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Low-carbon consumer behaviour in climate-vulnerable developing countries: A case study of Sri Lanka

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ABSTRACT

A low-carbon economy requires low-carbon consumption by the public. Despite the importance of consumers in low-carbon economies, so far, most studies have ignored low-carbon consumer behaviour in developing countries that are vulnerable to climate change and its consequences. This indicates inattention to the socio-economic aspects of the general life style of the people in promoting sustainable consumption and accountability. This study examines the determinants of low-carbon consumption behaviour of consumers in climate-vulnerable developing countries by focusing on consumers in Sri Lanka. Combining the Theory of Planned Behaviour (TPB) and the Theory of Perceived Marketplace Influence (TPMI), the data collected from 440 Sri Lankan consumers was analysed using a structural equation model. The findings revealed the antecedent variables of TPB (i.e., attitude, subjective norm and perceived behavioural control) and the additional variables (i.e. low-carbon-self-identity and implementation intention) that fully explains the carbon-conscious decision-making phenomenon in a developing country setting. The results confirm the appropriateness of the proposed model for predicting low-carbon consumer behaviour in climate-vulnerable developing countries such as Sri Lanka as it increases the predictive power of the TPB framework. Accordingly, policy level implications and strategies for promoting individual low-carbon consumption behaviour are proposed.

1. Introduction

"Combating climate change and its impacts" is one of the seventeen Sustainable Development Gaols (SDGs) of the United Nations for promoting urgent collective action for controlling the rise in global mean temperature to two degrees Celsius above pre-industrial levels. Realizing this global target calls for understanding the role of consumers in a low-carbon economy (Chen et al., 2014; Peake, 2012). Low-carbon consumers are concerned about the carbon impact of buying, using and disposing of various products and services. Thus carbon-responsible purchasing by consumers is vital for preventing or reducing the environmental damage resulting from the purchase of carbon-intensive products and services (Joshi and Rahman, 2016; Yadav and Pathak, 2017). It is therefore important to understand consumers' attitudes and preferences and factors affecting their decision-making process for transiting to a low-carbon economy (Chen et al., 2014; Adagh and Francis, 2018). Despite the importance of low-carbon consumption, actual low-carbon consumer behaviour is still in its early

stages and marked by differences in consumer psychology and the complexity of the perceptions of people as ecologically responsible consumers (Geels et al., 2015).

The literature on low-carbon behaviour focuses mainly on developed countries (Adagh and Francis, 2018; Berardi, 2017; Claudelin et al., 2017; Long et al., 2015) and on a few developing countries such as China (Ye et al., 2017; Yang et al., 2016; Si et al., 2020), Brazil (Echegaray and Hansstein, 2017) and India (Yadav and Pathak, 2016, 2017). The extant literature on low-carbon behaviour assumes that low-carbon systems including consumption behaviour in developing countries would be similar to those in developed countries (Urban, 2014). Further, despite the common belief that the development trajectories of developing countries would resemble the historic development patterns of developed countries, the reality is that it is not the case owing to socio-cultural, technological and economic differences. With their relatively mature policies and institutional settings, developed countries show greater low-carbon consumption, whereas developing countries have only recently started looking at these aspects (Berardi, 2017). This

could lead to flawed interpretations, policies and mitigation and adaptation strategies relating to many socio-economic factors, including international institutions, governments of developing countries, corporations and civil society (Urban, 2014).

Developing countries are the most vulnerable to the effects of climate change and thus their development prospects are the most compromised (UNDP, 2011). It is therefore the responsibility of developing countries to embrace new and innovative approaches to leverage existing experiences and place them within comprehensive policy frameworks for supporting the development plans, polices and action programmes across multiple sectors and levels (UNDP, 2011). However, policy makers in these countries find it extremely difficult to transit to a low-carbon economy owing to the lack of understanding of consumer behaviour and many other factors such as deficient infrastructure and technology, rapid population and economic growth rates and poverty reduction programmes leading to sharp increases in the demand for electricity and modern fuels (Colenbrander et al., 2015; Mulugetta and Urban, 2010; Fujii et al., 2019). This is particularly so in climate-vulnerable developing island nations such as Sri Lanka, which is rated as the top second in the Climate Risk Index (CRI) listing for 2019 (Eckstein et al., 2018). Although studies reveal that low-carbon behaviour is widely encouraged among consumers in high-risk areas of climate change (Long et al., 2015; Ye et al., 2017), it is still largely unknown why the actual low-carbon consumer behaviour is still at a rudimentary level in these countries (Mulugetta and Urban, 2010; Chaudhary and Bisai, 2018). A comprehensive explanation of low-carbon consumption together with the socio-economic conditions of developing countries with climate-vulnerability open a new and valuable way to explore and develop low-emission climate-resilient development strategies to respond more effectively to climate change (Ye et al., 2017). Further, understanding the determinants of consumers' green/eco-friendly purchase behaviour can assist in eliminating the obstacles to low-carbon consumption (Welsch and Kühling, 2009). This paper examines the factors that determine low-carbon consumer behaviour in climate-vulnerable developing countries and poses the research question: *How do consumers in climate-vulnerable consumer societies in developing countries react to climate change risk through their consumption behaviour?*

By addressing this question, the study makes several contributions. First, it adds to the present understanding of sustainable (or environment-friendly) consumption in developing countries with high climate risk vulnerability such as Sri Lanka that has seldom been studied. Since climate risk can affect the public's low-carbon behaviour (Long et al., 2015; Ye et al., 2017), understanding this aspect is important from both theoretical and practical perspectives. This has important implications for future studies by demonstrating how people's consumption choices can lead to greater sustainability through collective action to limit anthropocentric climate change and greenhouse gas emissions (Chen et al., 2014; Claudelin et al., 2017; Joshi and Rahman, 2016; Peake, 2012; Yadav and Pathak, 2017). Second, this study extends and strengthens TPB in making green low-carbon consumption decisions by adding two additional variables in order to expand the explanatory power of the theory. This is an important consideration in view of the

need to include more psychological and other factors that lead to actual behaviour in examining low-carbon consumer behaviour (Chen et al., 2014; Gollwitzer, 1990; Kim and Choi, 2005; Rise et al., 2003; Rivis and Sheeran, 2003; Yadav and Pathak, 2017; Yang et al., 2016). Further, scholars have called for more empirical studies to bridge the wide gap between intention and behaviour (Echegaray and Hansstein, 2017; Hassan et al., 2016). Our study therefore provides an empirical case for addressing this gap by adding implementation intention to this model. Third, this study highlights the importance of the low-carbon behaviour of consumers in creating a low-carbon economy focused on low-carbon products. As the public plays a critical role in achieving low-carbon development (Chen et al., 2014; Claudelin et al., 2017; Adagh and Francis, 2018), this study sheds light on how to effectively promote low-carbon behaviour among the public and then establish and develop effective response mechanisms and low-emission climate-resilient development strategies.

The rest of the paper is organized as follows: Section Two discusses low-carbon consumer behaviour in developing countries. Section Three presents the theoretical framework of the study followed by the methodology. Section Five provides the analysis and results followed by the discussion and implications. The last section states the conclusions, limitations and future research.

