The Differential Risk Transfer: a new approach for reducing vulnerability to climate-related hazards

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Abstract

Purpose – Climate-related disasters are the most representative in terms of recurrence and impacts. To reduce them, risk transfer is a key strategy for climate risk management. However, this approach does not consider the socioeconomic vulnerability of each population group, limiting its effectiveness. The objective of this paper is to improve and increase the usefulness of risk transfer through the Differential Risk Transfer (DRT) approach.
Design/methodology/approach – A comprehensive and systematic review of the state of the art on Differential Approach (DA) is presented, and its connection with existing models of vulnerability to disasters is analysed. Through epistemic deliberations, an operational definition of Differential Risk Transfer (DRT), as well as its advantages are discussed. Finally, general guidelines are presented for the implementation of the DRT in a specific context.
Findings – The results confirm that DA presents a clear relation with the models for the study of disaster vulnerability. The small group discussions agree with the usefulness of DRT for improving climate-related risk management.
Practical implications – This paper argues for the inclusion of the DRT approach in the climate risk management strategies aiming to fill the disaggregated data gaps that limit the potentiality and accuracy of risk transfer schemes worldwide.
Originality/value – This innovative approach improves the accuracy of the risk transfer mechanisms through the recognition of the differences of ethnicity, gender and life cycle that increase socioeconomic vulnerability to climate-related disasters.

Keywords Climate risk transfer, Differential approach, Differential risk transfer, Disaster risk management, Inclusive insurance, Socioeconomic vulnerability

Paper type Research paper

Introduction

In the last ten years, climate-related events triggered 83% of all disasters resulting from natural hazards, which have caused more than 410,000 deaths and affected 1.7 billion people (IFRC, 2020). Just in 2020, 14,301 people were killed, 97.1 million people were affected and USD 171.3 billion in economic losses were caused by climate-related disasters (CRED, 2021). Floods, droughts and tropical cyclones are the most representative in recurrence and impacts. These events are expected to increase in intensity due to Climate Change (CC) (UNDRR, 2020).

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Organizations such as the United Nations and the World Bank Group include risk transfer in their policy framework as one of the five pillars for Disaster Risk Management (DRM) (DRFIP, 2020). In the same way, theoretical and practical models for risk intervention worldwide include risk transfer, e.g. risk governance models used in Europe (Klinke and Renn, 2019) and the model based on processes used in Latin America and the Caribbean (LAC) (Narváez *et al.*, 2009). Risk transfer refers to the process of formally or informally shifting financial consequences of a particular risk from one part to another, whereby an actor will receive resources from the other part after the occurrence of an event in exchange for social or financial benefits (UNGA, 2016).

Being that risk transfer is a highly valid strategy for the reduction of climate-related disasters, its use has increased significantly in the last ten years, especially in climate insurance. However, risk transfer has been limited by natural, socioeconomic and political factors that constrain its potential (Fernández, 2020). For example, the exclusion of women and ethnic groups from climate insurance has increased social inequity after disasters (Miles and Wiedmaier-Pfister, 2019). Accordingly, this paper builds on research that proposes an innovative approach based on the integration of vulnerability factors (gender, ethnicity and life cycle) to disasters using risk transfer.

The objective of this paper is to develop the Differential Risk Transfer (DRT) approach, providing general guidelines for its application as a contribution to the reduction of socioeconomic vulnerability to disaster. DRT is defined as the process of transferring the financial consequences of risk from one part to another, considering the characteristics of gender, ethnicity, disability and life cycle of an individual, family or community, in the activities related to the design/implementation of mechanisms that allow the access to social or financial benefits when a climate-related disaster strikes. This innovative concept improves the accuracy of the climate risk transfer mechanisms through the recognition of the differences that potentially increase socioeconomic vulnerability to climate-related hazards. For this, we present a comprehensive state of the art for Differential Approach (DA), its relation to DRM/risk transfer and epistemic deliberations in small group discussion as a base for generating practical guidelines for its implementation.

State of the art

Through a comprehensive literature review, this section aims to establish the theoretical background of DRT. The relationships between DA, DRM, social vulnerability to disasters and risk transfer are presented and discussed.

