Received 13 March 2021
Revised 22 September 2021
25 January 2022
19 April 2022
Accepted 26 April 2022

Understanding flooding events in Ghana: a social marketing and self-determination theory perspective

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Abstract

Purpose – The purpose of this study is to deepen the understanding of individuals' flood disaster mitigation behaviour through the theoretical lens of self-determination theory (SDT). Specifically, the paper examines the influence of autonomy, competence and relatedness on individuals' self-determined motivation for flood disaster mitigation. The study also examines whether self-determined motivation influences individuals' flood disaster mitigation behaviour adoption.

Design/methodology/approach – Through a cross-sectional survey design, the study used a quantitative research approach for data collection and analyses. Specifically, data was analysed using the structural equation modelling technique.

Findings – The result of this study revealed that competence was the strongest predictor of self-determined motivation, followed by autonomy. The result further shows that self-determined motivation positively influences individual's adoption of flood mitigation behaviour. However, the results showed that relatedness does not predict self-determined motivation for flood disaster mitigation.

Practical implications – To enhance the effectiveness of flood disaster mitigation social marketing campaigns, the SDT psychological needs constructs (particularly, competence and autonomy) can aid in assessing the motivation of the target population towards adopting mitigation behaviours. An assessment of motivation will help understand perception of flood risk and behavioural evaluation. The consideration of autonomy and competence on motivation will aid in developing effective campaigns to satisfy the needs of the target population.

Originality/value – The paper adds to the limited research that used SDT to understand a social marketing phenomenon.

Keywords Social marketing, Self-determined motivation, Autonomy, Competence, Relatedness, Flood disaster mitigation behaviour

Paper type Research paper

1. Introduction

Over the past decade, flooding has become one of the most threatening natural disasters confronting many parts of the world. Floods can cause widespread devastation, which results in loss of life and damages to personal property and public health infrastructure in both developed and developing worlds (Mensah and Ahadzie, 2020). In 2019, for example, a report from the World Health Organisation (WHO) suggests that between 1998 and 2017, floods affected more than 2 billion people worldwide (WHO, 2019). The 2019 WHO report as well as other scholarly sources indicate that developing countries are particularly vulnerable to flood disasters (WHO, 2019; AlQahtany and Abubakar, 2020; Fatti and Patel, 2013;

Journal of Social Marketing
Vol. 12 No. 4, 2022
pp. 534-555

2042-6763
DOI 10.1108/JSOCM-03-2021-0049

Glago, 2019). In Ghana, research suggests that flood disasters rank the second highest among natural disasters after epidemics (Addo and Adeyemi, 2013; Ansah *et al.*, 2020). This phenomenon has become a major hindrance to sustainable development in the country as governments and individuals have to bear many losses associated with flood disasters. Thus, if the country is to achieve sustainable development, the adoption of flood mitigation behaviours is a necessary condition for the implementation of effective policies.

Ghana recorded an unprecedented flood event in June 2015, which led to the death of 150 people (Graphic Online, 2020; Amoako and Inkoom, 2018) and a massive destruction of properties and economic losses (Erman *et al.*, 2018) costing the nation about US$116,340.22. Since this experience, a huge focus has been shifted to providing effective solutions to help mitigate flooding disasters in Ghana. For example, the Government of Ghana, through relevant agencies such as the Ministry of Works and Housing and Ministry of Local Government and Rural Development, have implemented some engineering interventions that aim at dredging and desilting major rivers and streams to increase their capacities (Modern Ghana, 2021), costing the taxpayer US$32m annually. Yet, it appears that mitigating flood disasters is still a daunting task for government and other stakeholders as there has not been much significant improvement in flooding events.

A study by Amoako and Inkoom (2018) revealed that heavy rainfall is one of the major causes of urban flooding. However, previous research in Ghana and other countries demonstrate that other anthropogenic activities further exacerbate it. Some of these activities include building on waterways (Nair and Abraham, 2018; Glago, 2021), inadequate drainage systems (Logah *et al.*, 2014), poor urban and structural planning (Owusu-Ansah, 2016), removal of urban vegetation (Owusu-Ansah, 2016), rural–urban migration (Amoako and Frimpong Boamah, 2015) and poor attitude of Ghanaians towards proper waste management practices (Tabiri, 2015; Alhassan *et al.*, 2018). For example, Alhassan *et al.* (2018) explain that the poor attitude of most Ghanaians with regard to the dumping of solid waste into nearby gutters and streams results in drainage blockages that prevent the free flow of flood water, thereby increasing flood disasters during the rainy season. The problem is thus ultimately one of a behavioural issue and thus requires a behavioural change approach towards its mitigation (Valois *et al.*, 2020). However, to date, little research (if any) has been conducted to understand the behavioural factors that influence individuals' adoption of flood mitigation behaviours. In this paper "mitigation behaviours" refer to any activity that individuals perform before a flood to reduce or eliminate the impact of or loss caused by it". Previous studies have focused primarily on the nature and extent of floods (Gyekye, 2013; Okyere *et al.*, 2013), and causes of flood and mitigation measures (Asumadu-Sarkodie *et al.*, 2015), institutional and social dimension (Korah and Cobbinah, 2019) and flood risk management strategies (Ahadzie and Proverbs, 2011) to the neglect of understanding the behavioural factors underlying mitigation behaviours. Consequently, understanding the behavioural and psychological mechanisms that influence flood mitigation activities among individuals could lead to a better and a more effective flood disaster mitigation programme in Ghana. Social marketing, thus, presents itself as a potential framework that could be used in this research enquiry as it seeks to understand and influence behaviour change of the target audience for social good (Spotswood *et al.*, 2012; Gruneklee *et al.*, 2016). Previous studies have applied the concept and seen enormous successes in diverse contexts, including recycling; food waste; transport; energy conservation; environmental protection; and proper waste management practices (Haghighatjoo *et al.*, 2020; Carins and Rundle-Thiele, 2014; Haj-Salem and Al-Hawari, 2021; Tweneboah-Koduah *et al.*, 2019; Abotchie and Shokar, 2009; Hodgkins *et al.*, 2019; Doku, 2012), among others, in both the developed and developing worlds. In spite of social

marketing's successful application in these aforementioned studies, it appears its application to the adoption of flood disaster mitigation behaviours is relatively silent in the literature and this study seeks to address that. According to Ayikwa *et al.* (2020), social marketers resort to theoretical frameworks to help understand and explain the motivation or influential factors underlying people's behaviour change adoption.