2. Low-carbon consumer behaviour in developing countries

Although concepts such as green consumption, low-carbon economy and sustainable energy have been integral aspects of the ideologies of developed countries for the last five decades, their acceptance and implementation in the developing world are at a slow pace (Moisander, 2007; Berardi, 2017). This has led to poor understanding in societies in general and as a result to limited research in this area, especially in the developing countries in Asia (Joshi and Rahman, 2016). This study focuses on Sri Lanka, a climate-vulnerable island nation in South Asia, the world's largest developing region with the world's largest population and the highest industrial and economic growth rates and contributing to global climate change (Urban, 2014).

Although some developing countries such as China, Brazil and India have invested widely in sustainable energy and other related sectors such as sustainable transportation (Beraradi, 2017; Colenbrander et al., 2015; Dong et al., 2018), most of the other developing island countries such as Sri Lanka have failed to make any substantial progress towards a low-carbon economy in order to mitigate the extreme impacts of climate change. These countries are severely affected by climate change making them the most vulnerable to extreme climate events due to many contextual barriers (Ayers and Forsyth, 2009; Mani et al., 2018): semi-arid climates, over-concentration of economic activities in hazardous zones (e.g. coastal areas), heavy reliance on agriculture and adaptation deficits such as the lack of institutional, financial or technological capacity for effective adaptation (Ayers and Forsyth, 2009; Fankhauser and McDermott, 2014; Gunarathne et al., 2019). These factors have resulted in rising mortality rates due to air pollution, to climate change and significant economic loss in these countries that

Table 1
Profiles of selected climate vulnerable countries.
Source: Eckstein et al. (2018); Climate Vulnerable Forum (2019); World Bank (2019)

Country	Sri Lanka	Nepal	Vietnam	Madagascar	Bangladesh
Climate Risk Index [2017]	2	4	6	7	9
Population [mn]	21.44	29.30	95.54	25.57	164.67
Emissions per capita (2014) [Tons]	1.368	1.194	3.260	1.338	0.936
Climate vulnerability level	Severe	Severe	Acute	Acute	Severe
Mortality attributable to air pollution (2015) [per 100,000]	125.4	103.2	83.2	85.2	68.6
Climate change attributable deaths (2015)	627	855	0.2	1.936	4,827
Climate change attributable deaths for children under 5	6.061	8.265	2.7	9.438	46,661
Economic loss [% of GDP]	1.135	2.412	0.625	1.739	0.410

have been identified as highly vulnerable according to the Climate Risk Index of Germanwatch (Eckstein et al., 2018) (see Table 1). In view of this vulnerability, the World Bank identifies Sri Lanka as a hot spot for climate risk in South Asia and projects a 7.0 percent reduction in living standards in the country by 2050 (Mani et al., 2018). The government of Sri Lanka therefore adopted, among several other initiatives, a "National Adaptation Plan for Climate Change Impacts in Sri Lanka" in 2015 to face the extreme risks of climate change. However, these policy level initiatives have yet to succeed because of poor implementation, lack of stakeholder support, public awareness and insufficient policy level directions (Gunarathne et al., 2019; Gunarathne and Lee, 2019).

Sri Lanka's inadequate preparedness for climate vulnerability and the government's ineffectiveness in identifying suitable climate-resilient development strategies to face extreme climate events were reflected in many recent events. For example, a flash flood in 2017 took the lives of more than 200 while displacing over 600,000 people from their homes. Further, the country's leading economic sectors such as tourism, agriculture and manufacturing are highly vulnerable to extreme weather events thus posing threats to the recent economic development it achieved (USAID, 2018). Many of the aforementioned contextual barriers that are at play in Sri Lanka impede the transition towards a low-carbon intensive trajectory (IPCC, 2014). This situation has invariably led to poor consumption decisions by Sri Lankan consumers who lack sufficient information and education on the potential socio-economic repercussions of climate change as well as on response options (Mani et al., 2018).

3. Theoretical background and hypothesis development

3.1. Theory of Planned Behaviour (TPB) and Theory of perceived Marketplace Influence (TPMI) for low-carbon consumer behaviour

TPB is a model for explaining the relationship between beliefs and behaviour, in which the intention to perform a given behaviour leads to actual behaviour (Ajzen, 1991). TPB is a widely used psychological framework that can be used to identify the factors influencing particular behaviours in specified contexts such as low-carbon behaviour (Ding et al., 2018; Borthakur and Govind, 2018). More specifically, TPB has been recently used to identify the determinants of intention and behaviour in various sustainability contexts such as bike sharing (Si et al., 2020), energy saving (Gao et al., 2017; Lopes et al., 2019; Ru et al., 2019), environmental complaints (Zhang et al., 2017, 2018), e-waste recycling (Echegaray and Valeria Hansstein, 2017; Lizin et al., 2017; Kumar, 2019), particulate matter reduction (Ru et al., 2019), plastic recycling (Khan et al., 2019), readiness towards a circular economy (Singh et al., 2018) and young consumers' green product consumption (Yadav and Pathak, 2016). It can be very useful for examining the creation of a low-carbon economy by analysing consumers' rational low-carbon consumption behaviour since it encourages the analysis of attitude, social influence, culture and personal aspiration for identifying personal purchase behaviour (Ding et al., 2018; Sarkis, 2017; Yadav and Pathak, 2016).

Despite the general usefulness of TPB, many researchers have tried to extend its explanatory power and practical application with additional constructs within the TPB model (Al-Debei et al., 2013; Borthakur and Govind, 2018; Chen et al., 2014; Chen and Tung, 2014; Conner and Armitage, 1998; Gkargkavouzi et al., 2019; Han et al., 2010; Hsu et al., 2006; Paul et al., 2016; Shi et al., 2017; Si et al., 2020; Yadav and Pathak, 2016). This study extends the TPB model by integrating the fundamental philosophy of TPMI in a novel approach to understanding low carbon consumer behaviour. According to TPMI, individual beliefs pertinent to environmentally friendly decision-making could determine and encourage the behaviour of other consumers (Groening et al., 2018; Joshi and Rahman, 2017). Hence, "the belief that one's efforts in the marketplace can influence the marketplace behaviour of other consumers and organizations, and inasmuch

serve as a motivation for one's own behaviour" (Leary et al., 2014, p. 1954).

In line with this thinking, in this study we make two important extensions to the original TPB proposed by Ajzen (1991) to make it more acceptable for low-carbon purchase consumption decisions in developing countries with high levels of climate risk. Firstly, we develop a new construct, "low-carbon-self-identity", and then posit it as an independent variable in determining behavioural intention in the original TPB model. Secondly, we incorporate "implementation intention" as a predictor of low-carbon consumer behaviour.