The differential approach and its relation to DRM

DA can be defined as a set of actions that seeks both the recognition of specific vulnerabilities of each population group as well as the ways to reduce them (Arteaga *et al.*, 2012, p. 17, p. 17). Its implementation depends on the characteristics of the minority groups, such as indigenous, roma, afro-descendant and raizal (Montealegre and Urrego, 2011). Both DA and DRM converge in the reduction of vulnerability to disasters.

The different characteristics of an individual or community can be mixed, making them more or less vulnerable according to their living conditions. For example, the vulnerability of an afro-descendant or indigenous individual would increase significantly according to gender (Delgadillo, 2018). Crate and Nuttall (2009) display that women are three to four times more vulnerable to hydrometeorological disasters than men. They conclude that the disparities in negative impacts are due to the opportunities of education and information being higher for men. In this case, women are excluded culturally from activities like hiking, climbing trees and swimming; thus, women have fewer skills for reacting to sudden hazards such as floods

and flash floods. In other cases, women are forbidden from leaving their houses without a man, which limits the possibility of evacuation (Miles and Wiedmaier-Pfister, 2019; Yadav and Lal, 2018).

Gender inequality extends the conditions of poverty and inequity, which leads to the increase of socioeconomic vulnerability to disasters (Sarduy *et al.*, 2019). Arteaga *et al.* (2012, p. 30) present a classification of population groups differentially, highlighting that an individual or community could be affected by one or more social conditions. Considering the classification stated by Arteaga *et al.* (2012), Table 1 presents the types of differentiation by population group which determine the characteristics of socioeconomic vulnerability to climate-related hazards.

At the international level, DA is based on the Convention on the Rights of Persons with Disabilities, the Declaration on the Elimination of Violence Against Women and the Universal Declaration on the Rights of Indigenous Peoples. During the last 20 years, and remarkably from 2005, components of DA have been progressively integrated into DRM through the Hyogo Framework for Action 2005–2015 (UNDRR, 2005) and the Sendai Framework for Action 2015–2030 (UNDRR, 2015).

Models of vulnerability to disasters and its relationship to DA

The theoretical bases for DRT are global vulnerability and differential vulnerability. In the context of this paper, vulnerability is understood as the "conditions determined by processes or physical, social, economic and environmental factors that increase the susceptibility of a person, community, the goods or systems to the effects of the threats" (UNGA, 2016, p. 25).

The model of global vulnerability is commonly used in the LAC region. It was developed by Wilches-Chaux (1989), referring to the set of factors that make an individual or community more vulnerable to disasters. This set includes 11 vulnerabilities such as natural, physical, economic, social, political, technical, ideological, cultural, educational, ecological and institutional. This approach offers, therefore, a way to understand the factors which may influence them and, consequently, foster vulnerability reduction strategies. In North America and Europe, global vulnerability is not referenced. Authors rather use the approach of differential vulnerability, widely described by Wisner *et al.* (2014).

The second model concerns the differential vulnerability which, according to Thomas *et al.* (2019), is the result of social, economic, historical and political factors which impact multiple scales and cause the consolidation of risk as a result of inequity conditions. Differential vulnerability is determined by economic, institutional and political capabilities, concerning impacts generated by external phenomena. As stated by Warner *et al.* (2019), this causes convergence in a relationship of power, that generates vulnerability through poverty and perpetuates the lack of capabilities for safe development.

Type	Population group
Gender	Women
Life cycle	Children
	Older adults
Ethnic origin	Afro-descendant
	Indigenous
	Raizal
Condition	Persons with disabilities

Source: Adapted from Arteaga *et al.* (2012)

Table 1. Classification of the differential approach by population group

Global vulnerability and differential vulnerability display similar components, for example the economic, cultural and social factors that determine the way individuals perceive their environment, know the risks and estimate their adaptation capabilities.

The socioeconomic vulnerability to disasters

Both approaches, differential vulnerability and global vulnerability include socioeconomic vulnerability. Socioeconomic vulnerability is defined as the set of characteristics related to the well-being in childhood, livelihood, resilience, social protection, social networks, institutions and policies which make them susceptible to be affected by a threatening phenomenon (Cannon *et al.*, 2003). Concerning this type of vulnerability, Thomas *et al.* (2019) mention that the process of marginalization of communities plays an important role in the germination of patterns of inequity in access to resources, that are simultaneously exacerbated by unevenness in the vulnerability conditions; for example after hurricane Katrina –in 2005–, the most affected communities in New Orleans were Afro-American and Latin people and communities, which presented lacks of resources for preparedness, response and recovery from the event. In the case of hurricane Maria –2017–, the loss and damages in Puerto Rico were devastating and the recovery took several months. The same physical conditions in Texas caused fewer losses, and the recovery took a few weeks (Weiss *et al.*, 2018). In both cases (Katrina and Maria), the effects of the disaster were exacerbated by the socioeconomic vulnerability of marginalized groups (Yadav and Lal, 2018).

