Journal of Disaster & Emergency Research
http://jder.ssu.ac.ir
J Disaster Emerg Res
2021; 4(1): 38-51
10.18502/jder.5664

Importance of Insurance Mechanisms in Natural Disasters' Risk Mitigation: A case study in India

Sangram Kishor Patel [1*], **Ankit Nanda** [1], **Saradiya Mukherjee** [1]

[1] *Population Council, Zone 5A, India Habitat Center, Lodi Road, New Delhi, India*

ARTICLE INFO

REVIEW ARTICLE

Article history:
Received: 1 Dec 2020
Revised: 26 Feb 2021
Accepted: 7 March 2021

***Corresponding author:**
Sangram Kishor Patel

Address:
Population Council, Zone 5A, India Habitat Centre, Lodi Road, New Delhi, INDIA.

Email:
sangramkishor@gmail.com

Tel:
+91 11 41743410

ABSTRACT

Introduction: This study aims to understand the dynamics of insurance as a risk management tool for natural disasters in India. It further explores different strategies and programs for disaster insurance adopted by the Indian government and highlights these initiatives' gaps.

Methods: The authors conducted both offline and online desk reviews to understand the dynamics of insurance mechanisms and government strategies. They conducted a narrative review of existing literature, including peer-reviewed articles, thematic books, and government and non-governmental reports from diverse sources.

Results: The review clearly shows that despite the various types of natural disasters the country faces, the coverage of disaster insurance in India remains low. It outlines the importance of insurance as a risk management tool, especially for the most vulnerable sections of society living in rural parts. The review further highlights the benefits of different government schemes and strategies while at the same time highlighting the gaps in these schemes.

Conclusion: The review calls for an urgent and sustained effort to increase the number of individuals insured against natural disasters in the country by addressing the policy shortcomings and engaging with the communities and the private sector to understand their respective needs. The review also underlines the importance of creating awareness regarding disaster insurance among the wider population. Furthermore, it calls for a comprehensive disaster management plan with insurance as one of its pillars.

Keywords: Insurance, Disaster, Risk management, Climate change, Extreme events, India

Introduction

Natural disasters cause widespread damage and destruction every year, affecting millions of people around the world. They impact every aspect of people's lives, causing life loss, damaging property and infrastructure, destroying livelihoods, and affecting health. All these factors put a financial strain on communities, stalling recovery from disasters and leading to long-term economic losses. Globally, the economic cost of natural disasters has increased substantially from USD 25 billion per year in the 1980s (inflation-adjusted) to USD 175 billion in 2016 (1, 2). While these disasters affect both the developed and developing countries, low-income and developing countries face more formidable challenges during recovery and reconstruction due to limited resources, low socio-economic capacity, and high population density. From 1980 to 2012, more than 80% of deaths due to natural disasters occurred in

This paper should be cited as: Patel SK, Nanda A, Mukherjee S. **Importance of Insurance Mechanisms in Natural Disasters' Risk Mitigation: A case study in India.** Journal of Disaster & Emergency Research. 2021; 4(1): 38-51.

developing or low-income countries, which faced far more debilitating recovery processes (3). The coping capacity of developing countries gets overwhelmed, individuals are forced to sell their limited assets like livestock, and governments are forced to divert limited resources away from health, education, and poverty reduction for the relief and reconstruction process. It leads to long-term negative impacts with interruption of economic activity, loss of employment, decreased governmental revenue, and increase in poverty levels. Considering the high economic impact of disasters, it becomes imperative for developing countries to strengthen their financial resilience to disasters (4).

Disaster Risk Management (DRM) is a means of building financial resilience to disasters and managing and mitigating different risks that emerge from these disastrous events (5). Transferring risk to a third party or a wider population through financial instruments designed for disaster risk mitigation is an essential aspect of DRM. Insurance is a financial instrument that helps spread the financial risk of a catastrophic event in exchange for a price (4). It is a risk covering device in which the insurer and insured enter into a contractual agreement where the insurer guarantees financial protection for a specified premium and reimburses the formerly agreed amount in case of specified loss (6). Insurance could be offered by private companies, public-private partnerships, or through a government-backed scheme. As Quarantelli (2006) stated, catastrophe can result in widespread destruction within the community and the neighboring areas while rendering the emergency response systems ineffective (7). A single company or a small country may fail to cover the wider population's risks in the event of a major disaster or a catastrophe, and thus reinsurance is used to transfer risks and distribute losses internationally (4). Disaster insurance becomes a means of covering losses incurred through disasters and catastrophic events and reducing disasters' severe financial impact on individuals and communities. Financial liquidity provided by insurance helps mitigate disasters' effects on food security, health and livelihood assets (6). It also reduces governments' burden by preventing the diversion of limited public resources away from important public services like health and education. However, benefiting from risk transferring schemes like insurance remains limited in developing countries, leaving large sections of its population vulnerable. The losses covered by insurance in the year 2016 shows this disparity between developing and developed countries, with only 11% of losses in Asia and 1% in Africa being insured losses, compared to 32% in Europe and 54% in North America (2).