TPMI demonstrates eco-conscious buyer behaviour as a unique quality associated with consumers who contribute towards selecting products which are less harmful to the environment than generic products (Groening et al., 2018). This manifests a perception geared to initiating an attitudinal and behavioural shift from traditional consumer decision- making based on maximising utility. Hence, this study introduces "low-carbon-self-identity" as an extension of this ideology with enhanced self-esteem and autonomy towards validating personal preference and acknowledging low-carbon consumer behaviour. Self-identity is a concept that was introduced a long time ago as a collection of identities that demonstrate the roles that a person plays in a particular social structure and the expectations pertinent to his identified role and behaviour (Stryker, 1968). In green product consumption, self-identify implies "a person who plays a specific role or a general sense of role (such as environmentalists) [to] define himself...and endow him/herself with the significance and the expectation associated with the role and then form a series of standards related to the role to guide their behaviour associated with the role" (Ding et al., 2018). It has been introduced as an additional variable in determining the behaviour of green products (Sparks and Guthrie, 1998; Gkargkavouzi et al., 2019) and as an important antecedent of environmentally friendly intentions and behaviour. It suggests "that with individuals who perceive themselves as eco-friendly persons it is highly possible to adopt environmental actions to express their green identity feeling" (Gkargkavouzi et al., 2019, p. 146). Building on prior work, the present study defines "low-carbon-self-identify" as the attitude towards the consumption of low-carbon products and the role of a consumer who advocates such behaviour in a developing country, as an opinion leader. As Mulugetta and Urban (2010) opine, the doctrine of low-carbon behaviour is at an infant stage in developing countries compared to developed countries; a person who embraces "low-carbon-self-identify" in a developing country can be positioned as an "innovator" in society, who demonstrates leadership and influence, as suggested by Rogers (1995). Studies show that low-carbon promotion schemes can perform well if these early movers with pro-environmental attitudes can be targeted (Long et al., 2015).

Gollwitzer and Brandstatter (1997) emphasised that individual beliefs, which underpin behavioural intention are inadequate determinants of behaviour. Hence, they identified the need to include an action-oriented intention to enhance the strength of behaviour (Gollwitzer and Brandstatter, 1997). This is necessary as behavioural intention does not always lead to successful enactment of actual behaviour (Conner and Armitage, 1998; Rise et al., 2003) resulting in a clear "intention–behaviour gap in ethical consumption" (Echegaray and Hansstein, 2017; Hassan et al., 2016). It is also expected that consumers will purchase low-carbon products if and only if they believe that their behaviour will actually contribute to the betterment of the environment (Kim and Choi, 2005). This is evident in low-carbon consumer behaviour where consumers highly value the need for and importance of socially responsible consumption but have failed to actually convert the ideology into practice through actual purchase decisions (Ha and Janda, 2012). This is relevant to consumers in climate-vulnerable developing countries as they have not developed low-carbon consumption (Chaudhary and Bisai, 2018; Mulugetta and Urban, 2010) although the studies show that climate risk encourages environmentally responsible behaviour (Long et al., 2015; Ye et al., 2017).

Gollwitzer (1993) suggests that individuals could transform behaviour into action through goal achievement which indicates a perceptual desire for an intended rational outcome of a decision. Therefore, this study incorporates implementation intention as a determinant of low-carbon consumption and behaviour in developing countries. This extends the ideology from mere conceptualisation to actual practice since heavy focus on implementation intention strengthens actual behaviour. Moreover, TPMI posits that the change in consumer perception as a result of perceived marketplace influence demonstrates a significant impact on generating consistent purchase behaviours leading to the acceptance of low-carbon products as a standard practice. This creates a higher degree of customer loyalty and repeat purchase of low-carbon products leading to the formation of implementation intentions. Implementation intention manifests a direct conversion of the perceived psychological expectation of low-carbon behaviour into a practical reality that shapes actual behaviour in present and future contexts thus validating the fundamental premise of TPB with assurance and certainty (Gollwitzer and Brandstatter, 1997; Sutton, 1998).

3.2. Hypotheses development

In the original form of TPB, behavioural intention is a function of three components: attitude, subjective norm and perceived behavioural control. In general terms, attitude is a favourable or unfavourable personal evaluation of a potential performance or behaviour leading to a decision. Thus, the more favourable the attitude with respect to behaviour, the stronger the individual's intention to perform that behaviour (Ajzen, 1991). In environmentally friendly decision making, the attitude towards behaviour shows the individual evaluation of the action from negative to positive (Echegaray and Hansstein, 2017). In many studies on sustainable consumption, attitude has been a core predictor of behavioural intention, which is one's willingness to perform a specific act (Si et al., 2020). In this study, attitude refers mainly to consumers' perceptions and tendencies regarding the consumption of low-carbon products while behavioural intention refers to consumers' intended desire to purchase low-carbon products.

Recent studies show a positive relationship between attitude and behavioural intention including green product consumption (Paul et al., 2016; Yadav and Pathak, 2017; Taufique and Vaithianathan, 2018), sustainable use of bike sharing (Si et al., 2020), intention to file environmental complaints (Zhang et al., 2017), e-waste recycling (Echegaray and Hansstein, 2017; Kumar, 2019), intention to visit green hotels (Chen and Tung, 2014) and intention to reduce particulate matter (Ru et al., 2019). Thus, we propose that:

H1. Attitude has a positive effect on behavioural intention to buy low-carbon products.

The second antecedent of TPB, subjective norm, demonstrates the impact of social pressures on an individual's purchase decision where high social influence contributes positively to the actual purchase intention (Ajzen, 1991). The influence of the immediate social circle of an individual including colleagues, close friends, family, inspirational groups and business partners is identified as the main driver of the environment for the practice of the ideology, the subjective norm (Hee, 2000). According to previous studies, there is a positive correlation between social influence and the practice of environment-friendly behaviour in areas such as green purchase behaviour (Yadav and Pathak, 2017), young people's particulate matter reduction intention (Ru et al., 2019), green hotel selection (Han et al., 2010), bike sharing (Si et al., 2020) and e-waste recycling (Echegaray and Hansstein, 2017). There is a clear tendency for consumers to demonstrate higher adaptability to low-carbon purchase behaviour if there is a significant influence from people connected with their regular activities in life (Kumar, 2019). Thus, we hypothesize that:

H2. Subjective norm has a positive effect on behavioural intention to

buy low-carbon products.

The next antecedent, perceived behavioural control, indicates the perceived ease or difficulty of performing the behaviour pertaining to past experience and knowledge of an individual functioning beyond volitional control (Ajzen, 1991). This concept has been recognised as a very significant predictor of low-carbon purchase behaviour in past research, including low-carbon purchase behaviour in a developing nation (Yadav and Pathak, 2017), battery recycling (Lizin et al., 2017), organic food consumption (Tarkiainen and Sundqvist, 2005), energy saving in a workplace setting (Lopes et al., 2019), e-waste recycling (Kumar, 2019), young consumers' intention to reduce particulate matter (Ru et al., 2019), sustainable user intention towards bike sharing (Si et al., 2019) and predicting low-carbon product consumption (Paul et al., 2016). However, effective past experience and behavioural control of low-carbon product and low-carbon consumption depend on the purchasing power of consumers since these products are sold at a premium price (Zanoli and Naspetti, 2002). Therefore, we propose that the perceived behavioural control has a direct influence on pursuing low-carbon purchase intention and low-carbon behaviour with the following hypothesis:

H3. Perceived behavioural control has a positive effect on behavioural intention to buy low-carbon products.