Why socioeconomic vulnerability to climate-related risks?

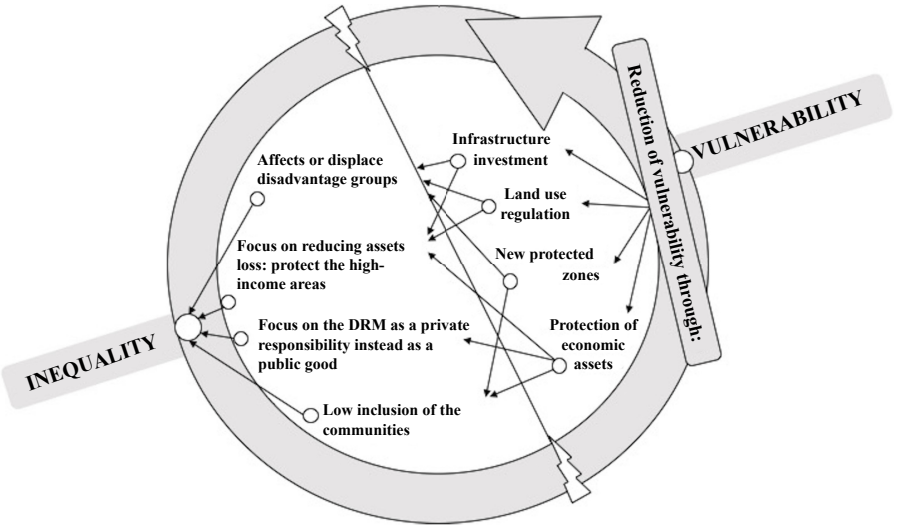
From the literature review, we can now identify a notorious prioritization of socioeconomic vulnerability as key in the attenuation of political and institutional vulnerability. The reduction of climate-related disasters is necessary to reflect critically around the risk of increased vulnerability through the intention of reducing other kinds of vulnerability (e.g. physical vulnerability).

Concerning the prioritization of interventions in vulnerability, we take as an example the study developed by Anguelovski *et al.* (2016, p. 334), in which two main ways in which the actions for reducing physical vulnerability to disasters create social inequities were identified Figure 1(a). The investment in infrastructure, land use regulation and declaration of new protected areas affect/displace disadvantaged population groups. (b). DRM plans prioritize areas with more probability of expected losses over low-income areas. Figure 1 shows social inequities related to the strategies for the reduction of physical vulnerability presented above. The decision to invest in the mitigation of socioeconomic vulnerabilities not only depends on the technical relevance associated with the hazards, but is also highly influenced by political interests (Thomas *et al.*, 2019).

The examples listed above show how deciding to reduce physical vulnerability to disasters can increase the risk through the rise of inequity conditions. An alternative way for reducing the vulnerabilities to floods would be mandatory insurance buyouts to discourage the occupation of risk areas and foster residents' relocation.

Disaster approach and Disaster Risk Management

This section is based on the review of academic and gray literature, which involve DA, socioeconomic vulnerability to disasters and DRM, as a contribution for establishing the conceptual foundations of DRT. The selection of the relevant experiences is carried out considering 70 documents, analysed through the web application Rayyan (Ouzzani *et al.*, 2016). Such supervised review considers as search criteria the next keywords (in English and Spanish): Differential approach, gender approach, ethnic approach, climate risk, climate



Source(s): Adapted from Anguelovski *et al*. (2016)

Figure 1.
Increase of inequalities related to the implementation of strategies for the reduction of the vulnerability to climate-related hazards

hazards and CC adaptation. The research timespan is 15 years (2005–2020), corresponding to the international frameworks for DRM (Hyogo 2005–2015 and Sendai 2015–2030).