India, with its varied topography and climate, India, large and densely populated coastline, and high poverty levels remain vulnerable to multiple natural disasters. The country has one-sixth of the world's population, with most people dependent on nature-based livelihoods. About 40 million hectares of its land is flood-prone, and 68% of its agricultural land is drought-prone, with various other natural disasters like floods, cyclones, avalanches, and landslides causing repeated destruction in India (8). According to the United Nations Office for Disaster Risk Reduction (UNDRR), after United States and China, India is the third hardest hit nation from natural disasters. As per CRED and UNDRR, 79,732 people have lost their lives, and 1083 million people were affected in 321 incidences of natural disasters in India between 2000 to 2019 (9). Apart from causing death and destruction, these disasters have caused huge damage to the country's economy, with losses of over USD 80 billion between 2000 and 2019 (9). In the event of a disaster, people cope with the reducing risk through traditional strategies of borrowing money, selling assets, and diversifying their sources of income, but these strategies fail to alleviate the adverse impact of disasters on people's lives. Institutionalized risk management strategies for disasters remain inaccessible and underutilized with only 11% of

losses between 1990 and 2016 being covered by the insurance sector (10).

However, limited comprehensive studies are available on the types of insurance risk management, its accessibility, and utilization in the context of different natural disasters in India. Considering these points going forward, this review study's main objective is to understand the dynamics of insurance mechanisms (e.g., crop, home, livestock, health, life, accidental and other insurances) related to disaster risk management. Besides, it explores the programs and strategies for insurance undertaken by the government in India and identifies the gaps. Further, this study tries to provide possible recommendations for the way forward. This review article contains six sections. Section 1 is about introducing and reviewing the article's literature, followed by section 2 as methodology. In section 3, we engage with the literature on insurance as a tool for risk management and its application across varied scenarios. In sections 4 and 5, we attempt to analyze the various types of insurance products in the Indian context and their penetration. Section 6 includes the discussions and conclusions as well as recommendations from the study.

Materials and Methods

To understand the insurance dynamics related to disasters, we conducted both offline and online desk reviews for this study. This review incorporates data from various sources, specifically peer-reviewed literature, thematic books, government and non-government agency reports, and thematic communication with people engaged in the insurance mechanisms. The primary research questions we followed were as follows: What is the empirical research available on the dynamics of insurance mechanisms related to natural disasters in India? The second line of inquiry examined the government's strategies on this and gaps associated with this. We searched for peer-reviewed and grey literature through Google Scholar, PubMed, government websites, and search engines like google and Bing. The main keywords searched in different combinations were crop insurance, home insurance, livestock insurance, health insurance, life insurance, accidental insurance, climate change, natural disasters, disaster risk management, impact, resilience, adaptation, coping mechanism, policy, program, strategy, and India. We adopted the approach of narrative review and used thematic analysis to synthesize the literature. The narrative method of review allows researchers to effectively interpret, synthesize prior knowledge, and bring forth significant gaps in the subject matter (11, 12). This approach helped us understand the status of insurance and risk management of disasters in the country and underline the gaps and the potential of further research.

Conceptualizing disaster insurance – a risk management tool

Benefits of insurance cover for disaster situations can be seen at three levels: i) at direct beneficiary level, i.e., people who are affected by disaster situations, ii) at the insurance company level, and iii) at the state or government level (Figure 1). The immediate outcome of insurance coverage at the beneficiary level includes improved disaster risk awareness, improved post disaster management, improved protection against disasters, reduced borrowings from informal sources, reduced out-of-pocket expenditure, and improved protection against loss of life, health, and property. These factors can result in improved economic status, enhanced agricultural proficiency, and speedy recovery from loss triggered due to disaster and can help ameliorate household members' and livestock's health and well-being. Next, the immediate outcome at the insurance company level includes improvements in financial products, investments, and better market gains. These can result in the broader client base. Immediate outcome of insurance coverage for disaster situation at state-level can be measured in terms of improvements in infrastructure,

better farm productivity, and post-disaster management that leads to reduced fiscal burden, better preparedness for shocks, and ultimately can lead to growth in the economy. With insurance in place, there is overall improvement in disaster risk management as measured by these outcome indicators.