According to the Theory of Organizational Behaviour, individual behaviour is dependent on behavioural intention (Si et al., 2020). Thus, as a general principle, the stronger the intention and ambition to engage in a particular behaviour such as low-carbon behaviour, the more likely it is for such behaviour to lead to actual performance (Ajzen, 1991). In environmentally relevant behaviour, intention to act has been identified as a direct predictor of behaviour in most of the common theories in environmental psychology (Klöckner, 2013). For instance, in various previous studies such as green product consumption (Yadav and Pathak, 2017; Taufique and Vaithianathan, 2018; Gkargkavouzi et al., 2019), energy saving behaviour (Lopes et al., 2019; Zierler et al., 2017) and sustainable use of bike sharing (Si et al., 2020), the intention has been understood to significantly influence the consumer's actual buying behaviour. Therefore, we intend to extend TPB by incorporating the same doctrine in the context of low-carbon purchase behaviour and low-carbon behaviour with the following hypothesis:

H4. Behavioural intention has a positive effect on actual purchasing behaviour in purchasing low-carbon products.

As discussed in the previous section, the intention-behaviour gap can be reduced by introducing additional variables into the TBP model such as implementation intention, which offers greater opportunities for the exploration of the translation of intention to the enactment of behaviour (Echegaray and Hansstein, 2017; Hassan et al., 2016; Rise et al., 2003). The incorporation of the implementation intention extends the original TPB and emphasises the need to inculcate a two-stage process in examining actual behaviour. This is where the original ideas of Ajzen (1991) are considered the first stage with the demarcation of motivational factors which depict behaviour and the second stage as the volitional or implemental stage which considers implementation (Conner and Armitage, 1998). Hence, the formation of an implementation intention is important to effectively translate a behavioural intention into actual behavioural performance by specifying a plan to bring an intention to fruition in sustainable consumption (Carrington et al., 2010). Therefore, to enhance the validity of the actual purchase of low-carbon products and to examine actual low-carbon behaviour, this study hypothesises the following extensions based on the implementation intention in the conceptual model.

In this study, we add low-carbon-self-identity as an antecedent of behaviour in order to enhance the scope and practical validity of understanding low-carbon purchase behaviour in order to facilitate the creation of a low-carbon economy in developing countries. A long time

ago, Charng et al. (1988) and Granberg and Holmberg (1990) identified the concept of self-identity as an independent predictor of behaviour irrespective of attitude and other antecedents that influence behaviour. More recently, self-identity has been identified as a determinant of a range of intentions and behaviours such as electric car adoption (Barbarossa et al., 2017), green product consumption (Gkargkavouzi et al., 2019), sustainable buying and curtailment (Dermody et al., 2018) and pro-environmental behaviour (Moser and Kleinhückelkotten, 2018).

Therefore, considering the limited scope and inadequacy of previous research on intention to predict behaviour, we propose the following hypotheses based on implementation intention and low-carbon-self-identity:

H5. Attitude has a positive effect on implementation intention to buy low-carbon products.

H6. Subjective norm has a positive effect on implementation intention to buy low-carbon products.

H7. Perceived behavioural control has a positive effect on implementation intention to buy low-carbon products.

H8. Low-carbon-self-identity has a positive effect on implementation intention to buy low-carbon products.

H9. Behavioural intention has a positive effect on implementation intention to buy low-carbon products.

H10. Implementation intention has a positive effect on actual behaviour in purchasing low-carbon products.

Based on these hypotheses, the conceptual model of this study is presented as follows (see Fig. 1):

Fig. 1 presents our conceptual model as a modification of the TPB model. While there are many extensions and modifications to this model, most of such models still have one mediating variable, namely, that behavioural intention is the most important antecedent variable predicting actual behaviour (Si et al., 2020). But, in addition to adding low-carbon-self-identity as an antecedent variable in parallel with attitude, subjective norm and perceived behavioural control, we also introduce another mediating variable, namely, implementation intention. This new construct of the model gives rise to many possible indirect relationships whose indirect effects are too complex to analyse. Therefore, in this study, indirect relationships are not separately hypothesized and tested.

4. Method

4.1. Questionnaire design

Our questionnaire has two sections: Section One covers demographic information, awareness and availability/accessibility of low carbon purchasing options of the respondents, and Section Two consists of 29 questions on their low-carbon consumption behaviour. The responses were marked on a five-point Likert scale from "Strongly disagree" to "Strongly agree". As shown in Table 2, these latent variables, i.e., attitude (four items), subjective norm (four items), perceived behavioural control (four items), low-carbon-self-identity (four items), implementation intention (four items), behavioural intention (five items) and behaviour (four items) were assessed with items adapted from extant measures based on prior research with minor lexical changes to suit low-carbon consumption. We pilot-tested the initial survey instrument and refined it to avoid possible response bias and to ensure clarity and comprehensibility by distributing it among 30 known parties before the actual data collection. Based on the responses in the pilot survey, the questions were appropriately altered to ensure that they were not leading questions. Further, in response to the pilot survey feedback we treated the questions on age and income as optional. As mentioned in the next section, all incomplete questionnaires were removed. The first part of the questionnaire included questions to check awareness and the education level of the respondents to ensure that they had the capacity to respond to the second part.

4.2. Sampling and data collection

In this study, the population of interest was initially composed of Sri Lankan consumers. Accordingly, we collected data from 3011 respondents from six major cities in six different districts constituting about 50 % of the population (Department of Census and Statistics, 2012) between March 2018 and June 2019. We followed a multi-stage sampling strategy, with stratified random samples from each district from a metro region, urban region, suburbs and rural areas. The respondents were contacted face-to-face, and we collected the hard copies of the questionnaire (which were both in English and in Sinhala depending on the respondent's preference) from them immediately after they were completed. Despite the considerable effort and time involved, this method ensured a high response rate with wide coverage of the survey items. It also allowed the respondents to ask for clarifications, if any, of unclear survey questions/items.
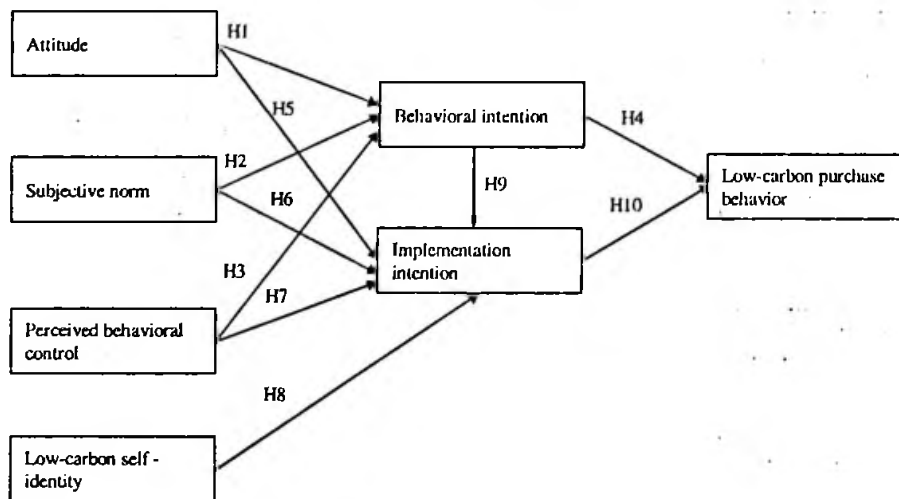

Fig. 1. Research model of the study.