The literature review shows that there are no registered references about DA in regions other than LAC. In this region, Colombia is the country that shows more progress, as DA is mainstreamed in public policies, for example Law No. 21 of 1991 (United Nation Declaration on the Rights of Indigenous Peoples), Law No. 1257 of 2008 on the prevention of violence against women and Law No. 1448 of 2011 on the restoration of victims of the armed conflict. This fact allows us to take the region as a representative case in which DA has been used for addressing risk reduction.

From a DRM perspective, DA is defined as the territorial intervention method that takes into consideration the diversities and inequities of the population at risk of disasters, aiming to provide an integrated approach (Granés *et al.*, 2019). In the LAC region, Álvarez-Díaz (2020) research in Mexico highlights the necessity of disaggregated data by sex for the implementation of preparedness and response actions. Sarduy *et al.* (2019) argue for the need of including gender in the national strategies for CC in Cuba and a gender approach in projects of the Green Climate Fund. In Colombia, Delgadillo (2018) studied the strategies for CC adaptation and concluded that the gender approach allows identifying communities' limitations and strengths. Sánchez (2018) presents guidelines for DRM with an ethnic approach. Other examples from the LAC region are the works carried out by Espinosa and Pérez (2018) about co-responsibility in DRM.

Although DA refers only to the LAC region, the literature review exposes some contributions that include vulnerability to disasters in a differential way. Tozier De La Poterie and Baudoin (2015) display an analysis of the international public policy frameworks for DRM (Yokohama Strategy, Hyogo and Sendai Frameworks). Their results show an increase in the words "Women", "Indigenous" and "Disability", which represent the prioritization of actions from the United Nations member states. Few *et al.* (2016), analysed strategies for strengthening capacities on DRM through 13 case studies in Ethiopia, Pakistan, Myanmar, Philippines, Haiti and Mozambique. This study highlights the need of reducing differential vulnerability as a pillar in the improvement of DRM. The research developed by Pérez (2019)

considered how climate migrations affect women and girls. This research highlights the relevance of creating data and information about the characteristics of how differently people are affected. Adams (2019) identified in Accra, Ghana, the triggers of differential vulnerability, and proposed recommendations for reducing socioeconomic vulnerability in slums. In Germany, Klinke and Renn (2019) argued for the importance and usefulness of generating disaggregated data by gender and life cycle. Rice *et al.* (2015), implemented a project for the generation of knowledge about climate-related hazards in territories with ethnic cultural interest in South Apachala (USA). This study also points to the generation of data differentially by gender and life cycle.

The differential approach in risk transfer

This section is also carried out through a review of gray and academic literature and aims to identify signs of progress on the topic. The initial review is defined by three basic criteria: language (English/Spanish/Portuguese); keywords (Differential approach, risk transfer, climate-DRM, climate risk, climate insurance) and, timespan (2005–November 2020, corresponding to international frameworks as Hyogo and Sendai). The documents are reviewed through the Rayyan web application in which 221 documents were uploaded (Ouzzani *et al.*, 2016).

Our literature review shows that only 11% (24 of 221 documents analyzed) include some components of DA. We can conclude that there are no references in which the socioeconomic vulnerability to climate-related hazards is addressed from the DA perspective and in the risk transfer context. At the international level, DA has not been considered a strategy for enhancing the risk transfer mechanisms. Nevertheless, since 2011 there have been references related to gender. Below we present a chronological description of relevant contributions related to some of the components of DA in the climate risk transfer sector.

Progress in the inclusion of gender in the climate risk transfer

The study developed by Fletschner and Kenney (2011) presents the advantages of inclusive insurance, specially designed for the needs and features of rural women, that impact positively both on women as on children's nutrition and quality of life. The literature review shows a relevant increase since 2015 in the inclusion of gender in the (re)insurance sector. Gender is a social construction that can change both in time as well as from a place to another (Miles, 2016). The systematic inclusion of gender in data production is due to the creation, in 2014, of the Lima Work Programme on Gender (CMNUCC, 2014) of the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC was extended to COP 23 (2017), which established the Gender Action Plan (UNFCCC, 2019). AFI (2017) fosters the generation of disaggregated data by gender and promotes the financial inclusion of women in the national strategies. Miles and Wiedmaier-Pfister (2018) developed the concept of gender-sensitive climate risk insurance which considers the factors that can increase differential vulnerability. ARC (2020) incorporates gender in its planning instruments through concerted inclusion of the matter in public policies. CCRIF (2020) has included gender criteria to help mitigate the problems related to cash flow in small developing economies. InsuResilience (2020b) advanced in September 2020 with the Declaration on Gender.