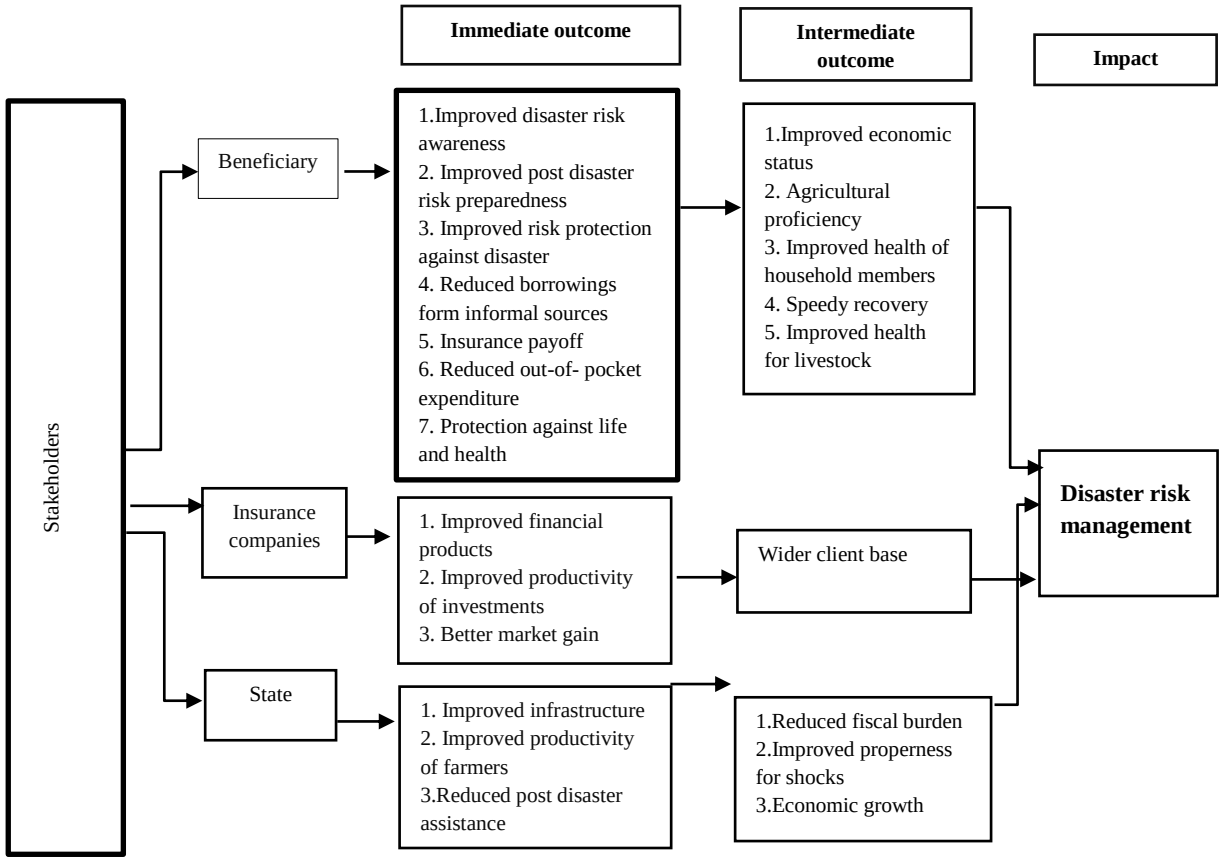

Figure 1. Framework for the relationship between insurance and disaster risk mitigation

Risk management to hedge against disasters has been practiced by individuals and communities throughout the world. Low-income communities depend upon their savings, selling or mortgaging their assets, and acquiring loans from local money lenders in times of a disaster (13). In the agricultural sector, farmers have traditionally used different farming techniques based on the topography, soil type, and altitude of the farmland and have changed their practices based on their anticipation of timing and quantity of rainfall (14). These practices, while helpful, have failed to cover for the devastating impacts of natural disasters. Governments have historically tried to handle disasters expediently, focussing on post-disaster recovery rather than building resilience (15). However, even the immediate response to disasters and catastrophes has often been riddled with administrative inadequacies and breakdowns and hampered by delayed decision making and layered bureaucratic procedures, as highlighted by Sobel and Schneider case study of Katrina (16, 17). As natural disasters have increased, it has become imperative to manage and transfer the financial risks more efficiently. As a risk management tool, insurance has emerged as an effective tool to cover against financial loss. The financial loss could be direct (e.g., damage to house, car, or other property) or indirect (loss of life or limbs), and it is covered by a company or the government in return for an annual premium based on the risk assessment.