Table 2

Survey items and measurement of constructs.

Construct	Indicator	Question	Source
Attitude	ATT	I think buying low-carbon products will improve the standard of living of producers in countries such as Sri Lanka that are faced with high climate risks. I think buying low-carbon products will lead to a better environment for people in climate vulnerable countries. Consumption of low-carbon products will lead to a carbon responsible life style. Purchase of low-carbon products is in line with my future life style and personal goals.	Lakhamen and Sundqvist (2005)
Subjective norm	SN	I will be more accepted by the people in my aspirational group in Sri Lanka if I purchase low-carbon products. My peers always expect me to purchase low-carbon products. Purchase of low-carbon products is considered a future trend among my peer groups in Sri Lanka. Purchase of low-carbon products will enable me to progress in society and become an initiator in a country that face high climate change risk.	Sheeran et al. (2005); Terry et al. (1999)
Perceived behavioral control	PBC	I am comfortable with changing from the purchase of generic products and moving towards buying low-carbon products. Low-carbon products are available in the shops where I usually shop. I have the capacity to pay a premium price for low-carbon products. I need to shift from my comfort zone to specifically purchase low-carbon products.	Hsu et al. (2006); Paul et al. (2016)
Low-carbon-self-identity	LCSI	I think of myself as a consumer who generates low carbon for the betterment of the countries that face high climate change risk. I think of myself as someone who is very concerned with environmental issues such as climate change and carbon emissions. I would like to be recognised as a person who purchases low-carbon products. I can have a positive effect on society that is highly vulnerable to climate change by purchasing products sold by carbon responsible companies.	Dermody et al. (2015), 2018; Sparks and Guthrie (1998)
Implementation intention	II	I have a clear target in the next month/year to include low-carbon products as an integral part of my purchase decisions towards achieving a mission of low-carbon economy in countries that are vulnerable to climate change risk. I am willing to pay more money for low-carbon products at shopping outlets because they are worth the additional charge. I will allocate a specific percentage of my income to purchase low-carbon products in my next monthly budgets. I will continuously monitor the progress of my purchase behavior against my personal goals.	Perugini and Bagozzi (2001); Rise et al. (2003)
Behavioral intention	BI	I'm motivated to purchase low-carbon products whenever I'm engaged in a purchase decision. I feel highly satisfied after the purchase of a low-carbon product. I will create an incremental effort with an opportunity cost if required to purchase low-carbon products. I will purchase low-carbon products in the next 12 months. I think citizens, especially those who live in climate vulnerable countries such as Sri Lanka must live in harmony with the natural environment in order to survive in the future.	Chen and Tung (2014)
Behavior	B	I'm very happy with my experience in the consumption of low-carbon products. My decision to purchase low-carbon products was rational and practical. In the past one month, I have consumed/used low-carbon products frequently. When I use low-carbon products, I always look for some carbon labelling (or star rating).	Al-Debei et al. (2013); Hsu et al. (2006)

Table 3

Demographic characteristics of the selected sample of respondents.

Items	Category	Frequency	Percentage
Gender (N = 440)	Male	196	44.5
	Female	244	55.5
Age (years) (N = 426*)	Below 30	42	9.9
	31-35	129	30.3
	36-40	106	24.9
	41-46	98	23.0
	Above 46	51	12.0
Month income (Rs.'000) (N = 411*)	Below 100	13	3.2
	101-150	106	25.8
	151-200	95	23.1
	201-250	107	26.0
	Above 250	90	21.9

Note: * Since age and monthly income were optional questions, some respondents have opted not to answer these questions.

The initial analysis of the questionnaire revealed that 64.33 % of the respondents (1937) did not have a clear awareness of low-carbon products and consumption behaviour. Although another 20.23 % of the respondents (609) had some awareness, they had no available purchasing option (accessibility) or intended demand for low carbon purchases due to low purchasing power. Therefore, those (1937 + 609 = 2546) respondents with an average living style and low-income level identified as lacking awareness and accessibility were excluded from the analysis. Additionally, 25 respondents had made incomplete survey responses. Therefore, only 440 respondents had awareness of and exposure to low-carbon products and purchasing power to consider and/or chose low-carbon purchasing options. The authors observe that the percentage of the population that can be sampled in Sri Lanka is well below 20 % given the income level, education level, life style and population distribution. This is echoed in several key macro-economic indicators such as proportion of population a) living in cities, which stands at 18.2 %, b) having completed post-secondary education, which amounts to 13.72 % (Department of Census and Statistics of Sri Lanka, 2012), and c) earning a monthly income of less than LKR 115,648 (approximately USD 660), which is about 65 % (Department of Census and Statistics, 2016). Accordingly, these three parameters respectively indicate that accessibility, awareness and purchasing power (or income) to consider low-carbon options are limited to a small proportion of the population. Therefore, this selected sample is considered to represent a fraction of the population with the practical ability to respond to our survey questions. Many other researchers have identified that demographic parameters such as income, location of residence and education levels (Kalbar et al., 2018; Ding et al., 2017), and environmental knowledge and educational level (Ding et al., 2018; Adagh and Francis, 2018; Pals and Singer, 2015; Ye

Table 4

Mean, standard deviation and correlation matrix for latent variables.

Variables	Mean	SD	α	ATT	SN	PBC	LCSI	BI	II	B
ATT	3.823	1.038	0.860	1.000						
SN	3.107	0.891	0.730	0.482	1.000					
PBC	3.425	1.018	0.810	0.691	0.688	1.000				
LCSI	3.544	0.946	0.790	0.557	0.498	0.508	1.000			
BI	3.505	0.875	0.790	0.478	0.523	0.492	0.744	1.000		
II	3.355	0.875	0.780	0.442	0.539	0.477	0.597	0.651	1.000	
B	3.201	0.846	0.690	0.235	0.457	0.331	0.442	0.488	0.631	1.000

Note: all correlations are significant at the level of $\alpha = 0.001$.

ATT: Attitude, SN: Subjective norm, PBC: Perceived behavioral control, LCSI: Low-carbon-self-identity, BI: Behavioral intention, II: Implementation intention, B: Behavior, SD: Standard deviation, α: Cronbach's alpha.

et al., 2017) affect environment-related consumption patterns. Further, Yadav and Pathak (2017) have followed a similar approach in screening their population interested in green product purchase behaviour by focusing on 'educated' consumers in 'urban' areas. The descriptive characteristics of the sample are shown in Table 3.

5. Analysis and results

The R-Studio (Version 3.5.2) was used for the analysis while package "Lavaan" (Rosseel, 2012) was used to run the structural equation model on R. The main objectives of the analyses were to observe the relationship proposed in the structural equation using structural equation modeling (SEM) and to check the discriminant and convergent validities of the proposed construct. For convergent validity, as recommended by Iacobucci (2010), a sample size of 150 is required with acceptable solutions for at least three factors of each latent variable. As this study used a random sample of size 440 using at least four factors or more in each variable, these requirements were met.