The year 2020 recorded a considerable increase in gender issues for the insurance sector, because the COVID-19 pandemic exposed the vulnerability of women and indigenous people (Lavell *et al.*, 2020). InsuResilience (2020a) argues that if the effects of school closings on women's jobs had been planned, measures would have been advanced so that their job performance was not drastically affected by taking care of children.

The complexity that represents the socioeconomic vulnerability to disasters not only demands attention to gender but also to other characteristics as ethnicity and life cycle, which

depend, at the same time, on the type of hazardous events. For example, concerning the life cycle, elderly women and girls are more vulnerable to die in flash floods and tropical cyclones (Fisher *et al.*, 2018). Contrarily, men are more susceptible to die during slow on-set floods by adopting dangerous behaviours (Urwin, 2016). Men above 70 years old presented a high proportion of deaths due to Covid-19 in 2020 (OECD, 2020). Thus, if a risk transfer mechanism is addressed to attend to the needs of affected persons, it must take into consideration the peculiarities of the vulnerability of each population group.

Methodology

We explore two main contributions: (i). Epistemic deliberations through multisectoral small group discussions; (ii). General guidelines that allow public and private stakeholders to implement DRT.

The first component is developed from small group discussions conducted in the frame of multidisciplinary events. Due to the restrictions of the Covid-19 pandemic, all the events were virtual. These events were: (i) International Congress on Risk (October 2020), (ii) Global-Insurance Forum (October 2020) and (iii) Understanding-Risk Forum (December 2020). This component aims to present a multisectoral perspective of the impacts of DRT on DRM. The participants were a representative from the Ministry of Finance and Public Credit of Colombia (public sector), who participated in events ii and iii. A representative of the InsuResilience-Global-Partnership (multilateral organization) that participated in event iii; and, a representative of the Microinsurance Catastrophe Risk Organization -MiCRO- (private sector) that participated in events i and ii. The sessions were carried out in separate virtual rooms and took 15 min by each stakeholder during each event (event i: 15 min; event ii: 30 min; event iii: 30 min).

The inclusion of the Colombian Ministry is due to the fact that this country presents relevant progress in DRM, risk transfer and DA. The involvement of MiCRO is due to its expertise on inclusive insurance, and InsuResilience due to its advanced work on gender-responsive climate risk transfer.

The discussion was based on three framing questions: What are the challenges of risk transfer for reducing social vulnerability; what differential components must DRT include (gender, ethnicity, age group, disability) and what are the pros and cons of the implementation of DRT. For the results' analysis, we implemented a matrix that relates six criteria to each stakeholder (in concordance with the framing questions). The criteria are challenges of risk transfer, the feasibility of the implementation of differential components and its pros/cons, topics of articulation between stakeholders and innovative contributions of the DRT. The analysis of the small group discussions through such a matrix aims to find points of convergence between the stakeholders 'answers, obtaining an integrated perspective about DRT.

Results

The concept of DRT answers to the gaps in risk transfer that show that despite DA having strong bases in international and national public policies, its potential for intervention in DRM has not been exploited enough. The use of DA in DRM including components as gender, ethnicity and life cycle only has been considered in Colombia, without practical implementations.

The vulnerable groups are selected based on the classification presented in Table 1. The prioritized vulnerable groups are women, ethnic groups, persons with disabilities and older adults, which present fewer capabilities for DRM and disasters recovery. These population factors should consider the (sub)national political structures, power dynamics and forces of

oppression that expand the socioeconomic vulnerability outside the mere climate-related event.

The small group discussions agree about the non-existence of DA for DRM in Europe, Africa or Asia. The group discussions highlighted that DRT does not seek to ensure the risk of a few at the expense of others, which means that DRT will not segregate specific social groups. On the contrary, DRT prioritizes vulnerable populations, promoting their inclusion in the risk transfer strategies. They also recognize the gaps in data that limit the potentials of climate risk transfer and the opportunity to generate disaggregated data through DRT.