Insurance products for disasters have traditionally been indemnity-based, i.e., providing coverage based on the loss incurred due to the disaster (14). It requires individual assessment of losses for each insured individual before compensation is paid out, resulting in high operational costs and delays in payment of compensation. Due to the high operating costs for the insurance provider and high premiums for the targeted low-income communities, these insurance products have low penetration in developing countries like India (18). A new insurance approach is based on indices or parameters based on specific and measurable parameters like rainfall, temperature, and wind-speed. Parametric or index insurance is designed based on the historical trends of a parameter, which are then matched with a corresponding economic loss so that any future change in the parameter can help calculate the potential loss (18). An example of index insurance is linking the quantity of rainfall to crop production and thus calculating the crop loss based on the variation in rainfall. For index-based insurance to be successful, it becomes necessary that large numbers of people are covered. In index-based insurance, an area-wide approach is taken, and all the clients with the same policy in a specific and defined area receive the same amount of claim (14). The claim is processed automatically when a parameter exceeds a pre-determined threshold value. In index-based insurance, the claims are transparent as it is based on a publicly accessible index and a pre-agreed threshold level, thus reducing the probability of disputes (18). It also reduces operational costs as it does not require an on-field assessment of the damage. Low operational costs and automatic payments reduce the premium charged to the people and provide immediate relief after disasters, leading to better financial resilience.

Insurance targeted at low-income people and communities against specific hazards, and in exchange for regular premium payments proportionate to the cost and probability of risks involved, is called microinsurance (14). Along with insurance cover for assets during disasters, microinsurance is also used for health and life insurance (13). Microinsurance products can be indemnity-based or index-based. In the agricultural sector, traditional crop insurance is used in yield-based crop insurance, taking into account damage caused due to multiple perils (14). Index-based insurance is in the form of index-based crop and livestock insurance and other weather-based index insurance policies. Due to its focus on low premiums, large coverage, and risk protection, microinsurance can help low-income households and farmers with access to post-disaster liquidity (13). Moreover, index-based microinsurance can provide this access to liquidity much sooner after the disaster as there is no need for on-site assessment. This helps economically disadvantaged communities to cope with disasters by securing their livelihood and rebuilding their lives.

Insurance has emerged as an essential tool for risk transfer, and with products like index-based insurance, many people can be covered and provided with faster relief after a disaster. Despite this, there remain two concerns – access for remote and poor communities and protection for the insurance provider in case of a large-scale disaster. For insurance to be viable and successful, it needs to be accessible to the people in rural and remote areas prone to disasters. One way of ensuring access is to link insurance schemes with existing infrastructure in rural areas. Bancassurance can be employed by using existing banking infrastructure and banking customer databases to provide index-based insurance to people (14). Besides, it provides a current market base for the insurance provider and reduces the risk of moral hazard and adverse client selection (14). Insurance providers can access global insurance markets for reinsuring their risks and spreading them globally (4). It will help in hedging against the risk of large-scale claims in case of a massive disaster.

Indian scenario

Crop insurance

Agriculture in India is still exceedingly dependent on rainfall for irrigation, making it highly vulnerable to extreme weather conditions

such as floods, cyclones, droughts, and heatwaves. Extreme events aside, even small changes in the amount of rainfall and its patterns affect agricultural output quantity. In 1985, the first countrywide crop insurance scheme, called the Comprehensive Crop Insurance Scheme (CCIS), was introduced (19). The scheme covered cereals, pulses, oilseeds, and decisions on its implementation was left to state governments; however, once implemented, it was a compulsory scheme for farmers (20). It was replaced by the National Agricultural Insurance Scheme (NAIS) in 1999, which was run by the government-owned Agriculture Insurance Company of India (AIC) (14). NAIS was also a compulsory scheme and covered commercial crops like sugarcane and cotton apart from cereals, pulses, and oilseeds (20). It was amended to Modified National Agricultural Insurance Scheme (MNAIS) in 2010 to reduce claim settlements' delays. Multiple pilot schemes were launched, and in 2003, ICICI Lombard-BASIX was the first weather index-based insurance scheme (WIBIS) to be launched in Andhra Pradesh (14). It spurred more private investment in crop insurance, and multiple weather index-based schemes were launched in the years since. Despite all these schemes, insurance penetration in the sector remained low due to high premium rates and prolonged delays in assessment and settlement of claims (19).