Although several behavioural theories exist, the social marketing literature is replete with the repeated use of traditional behavioural theories such as the theory of planned behaviour (Ajzen, 1991), stages of change model (Prochaska *et al.*, 2013) and the health belief model (Julinawati *et al.*, 2013), to the neglect of other relevant behavioural theories [such as the self-determination theory (SDT)]. Most of the aforementioned traditional behavioural theories describe motivation through extrinsic means. However, research suggests that because human behaviour is complex, it cannot always be well explained by extrinsic motives (Gilal *et al.*, 2019). For instance, an individual may be more willing to engage in behaviour because of his or her own inherent interest (self-determined motivation) in the behaviour and not because of any extrinsic motive. To that extent, some scholars (Dibb, 2014; Luca and Zervas, 2016) in social marketing have called for additional theories to better understand the complex nature of pro-social issues, which in the long run will offer a huge promise to intervention effectiveness. In an attempt to address the foregoing research gaps, the current study uses the SDT (Deci and Ryan, 2000), which is a human motivation theory to understand and predict a social marketing phenomenon (i.e. the adoption of flood disaster mitigation behaviours) in Ghana. Thus, the objectives of this study are twofold. First, the study seeks to examine the three psychological needs of SDT (i.e. autonomy, competence and relatedness) as predictors of self-determined motivation towards flood disaster mitigation behaviours. In this study, we operationalise flood disaster mitigation behaviours as a range of environmentally friendly actions, such as "proper waste disposal practices", "refraining from building on waterways and flood plain areas", "planting of trees", etc. Second, the study examines whether self-determined motivation influences flood disaster mitigation behaviour adoption.

The paper makes significant contributions to both theory and practice. First, the study adds to the social marketing literature by drawing on the SDT to help gain a better understanding into why people adopt flood mitigation behaviours. As this study, to the best of the authors' knowledge, is among the few studies that have attempted to fully test the SDT theory of predictors in a social marketing context, it makes significant contributions to theory by providing essential insights that extend our understanding of flood mitigation behaviour adoption from a developing country perspective. Second, the study contributes to practice, as the findings will provide important information to implementers of social marketing programs, policymakers and social marketers aiming to promote flood mitigation behaviours among Ghanaians, to better understand the strategies and communication messages they need to adopt in promoting mitigation behaviours. The remainder of this article is structured in the following order: Section 2 focusses on presenting the theoretical arguments of the appropriateness of the SDT in predicting behaviour, which subsequently leads to the development of hypotheses on the relationships within the model. Section 3 presents the research methodology, which is followed by analysis and results in Section 4. The discussions, practical and theoretical implications as well as the limitations and future research directions are also presented in Section 5.

2. Theoretical context and hypotheses development

As indicated earlier, the current study draws on Ryan and Deci's (2017) SDT as it is a leading theory of human motivation (Gilal *et al.*, 2019). SDT suggests that there are three

basic psychological needs, autonomy (have choice and control), competence (feeling competent and capable) and relatedness (feeling affiliated with others in the context) which shape self-determined motivation (Ryan and Deci, 2017; Slemp *et al.*, 2018; Van den Broeck *et al.*, 2016). The theory also posits that the extent to which these three needs are supported and satisfied largely dictates the level of self-determined motivation and that when these needs are met, participants experience more self-determined motivation and more positive outcomes (Sweeney *et al.*, 2014). SDT has been extensively applied to explain and predict human motivation in a variety of contexts, including health, education, recycling, e-waste, pro-environmental behaviours and in public policy to encourage better consumer decisions (Hiratsuka *et al.*, 2017; Pentecost *et al.*, 2017; Evans, 2015; Sweeney *et al.*, 2014; Webb *et al.*, 2013; Chen, 2014; Gilal *et al.*, 2019; Baxter and Pelletier, 2020). The theory has also been applied in commercial marketing in the areas of customer loyalty (Lin *et al.*, 2009) and relational marketing (Dholakia, 2006). Although SDT has been acknowledged in social marketing, it has not been frequently used by social marketers (Binney *et al.*, 2006; Mitchell *et al.*, 2017). To this end, this study explores the potential of SDT to address a social marketing phenomenon specifically, flood mitigation behaviour, which is currently limited in the literature. We, therefore, argue in this current study that the basic psychological needs of autonomy, competence and relatedness are predictors of self-determined motivation. We also argue that self-determined motivation influences individuals' flood disaster mitigation behaviours. The relationships within the model are further discussed in the sub-sections using existing literature.

2.1 Hypotheses development

2.1.1 Autonomy and self-determined motivation to engage in behaviour. In the view of Gilal *et al.* (2019), autonomy refers to the need to feel self-directed and to act volitionally with a sense of choice. Put differently, autonomy need is satisfied when individuals feel they have the power to control their own actions and behaviour (Deci and Ryan, 2000). For example, if individuals perceive pressure from other people such as city officials to engage in flood disaster mitigation behaviours, this would be a controlled situation that would result in perceived low autonomy, whereas a lack of pressure from outside sources would result in high perceived autonomy arising from a sense of personal choice, which in turn leads to self-determined motivation. For instance, in examining the relationship between autonomy and self-determined motivation, most findings established that autonomy was a good predictor of self-determined motivation (Deci and Ryan, 2000; Lavergne *et al.*, 2010; Osbaldiston and Sheldon, 2003; Standage *et al.*, 2003). For instance, in the physical activity setting, Standage *et al.* (2003), found autonomy to positively influence students' self-determined motivation towards physical activity. A study by Cooke *et al.* (2016) in the education setting also established that the use of autonomy supportive language in relation to recycling led to increased self-determined motivation which was related to better results on a quiz about recycling. Similarly, Lavergne *et al.*'s (2010) study in a pro-environmental context also found that autonomy predicted self-determined motivation for the pro-environmental behaviour. Following from the discussion above, we expect that in this research context, individuals' perceived autonomy in flood disaster mitigation will positively influence their self-determined motivation for flood disaster mitigation behaviour. The study, therefore, hypothesises that:

H1. Individuals' autonomy in flood disaster mitigation will have a positive significant influence on their self-determined motivation for flood disaster mitigation behaviour.