The group discussions showed that DRT encourages the reduction of social inequities by contributing to the equitable distribution of resources and the protection of peoples' rights in vulnerable conditions. The consideration of this approach, by both governmental authorities as well as international agencies and donors, allows the prioritization of the most disadvantaged population groups, optimizing the use of public/private resources for addressing the 2030 SDGs.

Group discussions highlighted that the data generated differentially are essential in the formulation of public policies, especially in gender-disaggregated differentiation. This represents a poorly addressed gap in risk transfer and even more in DRM. AFI (2017) shows that only 48% of the 16 AFI member countries generate gender-disaggregated data, which halves the opportunity to properly characterize the climate insurance sector.

Benefits of DRT approach for a comprehensive DRM

Through the matrix for the analysis of the small group discussions, we identify that participants agreed that the main challenge of risk transfer is the vulnerable group's exclusion from the benefits of climate insurance. Participants did not identify major constraints in DRT and prioritized gender and ethnicity as vulnerability factors rather than disability and life cycle. They argued that disability and life cycle insurance is not viable because it is difficult to implement due to two main reasons: the need for highly detailed data (according to the type of disability and kind of age group); and, the geographical dispersion of the insured. The stakeholders agreed that DRT is an innovative approach for reducing social inequity and enhancing DRM. They stated that some of the actions supported by the DRT that are useful for each stakeholder are:

Public Sector: Generation of information on socioeconomic vulnerability conditions and disaggregated data about the population groups. Such information contributes to enhancing risk assessment through the inclusion of variables that intensify socioeconomic vulnerability as gender and ethnicity, which translates into a comprehensive DRM approach. Disaggregated data also contributes to identifying systemic risk in a specific territorial context.

Private Sector: Improving the models for risk transfer schemes through more detailed data of socioeconomic vulnerability to disasters. This fact contributes to mitigating the uncertainty exacerbated by the CC and identifying systemic risks that can affect the sustainability of the risk transfer products. Likewise, it allows for avoiding a moral hazard, since the communication of DRT is focused on the recognition of governmental and civil society responsibilities associated with a risk transfer mechanism.

Public and Private Sector: Analysis and evaluation of risk and its categorization in levels: the disaggregated data is a fundamental input for the categorization of socioeconomic vulnerability as a contribution for the prioritization of intervention areas. DRT promotes differential information for the population groups about specific risks, their mitigation and how to be prepared. On the other hand, in the prospective risk intervention, the private sector provides support in technical assistance to the local authorities for the identification of non-structural risk reduction measures using disaggregated data. All the information about

livelihoods and resources used by the communities for managing their risk (architecture and materials of ancestral use) can be obtained during the formulation/implementation of the DRT. Such information is a valuable input for the design of natural-based solutions.

Multilateral organizations: DRT enhances technical criteria for prioritizing areas at the (sub)national level for implementing risk transfer mechanisms. Thus, the selection criteria include a more comprehensive approach since it includes gender and ethnicity as variables of vulnerability to disasters, enhancing the decision making for allocating financial and technical resources.

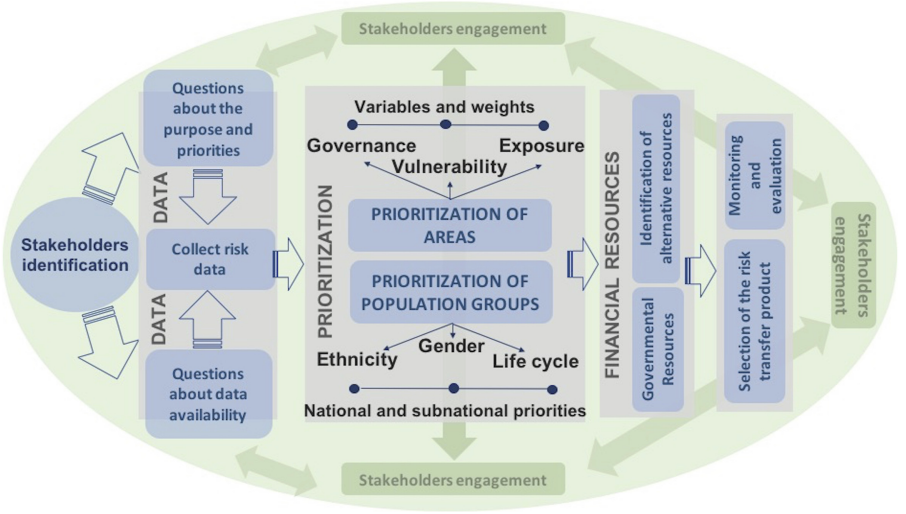
Discussion

The results presented above allow us to propose a set of general guidelines for implementing DRT. These guidelines are notably functional for national governments, (re)insurance companies and multilateral organizations for prioritizing areas, for designing and implementing inclusive risk transfer mechanisms in a specific territorial context.

