Challenges in multi-agency collaboration in disaster management: A Sri Lankan perspective

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ABSTRACT

This study was aimed at investigating the current challenges prevailing in relation to multi-agency collaboration during disaster management and at the strategies that should be implemented in order to overcome such challenges. The study was based on a qualitative approach under which 32 semi-structured interviews were carried out among agencies engaged in disaster management. The collected data were analysed using content analysis. The study identified seven challenges that hinder multi-agency collaboration (communication, environmental, social, political, inter-organisational, intra-organisational and infrastructure challenges) and corresponding strategies that can be used to overcome them. Communication was considered as the dominant challenge due to the lack of a technology platform and well-defined guidelines for sharing data among the agencies to establish a common view of the disaster context. Furthermore, the interoperability challenges that exist among the agencies seems to hinders the effective collaboration among agencies.

1. Introduction

The major natural disasters that occur worldwide (including the 2004 tsunami that destroyed many coastal regions of south-east Asia, earthquakes in south Asia and hurricanes in the coastal regions of the United States and in the Caribbean) are reminders of the immense capacity of natural disasters to destroy and harm both developed and developing countries [1]. Therefore, building resilience against natural disasters should be considered as an important factor in sustainable development. Scientific research has shown that disaster risks do not only exist because of the presence of a physical hazard; they are compounded by the presence of vulnerability [2]. Hence, there is an urgent need to shift our focus from pure emergency response and recovery towards a sustainable disaster mitigation framework [3] that focuses on building resilience within disaster prone areas, involving government agencies and the local community, to reduce the impact of a hazard [4]. As such, the focus of disaster management needs to change from hazard to vulnerability reduction; from reactive to proactive; from single agency to partnerships; from response management to risk management. However, these changes require new partnership models and an emphasis on the early stages of the disaster management cycle such as

preparedness and response [2]. In this context, multi-agency collaboration plays a key role in disaster management [5,6]. However, the process of collaboration between authorities is often challenging due to various reasons, namely difference of cultures, processes and systems [7], different motivations, incentives and competition for limited resources [8], and a lack of coordination between the agencies involved [7,9]. These reasons result in poor collaboration among agencies, leading to unnecessary casualties [10] and damage to the environment and economies. Therefore, strengthening multi-agency collaboration is a major challenge within disaster management [5,11]. In recognition of this challenge, the Sendai Framework priority 2 on strengthening disaster risk governance calls for national governments to strengthen their collaboration among relevant stakeholders to manage risks in a proactive manner.

Within the context of Sri Lanka, the need for effective and efficient multi-agency collaboration has been highlighted with respect to the handling of disasters in the past [12]. For example, the major landslide that occurred on October 29, 2014 in Badulla District in Sri Lanka (which caused 37 people missing or dead) exposed several collaboration issues among the relevant organisations [12]. The torrential rains unleashed in 2017 (leading to over 219 deaths and approximately 230,

000 affected families) raised many concerns over the degree of collaboration that exists between the agencies involved in disaster management [13]. Furthermore, the United Nations Office for Disaster Risk Reduction [14] recognised several issues in implementing disaster risk reduction and climate policies within the country and in the lack of coordination and information management between stakeholders. Therefore, it is evident that there are many challenges hindering multi-agency collaboration in disaster management in Sri Lanka. Therefore, the key motive of this paper is to address the following research questions within the context of Sri Lanka:

a) What are the challenges faced by these agencies to collectively respond to disasters?
b) How can these challenges be overcome?

The paper structure incorporates a literature review in section 2 focused on multi-agency collaboration and on the challenges in multi-agency collaboration. Section 3 presents the methodology followed by the study. The findings and discussions on the study are presented in section 4. Finally, section 5 presents the conclusions of the study.

2. Literature review

2.1. Multi-agency collaboration

Collaboration is a form of collective action and governance that brings together agencies to work across organisational boundaries to solve problems that cannot be effectively addressed by any single agency or organisation [15]. The essence of collaboration means that several organisations exert joint actions in favour of public interest [16]. According to Resetar et al. [15]; collaboration is sought when an objective or social issue cannot be achieved or addressed while working alone due to fragmented authority or when the actions of one organisation affects another. Therefore, collaboration across different agencies, prior to a disaster and after a disaster, is imperative to effectively manage the impact of disasters [17]. During a study on the Fort Worth, Texas, tornado incident, McEntire [3] founded that collaborative relationships, grounded in an understanding of resources and roles played by the different agencies, form a significant part in handling a disaster successfully. McGuire and Silvia [17] stated that poor collaborative networks are, at least, partially to be blamed for poor outcomes of disaster management. The hurricane Katrina is a solid example of a major disaster with many collaborative issues [18]. Furthermore, authors such as Cigler [19] and Kettl [20] have pointed out that inadequate collaboration leads to negative outcomes for society. International humanitarian workers, civilian and military alike, have identified that successful responses to large scale disasters are linked with the capability to cross professional and organisational boundaries with other agencies to fulfil critical liaison roles [21]. Furthermore, Burkle and Hayden [21]; state that current collaboration practices fall short unless the collaboration process is firmly institutionalised in disaster planning and preparedness. Therefore, it is clear that multi-agency collaboration is an essential element that should be integrated throughout all the stages of disaster management in order to effectively combat disasters.

Jung and Song [22] emphasised that the structure of the relational networks among organisations is a key determinant that enables local governments to mitigate and respond to disasters and to bounce back better. According to Agranoff and McGuire [23] and Jung and Song [22]; two forms of such collaborative networks exists, namely vertical and horizontal network structures. Vertical collaboration emphasizes interaction between different levels within government organisations, while horizontal collaboration focuses on inter-local government organisational interaction at the same level [22]. Bae, Joo and Won [24] have highlighted that well-developed and consolidated multilevel (vertical) and broader (horizontal) collaboration are prerequisites for decentralized disaster governance. According to Jung and Song [22];

approaches for strengthening coordination in a hierarchical structure are more significant than horizontal networks among inter-local organisations.