2.1.2 Competence and self-determined motivation to engage in behaviour. Within the SDT, competence denotes the need to feel "effective and confident with respect to some behaviour

or goal" (Deci and Ryan, 2014, p. 55) and achieving desired outcomes (Engström and Elg, 2015). The need for competence arises when individuals perceive that they are capable or have the ability to perform a determined task and it is related to seeking challenges that are optimal to one's abilities (Ryan and Deci, 2017). Chen *et al.* (2015) suggest that feelings of competence are necessary for individuals to approach optimal challenges that allow them to learn and develop. For example, in this research context, perceived competence may be the feeling that one has the skills, or access to the skills and information about flood disaster mitigation behaviour. The experience of low competence would be not having these skills, and not knowing where to find information or help regarding flood disaster mitigation. Some scholars intimate that competence is similar to the concept of perceived self-efficacy, which refers to beliefs about whether a person can achieve certain outcomes or not (Bandura, 1997).

Considerable research on SDT shows that when people's needs for competence are met, they are more likely to have self-determined motivation (Niemec and Ryan, 2009; Ryan and Deci, 2017; Gagne, 2003). For example, a study by Niemec and Ryan (2009) in an educational practice setting revealed that competence facilitates students' self-determined motivation towards academic performance. Similarly, in a meta-analysis of 184 SDT-based studies in the health domain, Ng *et al.* (2012) found support for the relationship between competence and self-determined motivation. On the contrary, Cooke *et al.* (2016) did not find competence to influence self-determined motivation. In spite of Cooke *et al.* (2016) indicating that competence is not a predictor of self-determined motivation, Engström and Elg (2015) found that competence is the strongest predictor of self-determined motivation. Consistent with Engström and Elg (2015) and SDT, we expect that in this research context, individuals' competence in flood disaster mitigation will more likely influence their self-determined motivation towards flood mitigation behaviour. We, therefore, formulate the following hypotheses:

H2. Individuals' competence in flood disaster mitigation will have a positive significant influence on their self-determined motivation for flood disaster mitigation behaviour.

2.1.3 Relatedness need and self-determined motivation to engage in behaviour. Relatedness represents the need to "feel personally accepted by significant others, and to feel cared for by others and caring for them" (Deci and Ryan, 2014, p. 52). In flood mitigation context, perceptions of relatedness may result from interactions from a variety of individuals such as family, friends, neighbours, community members and others involved in flood disaster mitigation behaviours. Huang *et al.* (2019) highlight that in relatedness, people perceive themselves to be socially accepted and connected to a social group they regularly interact with such as family, peers, colleagues and significant others. Because people usually want to feel connected to their social groups, they start taking in and internalising the values of such groups and accept them as theirs, which subsequently influences their decision-making (Ryan and Deci, 2017). An earlier study by Darner (2007) found that there is a relationship between relatedness and self-determined motivation. This finding is corroborated by Pacewicz *et al.* (2020) and Qian *et al.* (2020). For example, Qian *et al.* (2020) in their study of fans' psychological processes of exports consumption found relatedness to be a stronger predictor of self-determined motivation for exports consumption. In line with the foregoing, we expect that individuals' perceived relatedness in flood disaster mitigation will positively influence their self-determined motivation for flood disaster mitigation behaviour. The following hypothesis is, therefore, formulated:

H3. Individuals' relatedness in flood disaster mitigation will have a positive significant influence on their self-determined motivation for flood disaster mitigation behaviour.

2.1.4 Self-determined motivation and flood disaster mitigation behaviour. From the SDT perspective, many studies have found self-determined motivation to be a good predictor of behaviour (Weinstein and Ryan, 2010; Hagger and Chatzisarantis, 2009; Kaiser *et al.*, 2020; Ryan and Deci, 2017). For instance, it has been found that people with higher self-determined motivation were more likely to perform pro-environmental behaviours that were perceived to be challenging or difficult (Pelletier *et al.*, 2011; Sheldon *et al.*, 2016; Venhoeven *et al.*, 2013; Webb *et al.*, 2013). Consistent with previous SDT studies, we expect that individuals with higher self-determined motivation towards flood disaster mitigation will more likely participate in flood disaster mitigation behaviours. Thus, we hypothesise the following:

H4. Higher self-determined motivation towards flood disaster mitigation has a positive significant influence on flood disaster mitigation behaviour.

Our proposed research model in Figure 1 theorises that the basic psychological needs of autonomy, competence and relatedness relating to flood disaster mitigation have a positive influence on individuals' self-determined motivation for the behaviour. The model also argues that self-determined motivation will positively influence flood mitigation behaviour.

3. Methodology

3.1 Sampling and data collection

The study population comprised people who reside in Accra and Kumasi (i.e. Greater Accra and Greater Kumasi Metropolis respectively). The selection of these two cities for the survey was based on the fact that evidence suggests they are the most vulnerable cities in Ghana, as they record the most flood events every year (Mensah and Ahadzie, 2020). Because of the COVID-19 lockdown in Ghana at the time, we purposely sampled the respondents using an online survey. This approach was adopted because according to Fowler (2014), an online survey is suitable when the study's population is geographically dispersed. The use of online survey has become increasingly popular because it offers a comparatively more cost-effective method for reaching large groups of potential respondents in a short turnaround time (Sanders *et al.*, 2007; Couper, 2000). Its popularity, however, does not mean that the method is inherently valid and reliable as according to De Gregorio and Sung (2010), there are some problems associated with this sampling method (e.g. representativeness issues). Irrespective of this limitation, the current study used this method because it was the best option considering the "abnormal times we currently find ourselves in". Participants were

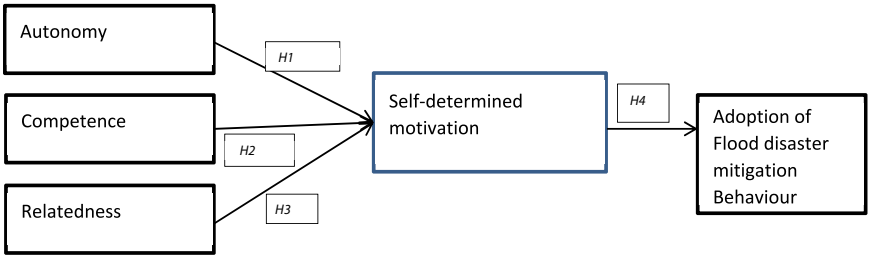


Figure 1.
Research model

invited to complete the online survey via a link that was shared on Facebook and on WhatsApp groups. As indicated earlier, only sample cases residing in Accra and Kumasi and aged between 18 and above were eligible to participate in the study and were used for analysis. Thus, as an inclusion criterion, the initial part of the questionnaire screened the respondents' eligibility including age and location of respondents. The Facebook accounts and WhatsApp groups were purposely selected to ensure that the respondents reside in Greater Accra and Kumasi Metropolis. No incentive was offered for participation and participants were assured of the anonymity of their responses. To ensure that no duplicate was used for analysis, the questionnaires returned were screened and only those that were not considered as duplicate were used for analysis. The survey was conducted between March and April, 2020. In all, 294 usable responses were obtained for the analysis.