The implementation of DRT requires the identification of resources that allows the technical, financial and administrative development of a risk transfer scheme. This pre-assessment of suitable conditions is highly relevant, mainly in developing countries that have data limitations and insufficient technical and financial capabilities. Figure 2 shows the detailed process for DRT implementation at the subnational level.

General guidelines for implementing the DRT

The first step is to identify the most relevant hazards and the risk transfer products that better fit the needs of persons. A second step requires the characterization of stakeholders and the identification of public policies' frameworks. Thirdly, the prioritization of the area and the population groups must be defined. Also, there must exist characterization of alternative funds for financial support. The main components in the DRT implementation process are as follows:



Source(s): Authors

Figure 2.
Scheme for the implementation of the Differential Risk Transfer approach

Stakeholders: Before starting to collect the data, it is necessary to identify and communicate with stakeholders the features of the process. The identification of information, data collection and the definition/implementation of the methodology require continuous negotiation with stakeholders. Some of the stakeholders at the national/subnational levels that are expected to be involved are the hydrometeorological services, the DRM authority, the institute of statistics, the finance department and the planning/development office.

Information: Refers to all the data related to the characteristics of (i) Hazard: type of event and its physical features, causes, recurrence, cascading/chain events, activation thresholds, multi-temporal variation and trend under CC. (ii) Exposure: identification of the presence of people, livelihoods, infrastructure and economic resources, impacts and recurrence of the events. (iii) Vulnerability: socioeconomic conditions of the exposed population and the capabilities of the institutions to disaster risk finance. (iv) Risk: means all the information that characterizes and analyses the interactions between the previous factors; the risk data is especially useful when expressing expected losses and damages. Before the data collection, it is relevant to ask how and where data can be obtained and if available data fit the process purposes and timeline.

Prioritization: DRT is a process that is based on agreements, and in which all the stakeholders take part in the definition of the variables that will be included in the prioritization of the areas for implementing a climate risk transfer mechanism and the selection of the population groups. The selection of the area must consider a multi-criteria decision analysis for indicating the most suitable area for intervention. The factors (composed of multiple variables) that we consider as essentials are: Vulnerability - The presence of ethnic groups, the incidence of multidimensional poverty, the incidence of the gender wage gap and the incidence of monetary poverty; Exposure – the presence of two or more hydrometeorological events, recurrence and impacts under CC scenarios; Governance - incorporation of the disaster risk finance in the DRM plan, the hierarchy of the DRM authority in the municipal structure. The selection of the population groups obeys the socioeconomic priorities stated by the stakeholders in terms of DRM, CC adaptation and social equity.

Financial resources: The consideration of alternative financial resources will promote the articulation of the local authorities with international private and public organizations. Alternative financial resources mean those that are not part of the local and national DRM budget. Alternative resources can be obtained from international cooperation (e.g. the Swiss Agency for Development and Cooperation -SDC, the German Agency for International Cooperation -GIZ-, the Japan International Cooperation Agency -JICA-), multilateral organizations (The World Bank Group -WB-, the Organisation for Economic Co-operation and Development -OCDE-, the Asian Development Bank -ADB-, The InsuResilience Global Partnership), private organizations (e.g. the Caribbean Catastrophe Risk Insurance Facility -CCRIF-) and NGOs (e.g. Development of Human Action -DHAN- Foundation, SOJAG NGO and MicroEnsure).

Monitoring and evaluation of the selected scheme: We suggest the indicators for assessing the costs and benefits of risk transfer based on the proposal by Prabhakar *et al.*, (2015, p42). The most relevant indicators for assessing the cost and benefits of the DRT approach are presented in Table 2.