In realising vertical collaboration, countries should move from overlapping regulations and the unclear allocation of responsibilities among central, regional and local levels of government [24] and focus on a more clearly determined delegation and enforcement coming from the national government in the area of disaster management [25]. Bae, Joo and Won [24] argued that vertical collaboration plays a critical role for countries with limited local capacities and technical and financial assistance. However, according to Wachtendorf and Kendra [26]; even in the developed countries (such as the U.S.A. which comprises a federal system having the support of strong local autonomies), local capacities have been observed to be overwhelmed during large scale disasters as, in such situations, local governments have been paralysed and have not been capable of providing meaningful assistance.

Therefore, Bae, Joo and Won [24] suggested that, in order to overcome the issues pertaining to low local government capacities in disaster management, horizontal collaboration with academics and various civil society organisations forms an important ingredient in successfully responding to disasters. According to Caruson and MacManus, [27]; well-functioning horizontal networks or inter-local relations are central to effective emergency management. Local governments are capable of understanding the disasters to which a city is vulnerable and thus can build close connections with relevant experts prior to disasters, so that the city can initiate immediate collaboration with such experts once a disaster strikes [24]. Such proactive disaster preparedness is crucial and could be viewed as providing a more important role than reactive post disaster collaboration efforts.

There are several well-known models for facilitating multi-agency collaboration during disasters. Among them, the National Incident Management System (NIMS), developed by the USA, incorporates a well-defined and standard command and coordination structure to facilitate multi-agency collaboration [28]. This system facilitates a consistent and unified nationwide approach for a federal state and local governments to prepare, respond and recover from disasters regardless of cause, size, or complexity. Based on the principles of NIMS in the USA, Australia and New Zealand have developed the Australasian Inter service Incident Management System (AIIMS) and the Coordinated Incident Management System (CIMS) respectively [29] to respond to major disasters. According to Alteneiji [30]; these systems adopt a decentralized "bottom-up" approach and have incorporated both vertical and horizontal collaboration structures in order to actively combat disasters. In the UK, the Joint Emergency Services Interoperability Programme (JESIP) was established in 2012 to improve how police, fire and ambulance services work together at major or complex incidents [31]. The Interoperability Framework (first edition) defines interoperability as "the extent to which organisations can work together coherently as a matter of routine" [32]; p.1). According to the authors, this framework which is based on five principles (co-locate, communicate, coordinate, jointly understand risk and shared situational awareness) forms the back-bone of UK multi-agency operations. However, JESIP is criticised for its exclusion of partners, lack of joined up working and sharing of information, lack of desire for joined up training including refresher training, the existence of silo-working, bureaucratic tendencies, discrepancies between JESIP and existing police public order terms [33].

Within the context of Sri Lanka, the National Council for Disaster Management (NCDM), established under the Ministry of Disaster Management and Human rights, acts as the governing body for disaster management with Disaster Management Centre (DMC) [34] as the implementation arm. DMC functions administratively via a disaster management portfolio for establishing coordination, collaboration, and communication mechanism with ministries, departments, and other stakeholders, including UN, non-government agencies, and the private sector. The Emergency Operating Centers (EOC), a unit within DMC, is linked to other national organisations horizontally as well as vertically

to districts, division and local level to facilitate emergency response mechanism across the country from early warning dissemination to rescue operations, relief, and re-constructions. Under EOC, 25 District Disaster Management Coordination Units have been established at District Secretariats, which de-centralize disaster management activities down to the local level through Divisional Secretaries.

The Sri Lankan framework embraces both the horizontal and the vertical collaboration concepts as suggested by Caruson and MacManus [27] and Bae, Joo and Won [24]. It is evident that in the Sri Lankan context the collaborative framework has been well defined giving prominence to both national and sub-national levels. However, the studies conducted on past disasters in Sri Lanka by the Japan International Cooperation Agency [12]; the Ministry of National Policies and Economic Affairs and the Ministry of Disaster Management [13] and the United Nations Office for Disaster Risk Reduction [14] suggest that there are several collaborative deficiencies in Sri Lankan disaster management. These include: inadequate coordination and collaboration among vertical structures within DMC/EOC; data and information gaps; limited coordination amongst the government agencies; lack of coordination between government and external partners (UN, NGOs, private sector); inadequate meetings by existing national-level coordination platforms; unequitable relief distribution; lack of government guidelines or standards for relief-assistance; unavailability of a proper coordinated system for providing updated information during emergency situations.

Therefore, there is a need to investigate the challenges that hinder collaboration in disaster management in Sri Lanka and to find solutions to overcome them.

2.2. Challenges in multi-agency collaboration

Although the need for multi-agency collaboration is well recognised, research from social and behavioural sciences indicates that collaboration among different individuals and organisations during disasters is a major challenge [3]. In order to identify the nature of these challenges, a state-of-the-art of literature review was conducted to identify and classify the salient challenges that hinder multi-agency collaboration in disaster management in countries other than Sri Lanka. These challenges were classified into 7 categories as presented in Table 1. They are information challenges, communication challenges, environmental challenges, social challenges, political challenge, inter- and intra-organisational challenges.

The non-availability of appropriate information at the right time has been recognised as a major challenge in enhancing the effectiveness of the collaboration process. According to McEntire [3]; a lack of information hinders the collaborative decision-making ability while too much information delays information processing and, hence, efficient collaboration. Furthermore, the findings of Bharosa et al. [10] revealed that available inter-organisational information is inconsistent, implying that agencies have a low level of appreciation of the value of inter-organisational information sharing. Misinterpretation of information was identified by Bharosa et al. [10] as another challenge hindering the collaboration process.