3.2 Measures

The online survey consisted of two sections, Sections A and B. Section A involved the background information of the respondents, while Section B looked at measures regarding need autonomy, competence, relatedness, motivation and behaviour. The need autonomy, competence and relatedness items were all adapted from Ng *et al.* (2012). Participants rated their agreement on a seven-point Likert Scale from 1 – *strongly disagree* to 7 – *strongly agree*. The motivation towards the environment scale by Pelletier *et al.* (1998) was adapted to measure participants' motivation for engaging in flood mitigation behaviours. Respondents read the question "why are you engaging in flood mitigation behaviour?" and were asked to indicate the extent to which each item corresponds to their personal motives for engaging in the behaviour on a seven-point scale ranging from 1 – *does not correspond at all* to 7 – *corresponds completely*. Four motivation items were included (e.g. "because *I like the feelings I have when I am doing things that will mitigate flood disaster*". Finally, behaviour was adapted from Ghani *et al.* (2013) and was measured with four items. Prior to the online survey administration, the questionnaire was sent electronically to five experts in the area of social marketing, to ensure content validity. Additionally, the questionnaire for the online survey was pilot tested with 18 people who bore similar characteristics as the participants of the study. Based on the comments received, minor changes were made to the wording and positioning of the questions, and finally shared on the social media platforms. To address issues regarding ethics, respondents were asked to read the informed consent form. After reading the form, those who agreed to participate in the study completed the online survey and all responses to this survey were anonymous.

Non-response bias (Armstrong and Overton, 1977) was assessed, comparing differences between early and late respondents. The results indicated that no significant differences exist between the two groups. Hence, non-response bias was considered not an issue in the current study. After three weeks of data collection, 322 responses were retrieved from the electronic version of the questionnaire. After data cleaning, we removed 28 ineligible responses and incomplete questionnaires. The study therefore used 294 valid and fully completed responses for further analysis. All statistical data were analysed using SPSS 23 and AMOS 23. The final sample comprised 149 males (51%) and 145 females (49%). Approximately 33% of the respondents were between the ages of 31 and 40 years. The majority of the sample had degree-level education (69%). This finding means that the majority of our sample were literate and so they could have cognitive capability to comprehend the statements (see Table 1).

3.3 Common method bias

Because our data were collected based on self-reports, we examined the potential effects of common method bias (CMB). We conducted a Harman single-factor test (Podsakoff *et al.*, 2003),

Characteristics	Frequency	(%)
Gender		
Male	149	50.7
Female	145	49.3
Total	*294*	*100*
Age		
21–30	90	30.6
31–40	98	33.3
41–50	79	26.9
51–60	24	8.2
Above 60	3	1.0
Total	*294*	*100*
Education		
Junior high school	2	7
Senior high school	4	1.4
Diploma	14	4.8
Degree	203	69.0
Others	71	24.1
Total	*294*	*100*
Marital status		
Single	130	44.2
Married	160	54.4
Separated	3	1.0
Divorced	1	0.3
Total	*294*	*100*

Table 1. Demographic characteristics of respondents

which is one of the most common techniques used in addressing common method variance. Confirmatory factor analysis was used to verify whether significant method variance was present. Our findings indicated that our single-factor model exhibited a poor fit (root mean square error of approximation (RMSEA) = 0.18; comparative fit index (CFI) = 0.61; normed fit index (NFI) = 0.052). Additionally, no single factor accounted for more than 30% of the variance, which is less than Podsakoff and Organ's (1986) 50% threshold, suggesting that the data for the study did not suffer from CMB.

4. Data analyses and results

4.1 Profile of the respondents

Table 2 provides the description of the measures used in the study with their mean, standard deviation (SD) and standard error (SE) values. From the table, it is observed that the statement "currently, I have found alternative ways to dispose my waste to mitigate flood disaster" recorded the highest mean value of 4.25 (SD = 0.83). This means that most of the study's participants agreed with this statement. On other hand, most of the study's participants disagreed with the statement "because helping to mitigate flood disaster is a sensible thing to do" (mean = 2.79, SD = 1.08).

In this study, the authors used structural equation modelling (SEM) to verify the proposed theoretical model and research hypotheses using the two-step approach recommended in SEM (Anderson and Gerbing, 1988). Thus, in Stage 1, the study evaluated the measurement model by running confirmatory factor analysis (CFA) to validate the measurement scales of all five constructs (autonomy, competence, relatedness, self-determined motivation and flood mitigation behaviour) in the research model. Second, the

Scale item	Variable code	Mean	SD	SE
Autonomy				
I feel I am pursing goals that are my own in flood disaster mitigation	Auto1	3.9014	1.11787	0.06520
I feel I participate in flood disaster mitigation behaviour willingly	Auto2	3.8605	1.04389	0.06088
I choose to participate in flood disaster mitigation behaviour according to my own free	Auto3	3.7245	1.13685	0.06630
Competence				
I feel I am good at performing flood disaster mitigation behaviour	Comp1	3.8401	0.96965	0.05655
I feel I can overcome challenges relating to flood disaster mitigation behaviours	Comp2	4.0612	0.92167	0.05375
I feel I have the ability to perform well in flood disaster mitigation behaviour	Comp3	3.2925	1.02001	0.05949
Relatedness				
I feel I show concern for others when I perform flood disaster mitigation behaviour	Relate1	3.4014	1.11863	0.06524
In performing flood disaster mitigation behaviour, I feel I have a close relationship with other people	Relate2	3.4796	1.06026	0.06184
I feel cared for when I perform flood disaster mitigation behaviour	Relate3	3.6190	1.03741	0.06050
Behaviour				
I have joined the campaign to educate others on flood disaster mitigation issues in my community	Beh1	3.1259	1.03578	0.06041
I am currently not interested in activities that could cause flood disaster	Beh2	2.8503	1.44456	0.08425
I currently do not dispose waste into drainage channels because of flood disasters	Beh3	4.2075	1.09036	0.06359
Currently, I have found alternative ways to dispose my waste to mitigate flood disaster	Beh4	4.2517	0.82903	0.04835
Self-determined motivation				
I partake in flood disaster mitigation behaviour because it is fun	SDM1	2.8503	0.99042	0.05776
I partake in flood disaster migration behaviour because it is a reasonable thing to do	SDM2	2.8265	1.05829	0.06172
I partake in flood disaster mitigation behaviour because I feel guilty if I do not engage in it	SDM3	2.7993	1.07589	0.06275
I partake in flood disaster mitigation because I feel is a way I have chosen to contribute to flood disaster mitigation	SDM4	2.9524	1.14381	0.06671

Table 2.
Descriptive statistics of constructs measures

structural equation model was estimated to test the hypotheses proposed in the research model.