5.1. Descriptive statistics

Table 4 gives the mean, standard deviation, and Cronbach's alpha (α) for each latent variable with the correlations of each variable pair.

All the mean values are over Scale 3, which indicate a clear positive attitude of the respondents to low-carbon products in general. The internal consistency of each of the latent variables was assessed with Cronbach's alpha. All the Cronbach's alpha values are well above the acceptable 0.6 and range between a minimum of 0.69 and a maximum of 0.86. In addition, all the correlation coefficients are statistically significant at $\alpha = 0.001$. As these initial results were consistent with the research model and supported the set of hypotheses, a CFA was performed next.

5.2. Measurement model

5.2.1. Assessment of the goodness of fit of the measurement model

Both convergent validity and discriminant validity were assessed using CFA to confirm construct validity. The goodness of fit of the seven-factor model was assessed using CFA. Bagozzi and Yi (1988) recommend that the standardized factor loadings should be between 0.60 and 0.95. However, factor loadings obtained for survey items SN2, BI4, BI5, LCSI1, B3 and B4 were below 0.6. Therefore, these items were removed from the analysis and CFA was used again without them. Table 7 shows the relevant assessment measures for the one factor model, the seven-factor model and the modified seven factor model respectively. Factor loadings for all items in the modified model are between these specified intervals, suggesting that the model's convergent validity is preserved. As Table 8 shows, the modified model significantly improved the goodness of fit of the data with all factor loadings being above 0.6. All the standardized factor loadings were

Table 5

Confirmatory factor analysis.

Fit indices	One-factor model	Seven-factor model	Seven-factor model (modified)
χ^2	1554.84	1013.51	788
χ^2/df	4.37	2.85	2.21
CFI	0.789	0.858	0.921
TLI	0.748	0.802	0.915
RMSEA	0.114	0.091	0.074

Note: CFI: comparative fit index, TLI: Tucker-Lewis index, RMSEA: root mean square error approximation.

found to be statistically significant ($p < 0.0001$).

Adopting CFA required an assessment of psychometric properties. Table 5 displays the indices used to assess the fitness of the model other than the factor loadings. χ^2/df for the measurement model of this study was 2.21, which is well within the level of acceptance ($\chi^2/df < 5$) recommended by Marsh and Hocevar (1985). The comparative fit index (CFI) and Tucker-Lewis index (TLI) are both above the minimum required for the acceptance level of 0.9 (CFI = 0.921) as recommended by Bentler (2010), and (TLI = 0.915) as recommended by Bentler and Bonett (1980). The root mean square error approximation (RMSEA) was 0.074, which is less than the recommended threshold of 0.08 recommended by Browne and Cudeck (1993). Therefore, the measurement model shows a good fit with the data.

Table 6 illustrates the effectiveness of the proposed modified model for the base TPB model. In the analysis, the TPB model was also tested for goodness of fit statistics. It was observed that the proposed modified model, which included 'implementation intention (II)' and 'low-carbon-self-identity (LCSI)', has improved the overall explanatory power of the purchasing behavior as indicated by a higher adjusted R-square value (which is 0.2367 for the TPB model and 0.482 for the proposed model). An R-square greater than 0.2 in consumer behaviour studies is considered to have sufficient explanatory power (Hair et al., 2016; Si et al., 2020). Since the Adjusted R-square is slightly below the R-square and is a much more robust measure of model validity, both the TPB model and the proposed modified model exhibit good model quality. As shown in

Table 6

Improvements of fit indices of the proposed model.

Fit indices	TPB model	Seven-factor model (modified)
χ^2	990.961	788
χ^2/df	3.811	2.21
CFI	0.839	0.921
TLI	0.814	0.915
RMSEA	0.08	0.074
Adjusted R^2(B)	0.2367	0.482

Note: CFI: comparative fit index, TLI: Tucker-Lewis index, RMSEA: root mean square error approximation.

Table 7
Discriminant validity assessment.

	ATT	SN	PBC	LCSI	BI	II	B
ATT	0.802						
SN	0.518	0.711					
PBC	0.691	0.701	0.714				
LCSI	0.560	0.512	0.495	0.735			
BI	0.454	0.545	0.462	0.743	0.768		
II	0.442	0.534	0.477	0.579	0.638	0.709	
B	0.345	0.481	0.380	0.456	0.491	0.693	0.708

Note. All correlations are significant at the $p < 0.05$ level.
ATT: Attitude, SN: Subjective norm, PBC: Perceived behavioral control, LCSI: Low-carbon-self-identity, BI: Behavioral intention, II: Implementation intention. B: Behavior.

Table 6, fit indices resulting in the modified model indicate better outcomes of ($x^2 = 788$, $x^2/df = 2.21$, CFI = 0.921, TLI = 0.915, RMSEA = 0.074) indicating theoretically a better capacity to represent the model fit compared to the TPB model ($x^2 = 990.961$, $x^2/df = 3.811$, CFI = 0.839, TLI = 0.814, RMSEA = 0.08).

Table 7 gives the correlation between each pair of the latent variables compared with the square root of average variance extracted (AVE) for each latent variable. All the diagonal values are the square root of AVE for each dimension. Other values below the diagonal value are the correlation coefficients of each pair of measurement scales. The standard requirement is that the correlation coefficients be below the square root of AVE. According to Table 7, the square root of each AVE is greater than the relevant correlation coefficients under each latent variable. These are dimensions not completely related to each other. These results demonstrate that discriminant validity is maintained.

Table 8
Reliability and validity indicators.

Construct	α	CR	AVE	Item	Factor loadings
Attitude (ATT)	0.86	0.872	0.634	ATT1	0.708
				ATT2	0.900
				ATT3	0.880
				ATT4	0.670
Subjective norm (SN)	0.74	0.75	0.505	SN1	0.708
				SN3	0.654
				SN4	0.765
Perceived behavioral control (PBC)	0.81	0.810	0.510	PBC1	0.746
				PBC2	0.668
				PBC3	0.720
				PBC4	0.721
Low-carbon-self-Identify (LCSI)	0.77	0.780	0.540	LCSI2	0.697
				LCSI3	0.752
				LCSI4	0.747
Behavioral intention (BI)	0.81	0.810	0.590	BI1	0.807
				BI2	0.826
				BI3	0.670
Implementation Intention (II)	0.78	0.80	0.503	II1	0.745
				II2	0.675
				II3	0.683
				II4	0.732
Behavior (B)	0.69	0.670	0.501	B1	0.754
				B2	0.659

CR: α: Cronbach's alpha, Composite reliability, AVE: Average variance extracted.

Table 9
Path relationships of structural model.

Paths	Estimate	Z-Stat	P-value	Relationship
ATT → BI	0.417***	7.602	< 0.0001	Supported
SN → BI	0.541***	8.655	< 0.0001	Supported
PBC → BI	0.505***	8.178	< 0.0001	Supported
ATT → II	0.393**	7.414	< 0.0001	Supported
SN → II	0.508***	8.384	< 0.0001	Supported
PBC → II	0.493***	8.130	< 0.0001	Supported
LCSI → II	0.655***	8.904	< 0.0001	Supported
BI → II	0.666***	9.778	< 0.0001	Supported
BI → B	0.575***	8.688	< 0.0001	Supported
II → B	0.775***	10.345	< 0.0001	Supported

Note: *** indicates that coefficient is statistically significant at $p < 0.001$.
ATT: Attitude, SN: Subjective norm, PBC: Perceived behavioral control, LCSI: Low-carbon-self-identity, BI: Behavioral intention, II: Implementation intention, B: Behavior.