Moreover, literature review findings reveal that challenges emerging due to inefficiencies in communication can stall the collaboration process [3,27]. A lack of communication between all the agencies, including field personnel and emergency operation centers, has been identified as a reason for ineffective response to disasters [3]. Moreover, Caruson and MacManus [27] stated that, despite the critical importance of communication across agencies, the issue of interoperability in communication continues to persist between agencies.

Previous studies have manifested that many challenges in multi-agency collaboration have been created by the natural environment itself [10,40]. According to Bharosa et al. [10]; the ability to collaborate effectively is greatly affected by the fact that disasters tend to unfold suddenly with a great level of uncertainty creating threats to urban infrastructure. This causes considerable strain on materials, equipment, electricity and transport etc., hence impacting on the effectiveness of collaboration among agencies.

Regarding social challenges, the National Research Council [41] highlighted the need for involving minority, elderly and infirm groups in the collaboration process to ensure their safety during disaster events. Political rivalries between jurisdictions have been identified as a fact that hinders inter-governmental cooperation [27]. The study by these authors revealed that officials from areas with denser populations regard inter-local political tensions to be a serious problem.

Coordination among multi-agencies during disaster collaboration forms a key issue due to the various challenges faced when there is interaction between agencies [7]. Chen et al. [5] stated in their study that a key challenge is the interaction between communities and/or several authorities. Salmon et al. [7] pointed out that a lack of understanding of agencies' contributions (in terms of what they can and cannot do, and also what resources they possess) can create a challenge during multi-agency collaboration. Salmon et al. further stated that different organisational cultures can produce several collaboration problems due to incompatible procedures, processes, and a lack of understanding of concepts (thus creating inter-organisational challenges). A lack of policies to encourage and assist collaboration was highlighted in the study of Jones, Oven, Manyena, and Aryal [43] as a barrier, hindering multi-agency collaboration. Eide et al. [35] and Salmon et al. [7] highlighted that various collaboration problems are due to the lack of situational awareness caused by conflicting, inaccurate, unreliable or incomplete information. The Joint Organisational Learning (JOL) database highlights that lack of situational awareness, due to the fact that the hazard information not being shared, limits the response and result in on-scene commanders failing to establish agreed priorities [33].

Finally, the forms of intra-organisational challenges revealed in the literature review were: inefficient organisational processes and procedures, a lack of clarity between roles, tasks and responsibilities within agencies, and personnel resistance to adopting innovation [7,10].

2.3. The Sri Lankan multi-agency context

To determine the Sri Lankan multi-agency context, a desk study was

Table 1
Challenges to multi-agency collaboration.

Category	Challenges	Sources
Information challenges	Lack of relevant information	[7,10,35]
	Information overload	[17,27]
	Inconsistency in sharing information	[35,36]
	Demand for timely information	[5,35]
Communication challenges	Lack of communication	[3,10,27, 35,37],
	Incompatible communication equipment	[36,38]
Environmental challenges	High uncertainty, sudden and unexpected events	[3,5,7,39, 40],
	Disruption to infrastructure support	[5,7,10]
	Increased time pressure and urgency	[5,7,10]
Social challenges	Lack of social support to minority, elderly and infirm groups.	[41]
Political Challenges	Political tensions between jurisdictions	[10,27]
Inter-organisational challenges	Involvement of multi-authorities and large crowds	[5,7]
	Lack of understanding of resources and contribution from each agency	[5,7,42]
	Lack of understanding of each agency's roles and responsibilities	[7,10,35]
	Different organisational cultures	[7,42]
	Lack of policies supporting collaboration	[43]
	Inadequate understanding of distributed situational awareness	[7,35]
Intra-organisational challenges	Organisational procedures	[7,10]
	Lack of clarity between roles, tasks and responsibilities within agencies	[7,35,39]
	Resistance to adopt innovations	[10,44]

carried out by critically analysing the Disaster Management (DM) Policy, the DM Act, the National DM Plan and the National Emergency Operations Plan of Sri Lanka. Table 2 Summarises the roles of the key agencies during the pre-disaster, response and disaster recovery phases. In this context, the Disaster Management Centre (DMC) has the responsibility for coordinating activities for disaster mitigation, preparedness and response in Sri Lanka. Furthermore, DMC is responsible for raising public awareness, training, promoting housing construction that meets technical standards, and disseminating the warnings issued by other agencies.

Fig. 1 below presents an institutional framework that captures the roles of the Sri Lankan agencies which are responsible for contributing to disaster management in relation to policy and governance, natural resources and hazards, the built environment, utilities and infrastructure, security, and research and data.

3. Research methodology

The aim of this study was to investigate the challenges within multi-agency collaboration in Sri Lanka and to identify ways in which these challenges can be overcome. To achieve this aim, firstly a desk study was carried out to identify the key agencies involved in multi-agency collaboration and their roles in disaster management. This study critically analysed the main policy documents and national plans such as the Disaster Management Policy, the Disaster Management Act, the National Disaster Management Plan and the National Emergency Operations Plan. Based on the desk study findings, key senior officers from these agencies were identified and interviewed to collect qualitative data to understand the challenges faced by these organisations regarding collaboration and, also, the potential solutions to overcome these challenges.