4.2 Confirmatory factor analyses and structural equation modelling

The confirmatory factor analysis was carried out using the Analysis of Moments of Structures (AMOS) software package (Version 22) as well as the maximum likelihood estimation procedure. The first measurement model tested specified five latent variables which were allowed to correlate freely with each other. The fit indices for the initial measurement model suggested a considerable misfit with a Chi square value of 261.24; df = 83; and an RMSEA value of 0.097; hence, the model needed to be re-specified (Bagozzi and Yi, 2012). Accordingly,

the initial measurement model was subjected to modification according to the sizes of the factor loadings. Based on the suggestion of the AMOS output, one item (SDM 4) was removed because it recorded a factor loading less than 0.50 (Hair *et al.*, 2013) and this significantly improved the model fit (χ^2 [239.874]; df = 109; χ^2/df = 2.201; NFI = 0.934; Tucker-Lewis index (TLI) = 0.953 and CFI = 0.963, RMSEA = 0.064; refer to Table 3). The fit indices for the improved model suggest that the research model fitted the data satisfactorily.

4.2.1 Reliability and construct validity. The study further assessed the measurement reliability and validity of the constructs in the research model. Reliability of the items were assessed using Cronbach's alpha and composite reliability. Both Cronbach's alpha values and composite reliability scores exceeded the 0.70 thresholds recommended by Krabbe (2016). To establish convergent validity for each construct, the study used factor loadings and average variance extracted (AVE) to show that measures actually measured their respective or intended constructs. The results indicated that all the factor loadings as well as the AVE values were above the acceptable levels of 0.50 (Hair *et al.*, 2006; Awwad and Agti, 2011). The *t*-values of all construct items were greater than 1.96, suggesting significance at $p < 0.001$, thus, indicating good convergent validity for all the constructs as well as high reliabilities for all the items (see Table 4 and Figure 2).

4.2.2 Discriminant validity. To test the discriminant validity of the construct measurements, the study adopted Fornell and Lacker's (1981), criterion. The results (as

Fit indices	Criteria	Initial model	Modified model	Literature support
χ^2/df	≤3	2.35	2.20	Schreber *et al.* (2006)
NFI	≥0.90	0.93	0.93	Hu and Bentler (1999)
TLI	≥0.90	0.82	0.95	Hu and Bentler (1999)
CFI	≥0.90	0.86	0.96	Hooper *et al.* (2008)
RMSEA	≤0.08	0.07	0.06	Hu and Bentler (1999)

Table 3.
Fit indices for the measurement model

Construct	Item code	Standardized factor loading	*t*-Value	CR	AVE	CA (α)
Self-determined motivation	SDM1	0.76***	Fixed	0.85	0.59	0.85
	SDM2	0.84***	14.13			
	SDM3	0.77***	13.02			
	SDM4	0.71***	11.84			
Flood reduction behaviour	Beh1	0.89***	Fixed	0.93	0.78	0.93
	Beh2	0.85***	20.15			
	Beh3	0.89***	22.53			
	Beh4	0.89***	22.55			
Autonomy	Auto1	0.75***	Fixed	0.88	0.71	0.87
	Auto2	0.87***	15.06			
	Auto3	0.89***	15.07			
Relatedness	Relate1	0.74***	Fixed	0.80	0.57	0.80
	Relate2	0.82***	12.46			
	Relate3	0.70***	11.03			
Competence	Comp1	0.86***	Fixed	0.91	0.77	0.91
	Comp2	0.87***	19.04			
	Comp3	0.90***	20.11			

Notes: CR = composite reliability; CA = Cronbach's alpha; χ^2[239.874]; df = 109; χ^2/df = 2.201; NFI = 0.934; TLI = 0.953, CFI = 0.963, RMSEA = 0.064; ***$p < 0.001$