5.3. Reliability and validity

Table 8 shows AVE, composite reliability (CR) and Cronbach's alpha of each latent variable along with factor loadings for each element of the variable measured.

AVE is a measure of how much variance is explained by latent variables, and in our model AVE ranges between 0.501 and 0.634. In general, AVE is expected to be above 0.5 (Zainudin, 2012) (See Table 8). Also, the CR measure for all latent variables was found to be above 0.6, and greater than AVE for each variable, providing supportive evidence of convergent validity (Zainudin, 2012). All AVE values above 0.5 and CR values greater than 0.6 and above the corresponding AVE confirm convergent validity and construct reliability. Internal reliability and consistency were measured using Cronbach's alpha. As Table 8 shows, Cronbach's alpha for each latent variable in the study is acceptable, ranging from 0.69 to 0.86.

5.4. Hypothesis testing

SEM was used to test the ten hypotheses given in Section 3.2 after ensuring the goodness of fit as shown in the previous section. The results of SEM are presented in Table 9.

As the above table shows, all the relationships in the ten hypotheses are statistically significant at the level of $\alpha = 0.0001$. Thus, all the estimates support the alternative hypotheses, namely, that attitude, subjective norm, perceived behavioural control, low-carbon-self-identity, behavioural intention and implementation intention positively affect/contribute significantly to the behaviour of low-carbon product purchases.

6. Discussion and implications

6.1. Discussion of findings

The study aimed to understand the importance of attitude, subjective norm, perceived behavioural control and low-carbon-self-identity in determining low-carbon consumption behaviour in Sri Lanka, a climate-vulnerable developing nation.

The empirical results of this study indicate that the antecedents of the TPB model and the TPMI used (i.e. consumers' attitude to low-carbon products, subjective norms, perceived behavioural control, and low-carbon-self-identity) exert a positive influence on consumers' behavioural and implementation intention to buy low-carbon products. Specifically, it shows that consumers' attitude, subjective norms, and perceived behavioural control affect not only their behavioural intention but also their implementation intention to buy low-carbon products. This indicates that attitudes, individual perceptions of one's behaviour influenced by friends, family members and social groups and an

appeal to feelings of personal obligation promote a positive urge to purchase low-carbon products in the case of consumers in climate-vulnerable developing countries. These results are consistent with those of previous studies focused on green or low-carbon products that found a positive influence of attitude (Yang et al., 2016; Chen et al., 2014; Kumar, 2019; Shi et al., 2017; Si et al., 2020; Yadav and Pathak, 2017; Echegaray and Hansstein, 2017), perceived behavioural control (Shi et al., 2017; Pals and Singer, 2015; Yadav and Pathak, 2016, 2017; Lizin et al., 2017; Lopes et al., 2019; Si et al., 2020), and subjective norm (Han et al., 2010; Kumar, 2019; Shi et al., 2017; Si et al., 2020; Yadav and Pathak, 2017; Echegaray and Hansstein, 2017) on purchase intention relating to low-carbon products. However, the findings of this study do not corroborate the results of other studies that did not find antecedent factors such as subjective norms (Lopes et al., 2019; Pals and Singer, 2015; Paul et al., 2016) and attitudes (Lopes et al., 2019) influencing consumers' pro-environmental behaviour and intentions.

Moreover, the new construct of low-carbon-self-identify added to TPB shows its predictive power to determine implementation intention. This implies that in developing countries consumers' social identities and social expectations of the identified role and behaviour (Stryker, 1968) have a positive impact on strengthening consumers' purchasing behaviour. Societal identity and recognition as an innovator and opinion leader in green or low-carbon product consumption motivate the consumer to follow a clear path towards achieving the desired outcome in behaviour, in this case, the purchase of low-carbon products (Sutton, 1998). This is mainly because low-carbon product consumption is yet at an emerging stage in developing countries such as Sri Lanka (Mulugetta and Urban, 2010), and consumers of such products are automatically regarded as opinion leaders.

As consumers do not necessarily enact their positive behavioural intention to purchase green or low-carbon products (Carrington et al., 2010; Echegaray and Hansstein, 2017; Hassan et al., 2016; Rise et al., 2003), this study introduced low-carbon implementation intention as another explanatory variable in low-carbon purchase behaviour. Recognizing the difference between intention and enactment, researchers have divided behaviour into a deliberative phase where motivation is created and an implementation phase where volition is formulated. This deliberative phase is similar to forming a behavioural intention in respect of TPB (Gollwitzer, 1990). In the second phase, the selection of the relevant steps to get started on behavioural execution through the formation of specific plans for the enactment of behaviour, in this case, the low-carbon purchase decision, is made in terms of *when, where and how* to act (Carrington et al., 2010; Rise et al., 2003). This study shows a positive impact of implementation intention on low-carbon purchase behaviour.

It also supports the premise that low-carbon purchase intention and implementation intention lead to low-carbon purchase behaviour. Interestingly, the indirect effect of behavioural intention through implementation intention on low-carbon purchase behaviour is greater (BI → II with 0.666 and II → B with 0.775, both P-value < 0.0001) than the direct effect of BI on B (BI → B with 0.575, P-value < 0.0001).This indicates that the effect on purchasing behaviour through initial factors such as attitude and subjective norms which lead to an intention to substantiate low-carbon behaviour is more effective in the case of an intermediate or psychological state of an intention to implement such change (Carringtonet al., 2010). For example, a budgetary allowance to substitute usual purchases with low-carbon products would be more effective than just an intention to purchase low-carbon products in the future. The latter is important, but an intention to implement such behaviour calls for some preparation and an expectation to buy low-carbon products within a time interval (Rise et al., 2003). Therefore, it is important that motivating factors for the purchase of low-carbon products are further analyzed to improve their positive effect on implementation intention rather than just producing an effect on behavioural intention alone.

The findings of our study add to the literature on low-carbon

behaviour by paying special attention to climate-vulnerable developing countries such as Sri Lanka. However, the research findings on low-carbon behaviour between developed and developing countries or even between developing countries vary according to differences in periods, situation, theoretical framing and samples. For example, Zierler et al. (2017), who investigated the energy efficiency behaviour of individuals in large organisations in the UK through a cluster analysis, identified a heterogeneity of employee populations' energy behaviours. Hence, they highlighted the difficulties in making assumptions based on single responses to cross-industry surveys. On the other hand, in China, Gao et al. (2017), by extending TPB, identify that the individual's attitude, perceived behaviour control, descriptive norm and personal moral norm influence employees' energy saving intention in workplaces. However, contrary to our study, they identify subjective norm as insignificant for predicting the individual's pro-environmental behaviour. As echoed by Ding et al. (2018), these theoretical, methodological and contextual disparities make it difficult to arrive at general conclusions about the differences between developed and developing countries on low-carbon behaviour.