Qualitative data collection can utilise several different forms of interviews; this study used semi-structured interviews as these would enable the respondents to share their knowledge and experience [45]. Thirty-two participants who hold senior positions such as director, assistant director, general manager, manager, chief scientist and chief engineer in the key disaster management organisations presented in Table 2, were interviewed for this study. The questionnaire was designed to elicit information on the challenges under the 7 categories that are presented in Table 1 as well as any other challenges. Interviews were between 1 and 2 h in length and the respondents were mainly questioned about the current status of disaster management in Sri Lanka (e.g. What are your roles and responsibilities relating to disaster management), the necessity of multi-agency collaboration (e.g. How do you collaborate with other agencies), the relationship between agencies (Who are the agencies you collaborate with and what kind of relationship do you maintain), the challenges pertaining to multi-agency collaboration (e.g. What are the challenges you have come across during multi-agency coloration) and strategies to overcome the challenges (e.g. What strategies do you propose to overcome the challenges). Face to face interviews were conducted, enabling researcher to use implied voices and clarify answers when necessary. During the process, interviews were recorded in audio form and notes were taken. Content analysis was carried out to extract the key messages from the interviews. Interviews were transcribed and carefully read in order to accurately analyse the collected data. The transcripts' texts were then divided into meaningful units and condensed further while maintaining the core meaning. Following that, codes were created to represent the context of the condensed units in a concise manner. Finally, the codes were organized into groups, and overall conclusions were drawn.

The respondent profile is provided in Table 3.

4. Results

4.1. CHALLENGES IN MULTI-AGENCY COLLABORATION

The categories identified through the literature survey were used as the basis for capturing the collaboration challenges that exist among agencies in Sri Lanka when interviewing the senior personnel from the organisations presented in Fig. 1. A summary of the collaboration challenges, as identified through the interviews, are presented below in Table 4.

Non-existence of a well-defined guidelines on data sharing and lack of a collaboration platform for sharing data were identified as information related challenges. Among these two, lack of a collaboration platform was referred by 24 respondents out of 32 making the most significant challenge for multi-agency collaboration. The communication among organisations was considered as poor by the respondents R3, R4, R5, R6, R15, R19, R21, R22. These respondents, representing their agency had a common view in terms of low connectivity and communication of their agency with other agencies.

High uncertainty and sudden and unexpected events, disruption to infrastructure support, cascading effect of a disaster and increased time pressure and urgency were identified as environmental challenges. Respondents agreed that disaster environment itself hinders collaboration and tackling this challenge would contribute immensely in improving effective collaboration operations.

The majority of the respondents agreed that institutional political power between actors as the major political challenge faced during disaster collaboration. In this regard, respondents representing the Ministries such as health, environment and agriculture agreed that such political influences exist. However, respondents mainly involved in the area of research and data (such as R13, R15 and R16) did not make any assertion on political intervention but rather raised the challenges regarding the disseminating and implementing of their research findings to transform current practices.

Within the domain of inter-organisational challenges several challenges were identified, namely deficiencies created due to a lack of formal and systematic coordination procedures; a lack of inter-organisational interdependencies and collaboration procedures and no long-term plans or policies for their incorporation; a lack of policies on data transformation and a lack of international collaboration. With regard to a lack of formal and systematic coordination procedures, respondents such as R7, R13 and R16 (largely engaged in providing essential data during the disaster management process) strongly pointed out that "despite the existence of a coordination process the real challenge that exists is whether the process is systematic and formal?". This challenging situation was further confirmed by R1 who reflected on the difficulties in governing the process involving many institutions. All the other respondents expressed similar views on existing coordination mechanisms. A lack of understanding of available resources and of the contribution obtainable from each organisation was highlighted by respondents such as R3, R4, R12, R17 to R32. These responders (more than half of the respondents) believed that their contribution is not sufficiently utilised and is underestimated throughout the disaster management cycle. A lack of inter-organisational interdependencies and collaboration procedures, no long term plans or policies for cooperation and a lack of policies on data transformation were pointed out by all the respondents. The respondents stated that insufficient procedures and policies were a major drawback within the existing disaster management system even though the collaboration process had seen some improvements compared to past scenarios. A lack of international collaboration was pointed by respondent R3, reflecting the need to obtain international assistance in technological enhancements.

With respect to intra-organisational challenges the study identified the lack of human capital and training in addition to a lack of clarity between the roles performed within agencies Respondents R5-R7, R9, R13, R12, R17 and R18 pointed out that human resource glitches and a

Table 2
Role of Sri Lankan agencies in Disaster Management.

Role played Agencies	Pre-disaster			Disaster response				Disaster recovery			
	Disaster preparedness and mitigation	Issuing of warning	Dissemination of early warning	Evacuation, search and rescue	Continuous monitoring and disseminating information	First aid, medical aid, health and sanitation	Resource/utility/ equipment/ mobility Provision	Coordination of relief activities	Immediate relief and recovery	Post disaster evaluation	Build back better
Disaster Management Centre	X		X		X			X			
National Building Research Organisation (NBRO)	X	X								X	
Department of Meteorology		X			X						
Department of Irrigation (DOI)	X	X			X					X	X
Mahaweli Authority		X									
Agrarian Services Department	X	X			X		X		X	X	X
National Water Supply & Drainage Board		X					X			X	X
Ceylon Electricity Board		X					X			X	X
Central Environmental Authority	X	X								X	
Dept. of Meteorology		X									
Geological Survey & Mines Bureau (GSMB)	X	X			X						
Airport and Aviation Authority		X									
Sri Lanka Transport Board							X		X	X	
Railway Department							X		X	X	
Marine Environment Protection Authority (MEPA)		X									
Local Authority (Fire Brigade)		X				X	X	X	X		
Police	X	X		X	X	X	X		X	X	X
Ministry of Health	X	X			X	X			X	X	X
Ministry of Defence	X	X		X	X	X	X		X		X
Sri Lanka Air-Force/ Army/Navy	X	X		X	X	X	X		X		X
Ministry of Industries		X									
Atomic Energy Authority		X									
Forest Department	X	X									
Coast Conservation & Coastal Resource Management Department	X	X								X	X
Ministry of Land	X									X	
Land Commissioner General's Department	X									X	
Survey Department	X									X	
Land Use Policy Planning Department	X									X	

Table 2 (*continued*)