A new crop insurance scheme called the Pradhan Mantri Fasal Bima Yojana (PMFBY) was launched in 2016 to provide better insurance coverage and financial support to the farmers (19). The scheme also focussed on providing a stable income to farmers and to encourage them to adopt modern agricultural practices. It is implemented by Agricultural Insurance Company (AIC) along with other public and private insurance companies. The scheme is implemented on an area approach basis, wherein it is assumed that all farmers in a defined area incur similar production costs and earn similar income for a particular crop (21). It is further assumed that all farmers face identical risks in a defined area and thus incur similar losses in a natural disaster. PMFBY covers farmers for loss of yield of a standing crop in case of natural disasters like droughts, floods, cyclones, landslides, lightning, and more (21). It also covers losses incurred in case farmers are unable to sow due to extreme weather conditions. It does not cover risk due to theft, war, riots, and destruction of crops by domestic or wild animals. The premium to be paid by the farmer is fixed at 2% of the sum insured or the actuarial rate, whichever is lesser, for the Kharif season (Kharif crops are the crops which are sown at the beginning of the rainy season, e.g., between April and May) and 1.5% for the Rabi season (Rabi crops are the crops that are sown at the end of monsoon or the beginning of winter season, e.g., between September and October). For commercial or horticultural crops, the same rate is fixed at 5% (21). PMFBY mandates that claims be paid within 3 weeks after the yield data is received to reduce the time in processing claims.

The number of insured farmers has increased from 47.5 million to 57.2 million between 2015-16 and 2016-17 after the implementation of PMFBY (19). There has been an increase in farmers' coverage in both Kharif and Rabi seasons, with an overall increase of 20.4 percent. PMFBY has also resulted in a 6.5 percent increase in the area under coverage as it has increased from 53.7 million hectares in 2015-16 to 57.2 million hectares in 2016-17 (19).

Livestock insurance

Livestock keeping forms an crucial part of the rural economy. It is an important source of livelihood for people in rural India, especially the poorer sections of the population surviving on subsistence consumption (22). In multiple disasters across the country, from the floods in Kashmir in 2014 and cyclones in 1999 and 2013 in Odisha, many livestock perished. India has the second-largest livestock population globally, but only 6% (excluding poultry) of those were insured by 2011 (23). Livestock insurance can act as an important risk management tool for deaths due to the spread of diseases and natural disasters like floods, cyclones, and droughts.

Livestock insurance could either cover all livestock or have separate policies in the form of

cattle insurance, sheep and goat insurance, and poultry insurance. The Livestock Insurance Scheme was launched as a pilot in 2005-2006 and has been implemented regularly since 2008, focusing on crossbred and high-yielding cattle (22). Multiple organizations provide livestock insurance across the country. United India Insurance Company offers a Cattle and Livestock Insurance policy covering multiple risks, including death or disability due to lightning, flood, and cyclone. The Oriental Insurance Company covers risks from natural disasters for private owners and institutions like dairy farms and co-operatives. Other organizations like New India Assurance Company, Bajaj Allianz General Insurance Company, and National Insurance Company also provide livestock insurance. Schemes vary across insurers, with some covering all livestock and some focussing on cattle or poultry or fisheries. Premiums charged by the insurer depend upon multiple factors, including the animal's age, breed, and current market value (24).

Home insurance

Natural disasters cause widespread destruction of property, and one's home is the most valuable property for most people in India. The insurance cover for homes in case of a disaster can be the difference between individuals being pushed into poverty or recovering and rebuilding their lives. The Gujarat earthquake in 1999, floods in Mumbai in 2005, the Uttarakhand floods of 2013, and multiple other disasters have caused widespread destruction of homes, leaving thousands of people homeless and with no means to rebuild their houses. Home insurance can act as an important risk management exercise that can help people cope and recover after disasters.

Home insurance policies are available for both homeowners and renters and can include either the property, its contents, or both. Multiple public and private sector organizations like New India Assurance Company, ICICI Lombard, Bajaj Allianz, and State Bank of India (SBI) offer home insurance policies. Policies protect against the risks of multiple eventualities, including coverage from natural disasters like earthquakes, floods, lightning, and cyclones. Most insurance policies are short-term, requiring yearly renewal, with only a few organizations offer long-term policies. Despite multiple policy options, insurance coverage remains low, especially in rural areas, due to lack of access and affordability (25).

Life and accident insurance

Life insurance and accident insurance are the two most important forms of insurance. Loss of life has an emotional and psychological impact and a significant financial impact on the kin of the deceased. Similarly, accidents can lead to loss of limbs or serious injury, making an individual immobile and unable to earn a living. Death and injury are common events during natural disasters and can leave the family members affected in financial peril, especially among poor households. Term Insurance, Whole Life Insurance, and Endowment Policies are some of the different life insurance policies. Term insurance is for a fixed term, usually up to 30 years, has a very low premium, and the dependants claim the policy only in the case of death during the period (26).