Table 4.
CFA results for final measurement model

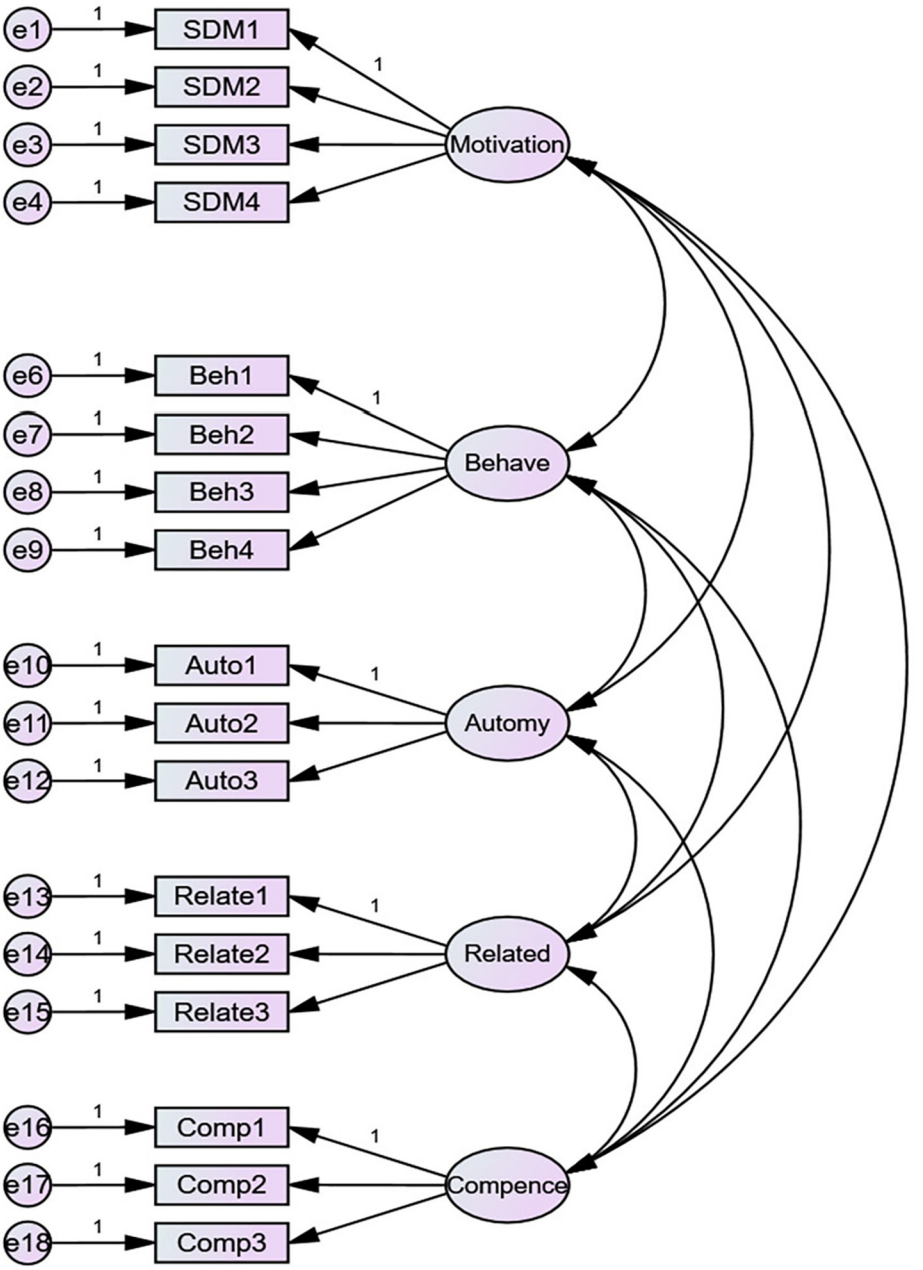


Figure 2.
Final CFA measurement model

Notes: χ^2 [239.874]; df = 109; χ^2/df = 2.201; NFI = 0.934; TLI = 0.953 and CFI = 0.963, RMSEA = 0.064

shown in Table 5) demonstrate that the square root of the AVE values for the constructs are greater than the inter-construct correlation coefficients, indicating that the constructs are distinct from each other, hence, providing evidence of good discriminant validity (Hair *et al.*, 2013).

4.2.3 Test for hypothesised structural paths using structural equation modelling. After the measurement model had been proven to be reliable and valid, the structural model was estimated. The results for the structural model (see Table 6) show that the fit indices for the hypothesised model fit the data satisfactorily (χ^2/df = 2.84; GFI = 0.97; NFI = 0.95; TLI = 0.94; CFI = 0.97; RMSEA = 0.079).

From Table 6, it is revealed that *H1* (the path from autonomy to self-determined motivation), *H2* (the path from competence to self-determined motivation) as well as *H4* (the path between self-determined motivation and behaviour) were all supported in this study as they recorded significant coefficients (β = 0.23, *t*-values = 4.72, $p <$ 0.001); (β = 0.33, *t*-values = 5.26; $p < 0.001$) and (β = 0.50, *t*-values = 9.89; $p < 0.001$), respectively. However, *H3*, which hypothesised a positive significant relationship between need relatedness and self-determined motivation, was not supported in this study, as the results showed a non-significant coefficient value (β = 0.12, *t*-values = 1.23; $p > 0.05$). Because the hypothesised path between relatedness and motivation (*H3*) was statistically unsupported, although not hypothesised, we tested a series of alternative models and compared it to the baseline model to exclude the possibility of alternative explanations. We estimated a baseline model as the full mediation model (see Figure 1), which did not have direct paths from the three psychological need dimensions to flood mitigation behaviour.

4.2.4 Tests for model comparison. Following Anderson and Gerbing's (1988) approach, the current study tested a series of nested models against our baseline model via sequential Chi-square tests with the parameter constraints of interest in the study. According to Lu *et al.* (2010), a significant change observed in the Chi-square difference would indicate the importance of the constrained path, and therefore provide support for the baseline model.

Constructs	Mean	SD	AVE	1	2	3	4	5
Self-determined motivation (1)	3.76	0.67	0.59	*0.77*				
Flood reduction behaviour (2)	3.92	0.96	0.78	0.43	*0.88*			
Autonomy (3)	4.19	0.73	0.71	0.34	0.68	*0.84*		
Relatedness (4)	3.39	0.79	0.57	0.63	0.59	0.53	*0.76*	
Competence (5)	3.43	0.78	0.77	0.75	0.56	0.49	0.70	*0.88*

Notes: SD = standard deviation; AVE = average variance extracted; square root of the AVEs are on the diagonal, and the inter-construct correlations are off-diagonal

Table 5. Discriminant validity (correlation matrix)

Hypothesized relationships	β-estimates	*t*-value	*p*-value	Results
H1: Autonomy → Motivation	0.23	4.72	***	Supported
H2: Competence → Motivation	0.33	5.26	***	Supported
H3: Relatedness → Motivation	0.12	1.23	0.52	Not Supported
H4: Motivation → Behaviour	0.50	9.89	***	Supported

Notes: ***$p < 0.001$; χ^2/df = 2.84; GFI = 0.97; NFI = 0.95; CFI = 0.97; RMSEA = 0.079; R^2 (motivation) = 0.42; R^2 (BEH) = 0.25

Table 6. Analysis of hypothesized structural paths

Consequently, in Model 1, the path linking autonomy, self-determined motivation and behaviour was constrained to zero. Likewise, the paths of the hypothesised relationships were constrained to zero in Models 2 and 3, one at a time, after which a partial mediation model was tested in Model 4, where direct paths from the three psychological need factors to the outcome variable were added to the baseline model. The results of the model comparison test are shown in Table 7.