Agencies	Role played — Pre-disaster: Disaster preparedness and mitigation	Disaster response: Issuing of warning	Dissemination of early warning	Evacuation, search and rescue	Continuous monitoring and disseminating information	First aid, medical aid, health and sanitation	Disaster recovery: Resource/utility/equipment/mobility Provision	Coordination of relief activities	Immediate relief and recovery	Post disaster evaluation	Build back better
Department of Fisheries & Aquatic Resources	X										
National Aquatic Resources and Research and Development Agency	X										
Urban Development Authority	X										
National Science Foundation	X										
National Physical Planning Department.	X										
Sri Lanka Land Reclamation and Development	X										
Sri Lanka Telecom		X								X	
Local authorities/ District & Divisional Administration	X		X	X	X		X	X	X	X	X
NGOs/UN Agencies				X	X	X	X		X	X	X

shortage of training influences the overall collaboration process during disaster management. Among these respondents R12 specifically stated the necessity for knowledgeable and experienced employees to implement innovative and efficient practices in disaster management. Providing a similar opinion, R13 expressed the need for continuous progression (by absorbing knowledge on global developments) as crucial. A few respondents (such as R5, R17, R25 and R26) pointed out that intra-organisational collaboration has become a challenge due to a lack of clarity between the roles performed within agencies. However, the majority of the respondents believed that the roles of the agencies themselves are sufficiently clear.

Resource constraints were identified by the study participants as another key barrier hindering effective multi-agency collaboration. Within this domain, a lack of technology was featured by R3-R7, R13, R19, R20, R24, R26 and R29. Whilst these respondents acknowledged that the existing technology is sufficient, a common opinion was that more advanced technology should be developed or imported. Some of the comments regarding the technology context were: "we lack technology for modelling the number of people to be evacuated" (R7); "better if we can run simulation and identify the wave height to determine tsunami conditions" (R6). The respondents had the view that technology plays a key determinant in effective multi-agency collaboration for disaster management, in particular within Sri Lanka, and that the current Sri Lankan developments are far behind other developed countries. In addition, R22 and R25 commented on the lack of regional offices to carry out their disaster management related tasks.

4.2. Strategies to overcome the challenges in multi-agency collaboration

In order to overcome the above stated challenges, several strategies were proposed by respondents. Similar to the process followed in identifying the challenges, strategies to effectively combat the challenges of multi-agency collaboration were identified. These strategies are summarised and presented in Table 5.

To overcome the challenges relating to communication, all the respondents strongly suggested the need for a platform for multi-agency collaboration. All of them believed that the availability of a digital platform would enable seamless exchange of information. Similarly, all of the respondents (R1-R32) emphasised the need for data sharing across entities to overcome the challenges relating to poor communication. R6, R19-R23 strongly believed that, even though they maintain data necessary for their functioning, the utilisation and sharing of data to promote disaster management is not happening at present. Hence, effective data sharing should be promoted for long term success in disaster management. Promoting resilience infrastructures to overcome environmental challenge, gained consensus among the respondents as a worthwhile strategy within the infrastructure and utilities domain (R2, R22, R26-R31). Moreover, this opinion was further confirmed by respondents such as R1 and R16. The respondents believe that the development of resilient infrastructures and utility services which could withstand the impact of environment damages could assist in the collaboration process.

Social challenges could be overcome by promoting community awareness. Respondents acknowledged that the readiness of communities to understand orders and act accordingly is paramount for effectively preparing, responding and recovering from disaster. On a similar note, responders R1, R6, R7, R20 and R16 were of the opinion that the availability of high-end infrastructure facilities to predict disaster and communicate such predictions would not be effective unless the community is willing to respond accordingly.

Minimising political intervention and empowering DMC was identified as a strategy to overcome the challenges related to political interventions. Respondents emphasised the need of a system free form political interventions throughout the stages of disaster management to effectively combat disasters.

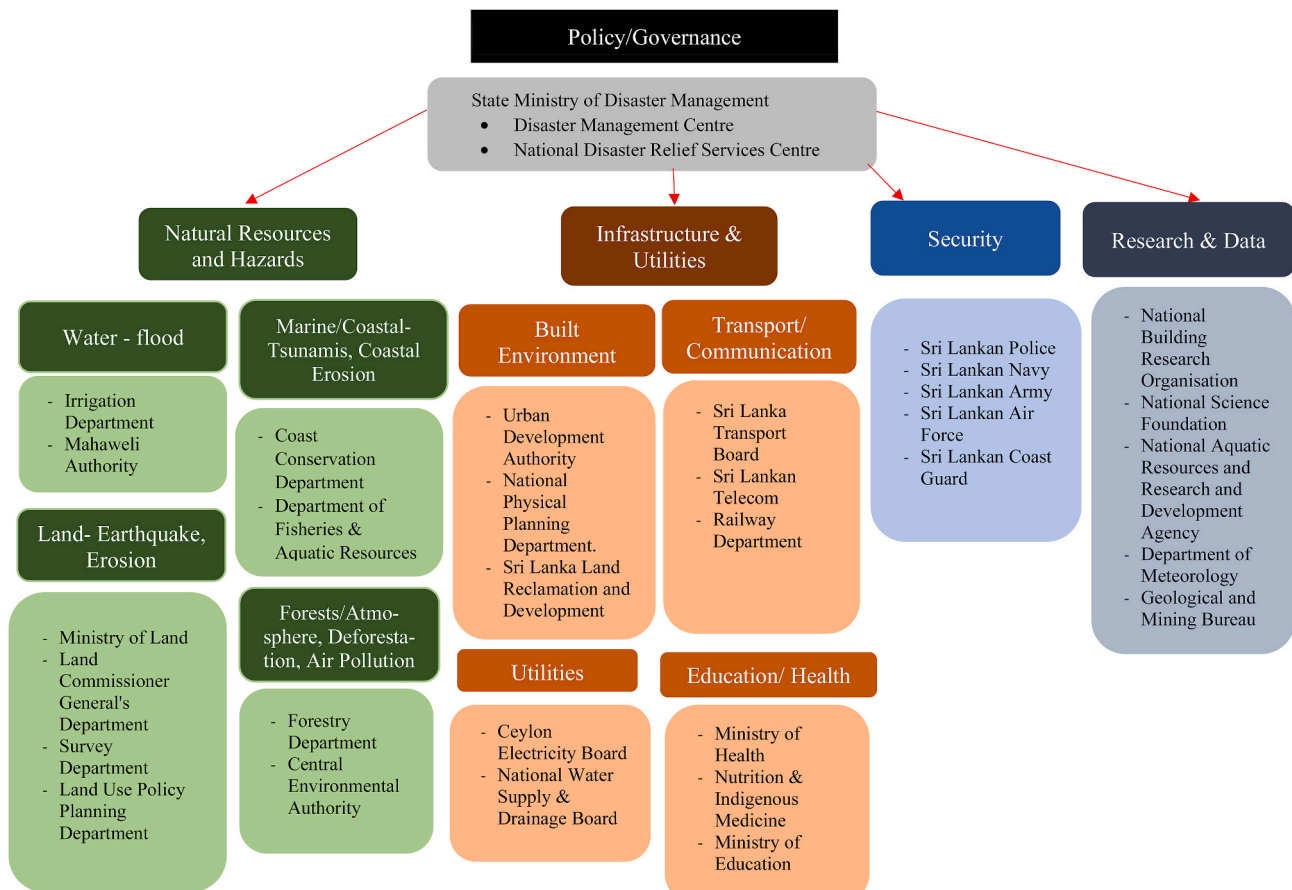Inter-organisational challenges were pointed out by many