Features of the climate-risk transfer scheme: When selecting the climate risk transfer product, it is relevant to ensure some features that promote a comprehensive financial instrument for strengthening the DRM and CC adaptation strategies. We suggest the ideal risk transfer features presented by Sarmiento and Torres-Munoz (2020) as their approach is focused on low-income countries. Some of the ideal risk transfer features are: (a). To address a variety of hazards; (b). To reduce disaster impact on income and socioeconomic development. (c); To contribute to residual risk coverage. (d); Help affected communities to re-establish their livelihood activities; (e). To promote risk mitigation; (f). To reduce government resources

Stakeholder	Cost indicators	Benefit indicators	Differential indicators
Community	Reduced social support and risk coping	Redistribution of risk, reduced informal borrowings and increased access to insurance-related information	Improved communication with stakeholders
Insurance Companies	Administrative costs, costs of reinsurance, costs of data/ technologies, research and development	Spreading and diversification of risks, improvement of social responsibility and reputation	Generated disaggregated data. Create more specific market products. Improved communication with stakeholders
Government	Subsidy costs, capital costs of program implementation, administrative costs, regulatory costs and monitoring/evaluation	Reduced relief expenditure, macro-financial stability, access to risk transfer and taxes from (re)insurers	Incorporated risk transfer and DA into the DRM plans. Promotes the reduction of multidimensional poverty

Source: Adapted from Prabhakar *et al.* (2015)

Table 2. Indicators for assessing the cost and benefits of risk transfer

burden associated with disaster response/recovery; (g). To be cost-effective; (h). To promote the opportunity for public-private partnerships.

Conclusions

There are significant experiences that link DA, mainly the gender component, to hydrometeorological DRM. The literature review shows that there are no records of DA in regions other than LAC; however, there are different institutions worldwide that contribute to fostering access to inclusive insurance such as the InsuResilience Centre of Excellence on Gender-Smart Solutions, ARC (2020) and CCRIF (2020).

DA for DRM has been addressed in Colombia since 2015, first in academic and institutional contributions and more recently in public policy guidelines. Two different approaches for understanding disaster vulnerability that are related to DA were identified (the Global Vulnerability and the Differential Vulnerability). Both approaches emphasize the prioritization of socioeconomic vulnerability over the reduction of physical vulnerability and highlight the significance of considering gender, ethnicity and life cycle as differential factors.

The state of the art exposes significant progress that includes the gender-sensitive approach in risk transfer (Miles and Wiedmaier-Pfister, 2018). However, although gender inequity is a relevant factor in the exacerbation of risk conditions, it is not the only one that increases vulnerability; thus, ethnicity, life cycle and disability should also be addressed by climate risk transfer.

The small group discussions recognized DRT as a mechanism to generate disaggregated data and, consequently, the opportunity to make available in the market more specific risk transfer products, filling the gaps identified by Fernández (2020), Fisher *et al.* (2018) and AFI (2017) related to access to inclusive insurance.

DRT intrinsically allows disaggregated data on gender, ethnicity and life cycle. The recognition of such population features enhances risk analysis and contributes to identifying systemic risks. Subsequently, a comprehensive analysis improves the loss expected models that are highly relevant for the development of a risk transfer mechanism.

DRT provides a way for vulnerable groups to be directly included in the DRM processes, fostering participation and empowering the involved communities.

This paper provided theoretical and methodological elements that show the usefulness of DRT at the (sub)national levels. The presented guidelines become a reference for practitioners

from public, private and multilateral organizations to implement DRT. Thus, we can conclude that DRT has a strong theoretical background and is a suitable/feasible approach for reducing social inequity and socioeconomic vulnerability to climate-related hazards, especially in developing countries.

This paper addresses Sustainable Development Goals 5, 11, 13 and 17 and the targets b and c of the Sendai Framework 2015–2030. The General guidelines for implementing DRT are a significant contribution to put in practice DA, for instance, in specific national contexts as the Colombian public policies (National Plan for DRM and the Policy Strategy for Public Financial Management of Natural Disaster Risk).

This work encourages climate DRM research to generate disaggregated data and moves forward to a new approach based on the socioeconomic vulnerability component of risk. We also challenge stakeholders from academia and the public and private sectors to articulate capabilities to implement comprehensive risk-transfer mechanisms as a strategy for tackling social inequity.

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