The results of the model comparison test show the Chi-square differences between the baseline model and each of the nested models were significant, indicating that the baseline model fits our model satisfactorily. It can also be observed from the results that the Chi-square difference between Model 4 (partial mediation model) and our baseline model (full mediation model) was significant ($\Delta\chi^2$= 26.66, Δdf= 7, $p < 0.001$). This, therefore, suggests that adding direct paths from the predictors (autonomy, competence and relatedness) to the outcome variable to the baseline model significantly improved the model fit from χ^2/df = 2.84, GFI = 0.97, NFI = 0.95, CFI = 0.97, RMSEA = 0.079 to χ^2/df = 1.14, GFI = 0.99, NFI = 0.99, CFI = 0.99, RMSEA = 0.022. Hence, this study concludes that the partial mediation model was superior to the full mediation model; therefore, it is acceptable for theoretical consideration. Figure 3 represents the final structural model for this study.

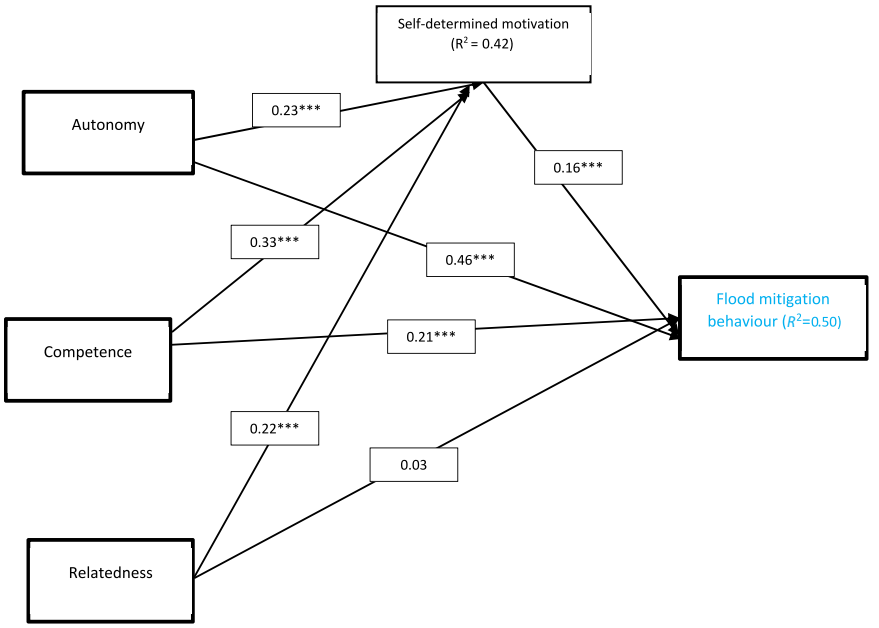
5. Discussion and conclusion

The paper sought to explain individuals' motivation to participate in flood disaster mitigation behaviours through the theoretical lens of SDT. Specifically, the study sought to examine whether the three psychological needs (autonomy, competence and relatedness) predict self-determined motivation for flood disaster mitigation, and also whether motivation acts as a predictor of flood disaster mitigation behaviour adoption. The findings of the study revealed that the relationship between need autonomy and self-determined motivation (*H1*) was positive and significant. This finding is consistent with previous studies (Deci and Ryan, 2000; Lavergne *et al.*, 2010; Cooke *et al.*, 2016; Gilal *et al.*, 2019; Trépanier *et al.*, 2015; Ryan and Deci, 2017). For instance, Lavergne *et al.* (2010) found that need autonomy for pro-environmental behaviour was related to self-determined motivation for environmentally active people. The findings of this current study suggest that individuals' self-determined motivations for flood mitigation are largely driven by their need autonomy for flood mitigation. This implies that individuals with psychological need for autonomy for flood disaster mitigation will develop self-determined motivation for behaviour adoption when they feel that their choices regarding flood disaster mitigation are

Model	χ^2	df	$\Delta\chi^2$	Δdf	χ^2/df	GFI	NFI	CFI	RMSEA
Baseline (full mediation)	31.23	11	–	–	2.84	0.97	0.95	0.97	0.079
Model 1	11.51	8	$\Delta\chi^2$ (b, M1) = 19.72***	3	1.44	0.99	0.97	0.99	0.039
Model 2	26.06	8	$\Delta\chi^2$ (b, M2) = 5.17***	3	3.26	0.97	0.93	0.95	0.088
Model 3	23.04	8	$\Delta\chi^2$ (b, M3) = 8.19***	3	2.87	0.97	0.95	0.96	0.080
Model 4 (partial mediation)	4.57	4	$\Delta\chi^2$ (b, M4) = 26.66***	7	1.14	0.99	0.99	0.99	0.022

Table 7.
Result of the Chi-square difference model comparison test

Notes: Baseline model: full mediation (paths between autonomy, competence, relatedness and self-determined motivation; and between self-determined motivation and behaviour). Model 1: (autonomy → self-determined motivation → behaviour) was constrained to 0; Model 2: (competence → self-determined motivation → behaviour) was restricted to 0; Model 3: (relatedness → self-determined motivation → behaviour) was constrained to 0; Model 4: (directs paths from autonomy, competence and relatedness to behaviour were included in the model, resulting in a partial mediation model); ***$p < 0.001$



Notes: Parameters are standardized estimates; ***$p < 0.0001$; ^{X2}/df=1.14, GFI = 0.99, NFI = 0.99, CFI = 0.99, RMSEA = 0.022

Figure 3.
Final structural model

based on their true interests and values and not based on coercion (Sheldon *et al.*, 2001; Guay *et al.*, 2010).

Similar to *H1*, our results in *H2* also indicate a positive significant relationship between competence for flood disaster mitigation and self-determined motivation. This finding corroborates the results of prior research (Deci and Ryan, 2000; Engström and Elg, 2015; Niemiec and Ryan, 2009). A study by Niemiec and Ryan (2009) in an educational practice setting revealed that competence facilitates students' self-determined motivation towards academic performance. Similarly, the results of this current research suggest that individuals' self-determined motivation for flood reduction increases when they feel more capable and believe they have the ability to successfully engage in the behaviour. Therefore, communications that reinforce the target group's capability and ability for the behaviour will enhance their motivation for flood disaster mitigation.