Whole life insurance guarantees payment to the dependents at the time of death of the insured and has a higher premium than term insurance. Endowment policies have a saving or an investment aspect along with the death cover. Besides, the claim is made at the time of death or on completion of the term. It has a higher premium as compared to other kinds of insurance policies. Most life insurance schemes cover death due to natural disasters, and some also cover a partial or complete disability due to accidents. Life Insurance Corporation of India, State Bank of India, ICICI Prudential, and Bajaj Allianz are some organizations offering life and accident policies across the country (26).

Microinsurance policies for life and accidents are also offered for people belonging to low-income households. Microinsurance policies in life and disability insurance are common due to low moral hazard, easy verification, and one-time payment (27). Government offers multiple low

premium schemes like Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY) and Pradhan Mantri Suraksha Bima Yojana (PMSBY) (28, 29). PMJJBY is a life insurance scheme covering death due to any reason, including natural disasters, and is renewable annually. The scheme is open for anyone between the age of 18 and 50 and covers an individual for 2 lakh rupees on a premium of 330 rupees per year (28). PMJJBY is unique compared to other schemes as it also covers death in case of suicides. PMSBY is an accidental insurance coverage scheme covering both injury and death due to accidents, including natural disasters. It provides a cover of 2 lakhs for death and permanent disability and a cover of 1 lakh for partial disability.

Moreover, the scheme is renewable annually and charges a premium of 12 rupees per year (29). Edelweiss Tokio, HDFC, Bharti AXA, TATA AIA, and others offer multiple private sector microinsurance schemes. Edelweiss Tokio offers Life – Raksha Kavach scheme, which can be utilized by anyone between 18 and 50 years of age with the minimum sum insured of 5000 rupees.

Other insurance schemes

Insurance schemes are also based on a partner-agent model in which private or public insurers offer an insurance product in collaboration with a community-based organization or another Non-governmental Organization. VimoSEWA and Afat Vimeo are schemes based on the partner-agent model and have played an important role in risk management during disasters by providing different microinsurance products.

VimoSEWA is a scheme offered by the Self-Employed Women's Association (SEWA), founded in 1972 as a union for informal economy workers (30). SEWA offers an integrated microinsurance scheme called VimoSEWA which provides cover for life, health, and property and disaster cover (13). It started operations as a full insurance provider but shifted its model to a partner-agent model after encountering multiple financial issues. It has partnered with various organizations to provide different products, AVIVA for life policy, and ICICI Lombard for health, assets, and accidental death policies (30). It offers an innovative package by providing integrated insurance covering life, assets, accidental death, and health under a single package (30). It reduces risk substantially, as a single package covers all risks and limits people not opting for one or the other insurance.

AfatVimo is a scheme designed on the partner-agent model by All India Disaster Mitigation Institute (AIDMI), which covers life risks, trade stocks, houses and assets, and other livelihood assets. It covers the policyholder on the total potential benefit of $1,560 on an annual premium of $4.50 (31). It covers risks for 19 types of disasters, including fire, floods, earthquakes, cyclones, and landslides. It has partnered with Life Insurance Company of India to provide life insurance products and has provided non-life products in partnership with United India Insurance Company (31). Like VimoSEWA, AfatVimo also offers an integrated Life and Non-Life policy. Apart from this, AfatVimo also focuses on raising awareness among the low-income communities about insurance benefits. It also played a prominent role in providing post-disaster liquidity in the aftermath of cyclone Phailin in 2013 (32).

Insurance penetration in India

The penetration of disaster insurance is intrinsically linked to the overall uptake of insurance in the country. As stated above (in section 3), high operational costs and the corresponding high premiums and low level of awareness about the different insurance products can be attributed to the current low penetration (18). In recent years, there has been an effort by the Government of India to make insurance more accessible and affordable for the masses of the country, but still, the penetration remains low. Insurance penetration is measured in terms of insurance premium as a percentage of the country's Gross Domestic Product (GDP) (33). Life insurance penetration has only increased from 3.17% of GDP in 2005 to 3.40% of GDP in 2016-

2017 (34). Life insurance density is defined as the per capita spending on insurance, and it has increased from $14.7 in 2002 to $52 in 2013 but remains low compared to other countries (33). The low uptake of insurance affects people in rural areas as their livelihoods are dependent on natural resources and thus prone to be affected by natural disasters. General insurance or non-life insurance products have even lower penetration as India spends $11.5 per capita compared to $102 in Russia and $153 in China (35). Only 29% of households have at least one member covered with health insurance, with only 20% of women and 23% of men covered within the age of 15-49 (36). Andhra Pradesh has the highest percentage of households with at least one member covered under health insurance at 75%, while Lakshadweep, Jammu & Kashmir, and Manipur have the lowest proportion of such households with less than 5% (36).

