78] World Bank Group. Towards a comprehensive, integrated, and effective social assistance system in Indonesia. http://hdl.handle.net/10986/28850; 2017.
[79] Zhang H, Zhuang T, Zeng W. Impact of household endowments on response capacity of farming households to natural disasters. Int J Disaster Risk Sci 2012;3(4):218–26. https://doi.org/10.1007/s13753-012-0022-2.
[80] Zhang Q, Zhao X, Tang H. Vulnerability of communities to climate change: application of the livelihood vulnerability index to an environmentally sensitive region of China. Clim Dev 2019;11(6):525–42. https://doi.org/10.1080/17565529.2018.1442808.