Fig. 1. Sri Lankan agencies in disaster management.

Table 3
Respondents' profiles.

Respondent	Agency
R1	Disaster Management Centre (DMC)
R2	Electricity Department
R3	Irrigation Department
R4	Land Use Policy Planning department
R5	Marine Pollution and Prevention Authority
R6	Coastal Conservation Department (CCD)
R7	Meteorology Department
R8	Ministry of Agriculture
R9	Ministry of Environment
R10	Ministry of Health
R11	Ministry of Land
R12	The Department of Geological Survey and Mines Bureau
R13	National Aquatic Resources and Research and Development Agency
R14	National Housing Development Authority
R15	National Science Foundation (NSF)
R16	National Building Research Organisation (NBRO)
R17	Road Development Authority (RDA)
R18	Survey Department
R19	Agrarian Insurance Board
R20	Department of Fisheries and Aquatic Resources
R21	Department of Railway
R22	Department of Social Service
R23	Forest Department
R24	Central Environmental Authority (CEA)
R25	Department of Fire Service
R26	Sri Lanka Land Reclamation and Development Board
R27	Sri Lanka Telecom
R28	Sri Lanka Transport Board
R29	Urban Development Authority (UDA)
R30	Urban Settlement Development Authority
R31	Water Resource Board (WRB)
R32	Wild Life Department

respondents as a hindrance to the overall collaboration process. It was revealed that the challenges could be overcome through identifying the gaps in the prevailing legislation, policies, procedures and refining them to suit the current context, fostering direct relationships between all agencies involved in disaster, and promoting international collaboration. The importance of identifying the gaps in the prevailing legislation, policies, procedures was pointed out by R1, R6, R8-R11, R14-R16, R19-R29. They emphasised that legislature, policies and procedures are the backbone of any system. Moreover, R1 strongly stated the necessity of fine-tuning the legislation, policies, procedures to support multi-agency collaboration, and this necessity was echoed by other respondents (R4-R20, R22). Respondents R5, R19, R20, R22, R23 and R32 felt they are left out from the disaster management process and emphasised the need for building direct relationships among the agencies. Moreover, promoting international collaboration was identified as important specifically by R3.

Providing frequent training for internal staff, spreading awareness on the importance of proper communication, and promoting team work were acknowledged as the major strategies to overcome intra-organisational challenges. Respondents R5-R7, R9, R13, R12, R17 and R18 pointed out the necessity of frequent training as a mechanism to update current knowledge and to embrace new innovations and process improvements. Spreading internal awareness was pointed out as a strategy by R8, R13, R21, R27, R28 and R31; they emphasised the importance of triggering change internally and on giving serious focus to the best practices required to succeed during the collaboration process. Promoting team work gained similar recognition among the respondents; R14-R16 additionally pointed out that team work would provide a sense of involvement and would encourage the organisations' staff to achieve greater outcome. They emphasised that the

Table 4
Challenges within multi-agency collaboration.