The reasons for the low penetration of insurance in India are manifold. The penetration of Non-Life or General Insurance remains even lower as access is still limited to large cities. General insurers have 57% of their branches in tier-I cities, and private insurers have 96% of their branches in large cities (37). There is a lack of knowledge about disaster insurance and a flawed mindset where people think that these perils will not affect them. It is especially the case in areas not frequently prone to natural disasters. In non-life insurance products, there remains pricing concerns and lack of innovative products according to people's varied needs in different regions (37). A study shows that one of the major reasons for low penetration in rural markets is the unavailability of insurance products according to rural needs (38). There is also a lack of trust in private insurers, especially in rural areas, due to a traditional mindset that looks at private companies with suspicion (38). Index insurance for farmers has tried to overcome these limitations, but it has its drawbacks. As the payments are made based on a presumption that all clients in an area suffer equal loss in a disaster event, it can vary from the farmer's actual loss (18). The payments could be higher than the loss suffered at times, or it can be lower and insufficient to cover the loss. It is also not suitable for complex risks, which cannot be easily measured. Risk such as drought can be easily covered, but disasters like flash floods, cyclones, and sea surges are much more complex, and the damage cannot be directly related to a parameter (14).

New insurance schemes like PMFBY also have some limitations. The capping on premium rates was removed, and the actuarial premium rates have not gone down as expected; instead, they have increased (19). In 2016-2017, the claim to the premium ratio for PMFBY reached an unsustainable level of 121%, and it was even higher for PMSBY at 170% (39). It has caused the insurance companies providing the schemes to call for a major increase in premiums for both the schemes (39). PMFBY also fails to cover the risk of price volatility in agricultural products as it is an entirely yield-based scheme and farmers continue to be at the mercy of markets for their income. There have also been delays in payment of claims by the insurance companies who have argued that they have not been provided subsidies from the state government as promised (19).

Conclusion

The study shows that while India remains vulnerable to multiple types of natural disasters causing large-scale destruction, its population's financial resilience remains low. The review outlines insurance as an essential risk management tool for natural disasters and highlights different insurance types from traditional indemnity-based to weather index-based insurance. It also shows the importance of microinsurance for people with low income as an essential strategy to bring large swaths of uninsured Indians living in rural areas into the ambit of insurance. Our study also outlines different schemes being run by public and private sector organizations for providing coverage for both life and general insurance. The review shows that while life insurance is the most popular form of insurance, its penetration as a percentage of

GDP (3.17% in 2005 to 3.40% in 2016-2017) and per capita spending remains low ($52) in India. General insurance is further explained by highlighting the schemes under crop insurance, livestock insurance, and home insurance. The review shows that after implementing PMFBY, there has been an increase in the number of farmers insured, but certain drawbacks like high claim-to-premium ratios and delays in payments remain. Livestock and home insurance from natural disasters are available through multiple public and private insurers, but the penetration in these sectors remains low.

This study has further substantiated other studies which have highlighted the importance of insurance as a means of hedging risks and providing much-needed financial liquidity to the low-income population in the aftermath of a disaster (31, 40). A study after cyclone Phailin in Odisha concluded that different insurance products made important contributions in rebuilding the lives of insured people after the disaster (31, 41). It also highlighted the importance of insurance as compared to the relief and compensation provided by the government. Insurance provided a sense of security to the people compared to relief measures, as it assured a level of certainty. It helps farmers plan and adopts innovative and new agriculture techniques as it gives them security against crop failure. Another study conducted in India, Sri Lanka, and Bangladesh corroborated this, as it showed people's preference towards the security of insurance rather than the ad-hoc nature of relief (42). The study also shows the importance of public and private insurers in covering a large country like India. Private insurance provides innovative products and competition, but insurance remains relevant only as long as the private insurers remain solvent (13). The role of government in such an atmosphere becomes important in formulating insurance schemes, making them financially robust for the insurers, and keeping them affordable for low-income households (13). It provides subsidies to low-income families directly through its schemes or subsidizing private insurers' products to make them affordable (31). It also provides reinsurance to insurance providers, thus reducing their risk. The government needs to invest in the expansion of weather index-based insurance by setting up weather stations, as private insurers are usually unwilling to set up the same given the high initial costs (43).