Contrary to our expectations, however, the results for *H3* revealed a non-significant relationship between relatedness and self-determined motivation. This finding contradicts existing studies (Qian *et al.*, 2020; Pacewicz *et al.*, 2020; Ryan and Deci, 2017; Lavergne *et al.*, 2010; Standage *et al.*, 2003). For instance, Qian *et al.* (2020) in their study on fans' psychological processes of exports consumption revealed relatedness as the most salient predictor of exports consumption. The SDT also posits that because people usually want to feel related and connected to their social groups, they start taking in and internalising the values and practices of such groups and accept them as theirs to meet social the group's approval (Deci and Ryan, 2000). However, in the current study, our findings suggest that in

the Ghanaian context, this did not seem to be the case as the need for relatedness regarding flood disaster mitigation does not actually increase participants' self-determined motivation for flood disaster mitigation. The plausible reason for this difference is that, it is possible that in Ghana participants' need relatedness for flood disaster mitigation is relevant as they make their decisions regarding flood mitigation based on their own values and self-interest rather than what their social groups prefer they do (Chau and Hu, 2002; Flannery, 2017).

With respect to *H4*, we found that self-determined motivation has a positive influence on flood disaster mitigation behaviour. This finding suggests that individuals who perceive that engaging in flood disaster mitigation activity is a way of contributing to flood disaster mitigation will more likely engage in the behaviour. This finding is similar to previous studies (Weinstein and Ryan, 2010; Hagger and Chatzisarantis, 2009; Ryan and Deci, 2017) that have averred that people with stronger self-determined motivation performed pro-environmental behaviours that were perceived to be challenging because they like the feelings they have when they perform the behaviour. Finally, this study tested a series of nested models and compared it to the baseline model in Figure 1 and, we concluded that the partial mediation model (Figure 3) was significantly better than our full mediation model in Figure 1. This is an important finding because it emphasises the need to further our understanding of the combined role of autonomy, competence and relatedness in motivational processes regarding behaviour change. Hence, future research in this area should fully analyse the mediator relations to explore this relationship in other activity contexts.

5.1 Theoretical implications

The current paper makes two main contributions to the growing body of literature. First, the study adds to the social marketing literature by extending the application of social marketing to the context of flood disaster mitigation, a previously under-researched area. Second, following calls to use additional theories in social marketing research (Dibb, 2014; Lefebvre, 2013), this study provides evidence of the applicability of the SDT to understand a social marketing phenomenon (flooding disaster mitigation behaviour adoption). To the best of the authors' knowledge, this study is one of the few studies that have attempted to fully test the SDT theory of predictors for motivation and behaviour in a social marketing context, as little (if any) research exists that has examined the potential relationships between autonomy, competence or relatedness and motivation for behaviour adoption, particularly, from a developing country context. In particular, the study found need competence and autonomy to be the most important predictors of higher self-determined motivation and flood reduction behaviour. This study thus provides support for the applicability of the SDT in predicting the motivation for flood disaster mitigation adoption in a developing country context. Social marketers interested in improving flood disaster mitigation behaviours can enhance intervention efficacy by considering the factors proposed by the SDT as a way of changing behaviour.

5.2 Implications for practice

The findings of this study also offer some implications for social marketing practitioners, policymakers and city planning officials as successes and failures in many social marketing interventions can be understood from the SDT perspective. In the current study, need competence relating to flood mitigation has proven to be the most important variable that predicts participants' self-determined motivation for flood disaster mitigation. This was followed by need autonomy relating to the behaviour. To this end, we recommend that implementers of social marketing programs and policymakers aiming to promote the

adoption of flood mitigation behaviours among individuals should not focus on relatedness because the study found a non-significant relationship between relatedness and self-determined motivation. They should rather focus more efforts on providing support for the individual's sense of autonomy and competence. In other words, social marketers can enhance intervention efficacy through the support of individuals' psychological needs for competence and autonomy. Doing so will not only enhance positive outcomes but also make interventions effective. They can, therefore, come up with communication messages that will support people's sense of competence and autonomy to make them feel they are in charge or have control over the performance of the behaviour and that they are capable of performing the behaviour successfully without coercion (Deci and Ryan, 2000). According to Russell-Bennett *et al.* (2009), for consumers or individuals to exert effort to change and adopt a given behaviour, there must be a value proposition that incentivises them. The incentive could be an inherent desire to achieve a desired behavioural outcome which the individuals feel is based on their true interests and value, and although the task or behaviour may appear challenging, they will still perform it out of their own choice and volition, and not because of an external reward (Deci and Ryan, 2000; Ryan and Deci, 2017). Thus, Zinuddin *et al.* (2013) have suggested that policymakers and intervention planners, when designing social marketing programmes, must understand the motivational mechanisms that underlie the behaviour and what the individuals perceive as value to reduce the barriers to participation, as this will encourage sustainable behaviour change.

Finally, we suggest that practitioners aiming to promote flood disaster mitigation behaviour should demonstrate care and interest, by providing an emphatic and warm interpersonal environment and opportunities that support individuals' relationships and connection with their social groups as this will likely influence their self-determined motivation for the behaviour (Van den Broeck *et al.*, 2016) and intervention effectiveness.

5.3 Limitations and future research directions

In spite of the outlined contributions, the study has some limitations that need to be taken into consideration when interpreting the findings. First, the study tested the relationships among the constructs using urban dwellers only. Therefore, it will be interesting for future studies to test our model in non-urban settings for theory validation. Second, the research design used in this study was cross-sectional, which may suggest static relationships between the variables used at a single point in time. Future research may have to adopt longitudinal or experimental designs to determine the pattern of change and the extent to which self-determined motivations that are based on need competence and autonomy influence flood mitigation behaviour over time. Additionally, the current study applied the SDT in a specific pro-environmental context (flood disaster mitigation). Studies in a range of behavioural settings, including, e.g. illegal mining, energy conservation, recycling, would strengthen the theory. Finally, we relied on participants' self-reports as a single source of information about the study variables, which may suffer social desirability bias. Future research would benefit from using objective measures, or it would be desirable to control for social desirability. In spite of the delineated limitations, the testing of a theoretical model that had all the paths included in the model (partial mediation model) adds to the literature in this area and offers direction for future research.

5.4 Conclusion

The current study is the first, to the best of the authors' knowledge, to attempt to find support for a theoretical model of motivation (specifically, SDT), which combines all three psychological needs dimensions (autonomy, competence and relatedness) and self-

determined motivation in one model in a social marketing context. The study found that competence was the strongest predictor of self-determined motivation for flood disaster mitigation, followed by autonomy. Furthermore, self-determined motivation was found to positively influence individuals' flood mitigation behaviour. Thus, we suggest that identified variables (i.e. competence and autonomy) that are important in predicting people's self-determined motivation towards flood disaster mitigation should be prioritised in social marketing programmes and public campaigns that aim to promote effective and sustainable behaviour change.

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