Categories	Challenges	Respondents	No of respondents	Comments
Information challenges	No well-defined guidelines on data sharing	R1-R10, R13-R17, R21, R32	17	"No procedures to interact or share data with other government institutes" (R22)
	Lack of a collaboration platform for sharing data	R1- R17, R21-R27	24	"data sharing and communication is challenging […] this is mainly due to lack of a common platform […]" (R20); "data stored in our agency is unable to be used by other agencies […]" (R3)
Communication challenges	Lack of communication among agencies	R3- R6, R15, R19, R21, R22	8	"Communication among agencies are at poor state […]" (R3)
Environmental challenges	High uncertainty and sudden and unexpected events	R5-R9,R13,R15	7	"[…] sometime our forecast changes due to un-certainties associated with events" (R16)
	Disruption to infrastructure support	R3,R5, R7, R15-R20, R22-R30	17	"Our rain gauges destroyed due to heavy rain […]"(R7)
	Cascading effect of a disaster	R5, R8, R10	3	" When floods last for a long period it creates many other disasters […]" (R3)
	Increased time pressure and urgency	R4-R10, R12	7	"[…] we need to act quickly, we cannot have any delays" (R1)
Social challenges	Behavioural and risk perception issues	R1-R10, R12, R22, R26 R27	15	"no matter how hard we try some people do not understand disaster risks" (R1)
Political challenges	Institutionalization and political power between actors	R1-R10, R21, R31	12	"illegal and unapproved buildings create a burden in water flows and blocks drains […] we are un-able to control them due to political involvement […]" (R24)
Inter- organisa-tional challenges	Lack of a formal and systematic coordination procedures	R1, R5, R7, R8, R11, R13,R16 R22-R28, R30-R32	16	"At certain instances developing a strong and formal coordination is challenging" (R8). "handling a range of agencies and people is itself a challenging task" (R1)
	Lack of understanding of available resources and contribution from each organisation	R3, R4, R12, R17-R32	18	"sometime agencies are not aware on how other agencies could assist them […]. This effects the response process" (R23)
	Lack of inter-organisational interdependencies and collaboration procedures.	R1, R5-R20	17	"lack of pre preparedness for disaster due low connectivity between institutes" (R21)
	Lack of international collaboration	R13	1	"we need to take support from international agencies for technology advancements and do-nations" (R3)

Table 4 (*continued*)

Categories	Challenges	Respondents	No of respondents	Comments
Intra- organisa-tional challenges	No long term plan or policy for corporation	R2, R4-R6, R10-R13	8	*"A main drawback in Sri Lanka is not having a long term policy and plan"* (R24)
	Lack of human capital and training	R5-R7, R9, R13, R12, R17 and R18	12	*"[…]we need more human resource and proper training to contribute during pre-disaster and post disaster"* (R6)
	Improper delegation of re-sponsibilities and lack of clarity on the role performed	R5, R17, R25 and R26	4	*"Some agencies have high burden on disaster related activities and they don't have clarity on the roles performed"* (R25)
Infrastructure Challenges	Lack of technology	R3-R7, R13, R19, R20, R24, R26 and R29	13	*"[…] we need to develop technological capabil-ities"* (R20)
	Lack of regional offices	R22 and R25	2	*"due to lack of regional offices we face difficulties in suppressing fires"(R25)*

collaboration process would be more efficient as a result. Finally, to overcome challenges relating to infrastructure, respondents R5-R7, R9, R13, R12, R17 and R18 suggested strengthening the capabilities of collaboration through sufficient resource allocation.

5. Discussion

It is evident from the primary data collected via interviews that agencies in Sri Lanka are also suffering from the same collaboration challenges that are reported in the literature. Although it was revealed that each agency has sufficient information to carry out their own ac-tivities, there are no agreed policies and platforms for sharing their in-formation with other agencies to develop a common understanding of risks and to prepare and respond better to disasters in a collaborative manner. While there have been attempts to share risk information via public web portals such as riskinfo (www.riskinfo.lk) and desinventar (desinventar.net), the agencies do not have access to continuously updated information on hazards, exposure and vulnerability and thus be able to engage realistically in a collaborative decision-making approach to disaster mitigation, preparedness and response. As pointed out by Caruson and MacManus [27]; such poor communication can hinder the overall effectiveness of the collaboration process in combating the impact of disasters.

In terms of the environmental challenges, the study confirms the findings of Chen et al., [5]; Salmon et al. [7]; Comfort, Sungu, Johnson and Dunn [39]; Jabareen [40]; and [3], where challenges such as high uncertainty, sudden and unexpected events, disruption to infrastructure support and increased time pressure and urgency has a negative impact on collaboration. Training on handling multi-hazard situations involving relevant agencies has the potential for addressing this challenge.

In addition, the lack of social support to minority, elderly and infirm groups as well as behavioural and risk perception of the public were found to hamper the overall effectiveness of the collaboration process. Therefore, there is a need for providing community support and spreading disaster awareness at community level and obtaining their

buy-in to work with agencies in responding to disasters.

Although there was no indication of political tensions between the jurisdictions that was found in other studies (Bharosa, Lee & Janssen [10], and Caruson & MacManus [27], the institutional and political powers exercised by actors were identified as a challenge within the Sri Lankan context. Such political interventions need to be eradicated and empower agencies such as DMC to collaborate through well-defined protocols.

In addition to the inter-organisational challenges pointed out by Bharosa, Lee and Janssen [10]; Chen et al. [5]; Eide et al. [35] Otjacques et al. [42] and Salmon et al. [7]; the study found that the agency collaboration is hampered due to lack of formal and systematic coordi-nation procedures; lack of inter-organisational interdependencies, collaboration procedures and long-term plans or policies for their incorporation; and lack of international collaboration that can bring innovation and support. With respect to intra-organisational challenges the study identified that there is a lack of human capital and training in addition to lack of clarity between the roles performed within agencies as alluded in Refs. [7,35,39]. As a remedy to overcoming these inter-organisational challenges the UK has operationalised the JESIP doctrine [33]. The aim of JESIP is to ensure the emergency responders are trained and exercised to work together as effectively as possible, at all levels of command in response to major or complex incidents. An approach such as JESIP that addresses the inter-operability challenges apparent among agencies in Sri Lanka need to be implemented, but this need to engage all the agencies identified in Table 1 and Fig. 1. However this requires the addressing of interoperability challenges such as time and resource constraints, culture, technology, training and exercising and strategic buy-in as suggested in Pollock [33]. This study found that the prevalence of infrastructure challenges such as lack of technology and lack of regional offices. According to the respondents, Sri Lanka, being a developing nation, faces several resource limitations which needs to be overcome through adequate investment in order to effec-tively address multi-agency collaboration challenges.

Table 5
Strategies to overcome challenges in multi-agency collaboration.