Microinsurance has emerged as an important product for providing access to low-income communities as they cannot be reached by regular commercial insurance. It can help poor communities by giving them the security to invest in new assets, take up new farming techniques, and risk new but higher-yielding seeds (13). It helps in the time of disasters and can generally help increase a farmer's yield, thus increasing his production and breaking the cycle of poverty. A study showed that around 39% of people, who accessed microinsurance in the study area, felt that these schemes would reduce the need for borrowing money after a disaster (42). Like most general insurance schemes, microinsurance schemes require renewal at regular intervals, usually yearly, and this underlines the need for trust in insurance providers among people and communities. The government's role in backing these schemes and visibly promoting them can help build this trust among the people. Urban flooding has become another common threat in India as multiple Indian cities are inundated year after year, with Mumbai, Srinagar, and Guwahati facing frequent flooding. Due to low insurance coverage of homes and businesses, these floods cause massive economic damage. A study conducted in the city of Guwahati recommends insurance coverage for not only homeowners and businesses but also public infrastructure and local authorities (44). It will help individual clients and ensure that local and state budgets do not go haywire in case of disasters.

As shown in this paper, there have been multiple insurance schemes initiated in the country over the last few years, but the penetration of insurance in our country remains low, not only compared to developed countries but also in comparison to other developing countries such as China. There

are high-risk levels even in publicly financed schemes, as shown through the claim-to-premium ratio for PMFBY and PMSBY for the year 2016-2017 (39). India needs to adopt global best practices in crop damage, as it affects millions of farmers in the country every year. While insurance companies have demands to increase the premium for PMFBY and PMSBY, the government needs to continue the heavy subsidization of premiums, which stands at 83% for 2016-17 (19). These subsidies are in line with international best practices as China subsidizes premiums up to 80%, and even a high-income, developed country like the USA subsidizes the premiums up to 70%. High subsidization has played a role in bringing more sown areas under insurance, which stands at 69% in China and 89% in the USA as of 2015 (19). India can also look at Kenya's example as it has developed a mobile-based application for transferring money to farmers resulting in efficient claim settlements within 2-4 days (19). PMFBY mandates mobile-based GPS technology for yield assessment, but its implementation at the ground level is lacking. Technological innovations can help in better management of these schemes and reducing leakages in the system. As most of the schemes are subsidized by India's government, risk pooling mechanisms among countries can be another important risk diversification (18). The pooling of funds can help India and other countries share risk management practices and exchange technical and financial resources for better disaster management. It can also be made more effective by involving multinational organizations like World Bank and International Monetary Fund (IMF) and investing in diverse financial instruments like Catastrophe Bonds (18).

While presenting an analysis of the importance of disaster insurance, the present study has some limitations. The study is based on existing literature, and no field-based study was conducted. The study also aims to provide a critical analysis of disaster insurance and does not claim an exhaustive survey highlighting every insurance scheme or policy. It also maintains its focus on insurance and does not go into other means of disaster management essential for risk mitigation.

Recommendations and future policy implications

The current study has shown multiple aspects of India's insurance, its benefits, lack of widespread coverage, policy shortcomings, and its potential to diversify risks. The study calls for an urgent effort to increase the number of insured to manage better the economic impacts of disasters. Lack of knowledge and trust are usually highlighted as the factors behind the low penetration levels of insurance. The government needs to run campaigns to increase awareness of insurance and its benefits. There is also a need to engage with current clients to ensure that their concerns are addressed and they do not opt out of the insurance schemes after a year or two. Community engagement is an important aspect to ensure the trust of people and will also help maintain proper feedback channels to the insurance companies and the government. It can also help make changes to existing products and better design insurance products in the future. While microinsurance has played an important role in disaster risk reduction, it needs to be supplemented by a comprehensive disaster management plan that focuses on building disaster-resilient infrastructure, preparing effective response measures, and promoting sustainable livelihoods and sustainable development.

List of abbreviations

DRM: Disaster Risk Management; CCIS: Comprehensive Crop Insurance Scheme; NAIS: National Agricultural Insurance Scheme; AIC: Agriculture Insurance Company; MNAIS: Modified National Agricultural Insurance Scheme ; WIBIS: Weather Index-based Insurance Scheme; PMFBY: Pradhan Mantri Fasal Bima Yojana; PMJJBY: Pradhan Mantri Jeevan Jyoti Bima Yojana; PMSBY: Pradhan Mantri Suraksha Bima Yojana ; SBI: State Bank of India; SEWA: Self-Employed Women’s Association; AIDMI: All India Disaster Mitigation Institute; GDP: Gross Domestic Product

Acknowledgements

The authors are grateful to other colleagues of Population Council, New Delhi India office for providing the necessary inputs for writing this paper.

Authors' contributions

Sangram Kishor Patel has conceptualized, performed the analysis and taken lead in writing the paper. Ankit Nanda has performed the analysis, review of literature and written the paper. Saradiya Mukherjee has done the review of literature, compiled the reagents/materials/tools/references sections and written the paper.

Funding

No funding sources

Conflict of interest

The authors declare that they have no competing interests.

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