Challenge	Strategies to Overcome the Challenges	No of respondents	Respondents	Comments
Communication and Information challenges	Development of a platform which could facilitate multi-agency collaboration and communication.	R1–R32	32	"Having a platform for multi-agency collaboration will support us in data gathering and dissemination" (R1)
	Promoting data sharing across entities.	R1–R32	32	"With proper access to data taking precautions and acting during disasters could made easier […]" (R21)
Environmental challenges	Promoting disaster resilient infrastructure developments.	R1, R2, R16 R22, R26-R31	10	"We should focus on resilient infrastructure developments […]" (R16)
Social challenges	Spread awareness at community level and obtain community buy in.	R1, R6, R7, R20, R16	5	"We need to make sure that fishermen actively engage in preserving coastal areas" (R6)
Political challenges	Minimising political intervention and empowering DMC.	R5, R19, R20, R22-R25	7	"should minimise political intervention as much as possible and assign more powers to DMC" (R23)
Inter-organisational challenges	Identifying the gaps in the prevailing legislation, policies, procedures and refining them to suit the current context.	R1, R6, R8-R11, R14-R16, R19-R29	19	"We need to look into existing legislation, policies, procedures and identify the gaps and refine them to match current context" (R25)
	Fostering direct relationships between all agencies involved in disaster.	R5, R19, R20, R22, R23 and R32	6	"We need to encourage and develop formal and direct relationships between the agencies" (R20)
	Promote international collaboration.	R3	1	"We need to take support from international agencies for technology advancements and donations" (R3)
Intra-organisational challenges	Provide frequent training for internal staff.	R5-R7, R9, R13, R12, R17 and R18	8	"Initiatives should be made for frequent and systematic trainings and developments" (R3)
	Spreading awareness on the importance of proper communication	R8, R13, R21, R27, R28, R31	6	"Developing a strong basis for internal communication is crucial. All should be made aware of this" (R13)
	Promoting team work.	R14-R16, R25, R27-R30	8	"Must work as team and solve problems together" (R31)
Infrastructure challenges	Strengthen the capabilities of collaboration through sufficient resource allocation.	R5-R7, R9, R13, R12, R17, R18	8	"[…] therefore, we need more resources such as advance equipment to assist effective collaboration" (R33)

6. Conclusion

The importance of strengthening multi-agency collaboration for disaster management is well understood by scholars and practitioners. However, there exists a range of challenges for implementing efficient multi-agency collaboration in many countries. The literature review conducted in this study shows that these challenges come from a broad range of perspectives which can be categorised as information

challenges, communication challenges, environmental challenges, social challenges, political challenges, inter-organisational challenges, intra-organisational challenges and infrastructure challenges. While the challenges under these categories may differ from country to country, they provide a good basis for researchers and practitioners to probe further into specific country settings.

The primary data collected within the context of Sri Lanka, involving senior personnel from the key agencies linked to disaster management activities, shows that there are a specific set of challenges that need addressing to strengthen multi-agency collaboration in disaster management in Sri Lanka. The key challenges identified in this research include a lack of data sharing protocols and platforms; weak inter- and intra- organisational collaboration; a lack of advanced technological infrastructure, and a lack of training, resources and formal and systematic coordination procedures. In order to overcome these challenges, the practitioners in this study have proposed a range of solutions such as the development of a platform to facilitate multi-agency collaboration; the promotion of a data sharing culture across entities; the fostering of inter-organisational collaboration and team building within organisations, promoting disaster resilient infrastructure developments; promoting awareness and buy-in from the community and minimising political intervention; empowering DMC to provide efficient leadership; refining and enforcing policies that support multi-agency collaboration, and making appropriate training and resources available.

However, the implementation of these solutions are challenging, requiring a strong leadership that believes in multi-agency collaboration and its social, economic and environmental benefits. According to Hofstede [46]; organisational cultures are usually set by the leadership team. Therefore, the most important pre-condition for achieving multi-agency collaboration is the leadership. The Disaster Management Centre could be empowered to provide such leadership across relevant agencies for implementing efficient and effective disaster management with a clear vision.

Langley et al. [47]; argue that the notion of boundary work can be used to observe different forms of collaboration and contribute to the development of a uniquely processual view of organisational design. In their paper, Langley et al. [47] identify three conceptually distinct but inter-related forms of boundary work: competitive boundary work that continues to build boundaries for gaining advantage over others; collaborative boundary work which attempts to aligning boundaries to enable collaboration, and configurational boundary work that manipulates patterns of differentiation and works towards integration among groups to ensure that certain activities are brought together while others are kept apart. Within this context, multi-agency collaboration is only possible if the leaders of the agencies operating in disaster management are prepared to come together to work towards collaborative boundary working or configurational boundary working styles. Munene et al. [48] defined the key characteristics (adopted from Ref. [49] which can enable such transformation as collaborative co-management that involves power-sharing; cross-sectoral institutional linkages; participation and collaboration (including social capital, knowledge-pooling and public participation processes); networks which can involve formal and informal organisations; social learning, and system innovation. While the presence of these components alone does not necessarily mean a transformation will occur, they can provide the conditions needed to enable transformation which requires the challenging of existing systems, processes, social values, institutions, technical practices and paradigms [50,51], enabled through adaptive governance, learning, innovation and leadership [52]. Therefore, the initiation of such transformation across agencies will require the presence of leaders who have a broad understanding of the complexity in implementing not only the conditions for transformation but also actively implement and

continuously monitor the maturity of collaborative practices in disaster management.

As future research, the findings of this study could be tested and validated in other developing countries to derive the similarities and differences among the challenges. Moreover, an additional research avenue would be to develop a framework that enables effective multi-agency collaboration among agencies, build on interoperable agency collaboration approaches such as JESIP in UK. Another valuable research contribution would be the development of a digital platform that can offer seamless data sharing among agencies to make evidence-based decisions and collaborate more effectively.

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.

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