This points to the need for comparative and country- specific future research on low-carbon behaviour in respect of a range of specific low-carbon products and services. However, scholars should acknowledge the differences in these countries before drawing conclusions. More specifically, while sustainable consumption patterns originated in the developed countries a long time back, it is still largely an emerging concept in many of the developing countries such as Sri Lanka (Mulugetta and Urban, 2010). Due to the established institutional, financial and technological capacity, in most of the developed countries concepts such as green consumption are well established. However, as we observed in our data screening process, nearly 80 % of the population in the country do not have the awareness, accessibility or purchasing power to consider low-carbon products in their consumption behavour. This inevitably leaves the extent of actual low-carbon consumer behaviour very low in developing countries (Fankhauser and McDermott, 2014; Geels et al., 2015). Hence, there is 'an adaptation deficit' in developing countries compared to developed countries (Fankhauser and McDermott, 2014). This calls for national sustainable development strategies (NSDS) that include policies, strategies and planning to "improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning" as outlined in the United Nations SDG #13.3 particularly aimed at low income and climate vulnerable developing countries.

6.2. Practical implications

This study has a number of practical implications for increased low-carbon consumption in developing countries that face high risk of climate change.

First, the study shows that favourable attitudes, social norms and a feeling of personal obligation and social recognition for low-carbon consumption affect consumers in countries facing high levels of climate risk. Marketers of major brands of low-carbon products and services such as energy-saving appliances, renewable energy products (e.g. solar panels) and low-carbon transport systems (e.g. bicycles) should collaborate with government agencies in planning their promotional activities so as to build a favourable consumer image (Si et al., 2020; Tan et al., 2017). For instance, producers of energy-efficient refrigerators can offer buy-back options for old refrigerators to customers looking for refrigerators with low energy consumption and more environment-friendly refrigerants. Further, they can demonstrate to consumers the monetary and environmental benefits of switching to low-carbon products over the life cycle of the products. This can be a key message for deciding on marketing strategies and promotional campaigns for these products. These campaigns of individual organizations should be supported by government-led mass media campaigns to improve consumer

awareness of rising environmental and climate risk faced by climate-vulnerable countries and the need for carbon responsibility from the side of consumers, and to increase its mass appeal (Bonner and Martinot, 2005).

Second, as this study shows, the formation of implementation intentions enhances the probability of successful performance of low-carbon behaviour. It is therefore necessary that policy makers and business entities provide a congenial environment and guidance for consumers in developing countries to form behavioural intentions. As studies have shown, low-carbon promotion schemes can succeed if early movers with pro-environmental attitudes are targeted (Long et al., 2015). Since they have already formulated an implementation intention, policy makers and low-carbon product makers and marketers should target these consumers when they are most likely to participate in such renovations or in buying new houses, household energy saving equipment or white goods during festival seasons when consumers in the developing countries increase consumption. Moreover, low-carbon production entities can capitalize on this in their marketing and promotions to encourage consumers to change attitudes, social norms, personal obligations and green identity processes into actual consumption behaviour by offering rebates, discounts and trade-in facilities during these specific periods (Chen et al., 2014).

Third, policy makers and marketers should think positively about low-carbon consumption that promotes energy saving, low-emissions and conservation of the environment so as to reduce vulnerability and lack of trust (Long et al., 2015; Yang et al., 2016). An important policy level initiative can be the introduction of a carbon-emission rating scheme to guide consumers and to build their trust in the products they purchase. However, it has been observed that consumers consider other factors related to these products such as quality, appearance and cost more than energy consumption or saving aspects in choosing products (Yang et al., 2016; Claudelin et al., 2017). Thus, these carbon ratings or energy saving products should be combined with other factors if they are to be purchased by consumers.

Further, because developing low-carbon consumption is at a rudimentary stage in most of the climate-vulnerable developing countries, the governments of those countries have a greater role to play in promoting low-carbon consumption. They should play an active role through public advertisements, policy level directions, relevant legislation and financial support for both consumers and organizations that produce low-carbon products (Ye et al., 2017). These actions can focus on creating awareness of climate risk, particularly in climate-vulnerable countries, of the benefits of and need for low-carbon consumption patterns, and the role of individuals in adopting low carbon living patterns to encourage more consumers to accept the low-carbon concept and to promote low-carbon economies (Chen et al., 2014).

Moreover, there is a great role for the education sector in these countries. As these countries face significant economic problems, high mortality rates and serious threats to social development due to climate change (Eckstein et al., 2018; Climate Vulnerable Forum, 2019), awareness creation and attitude formation should be a part of the curriculum of every discipline. While educational reforms can incorporate a basic knowledge of climate risk, carbon-responsible consumption behaviour and the importance of the low-carbon consumer decision-making process from the school level, the curriculum of higher education institutions such as universities can impart advanced knowledge of the subject, irrespective of the field of specialization, be it engineering, medicine or business management. This should be done urgently in order to enhance people's social responsibility and recognition, attitudes and social norms regarding low carbon consumption behaviour (Yang et al., 2016). For instance, in the case of Sri Lanka, the Ministry of Education and higher education monitoring bodies such as the University Grants Commission can issue the necessary guidelines for "education for sustainability" including carbon-responsible consumer behaviour in the curricula, of the Sri Lankan universities (Gunarathne and Alahakoon, 2016).

In sum, this study makes a significant contribution to the policy of climate-vulnerable developing nations by virtue of its novel approach to the upliftment of low-carbon behaviour in society. The motivation to engage in environment-friendly consumption should be part of the behaviour of the wider community leading to the establishment of a protocol and a social norm governing a broader stakeholder population. The findings are of benefit especially to environmental, government and business organisations in considering the activities of consumers as a pivotal phenomenon in promoting a low-carbon green economy. Thus, individual consumer action can make a significant change in the behaviour of an entire society and the overall responsibility of a nation to acknowledge and practice low-carbon consumer behaviour (Leary et al., 2017).

7. Conclusions, limitations and future research

TPB has been a widely used psychological framework for predicting a wide range of pro-environmental behaviour patterns in various fields and contexts. However, this study is one exploratory attempt to examine the low-carbon consumption behaviour of consumers in the climate-vulnerable developing country of Sri Lanka. The findings of this study point to the applicability of a well-established psychological model, i.e. TPB, in determining the intention as well as behaviour towards consuming low-carbon products in a climate-vulnerable island nation, Sri Lanka. Further, the results support the view that TPB combined with TPMI has strong predictive potential and robustness in the proposed framework for low-carbon product consumption, indicating its applicability in the domain of environmentally friendly and carbon-conscious decision-making.

This study also highlights the importance of having a clear internally developed implementation plan or intention for sustainable consumption to specify when, where and how the intentions will be realized as actual behaviour. This is an important consideration for bridging the intention-behaviour gap that exists in sustainable and ethical consumption, particularly in developing countries. Overall, the findings of this study provide a solid theoretical base for understanding the determinants of low-carbon consumption behaviours in developing countries such as Sri Lanka that face high levels of climate risk.

The current study has several limitations that can be eliminated in future research. First, it did not consider the impact of socio-demographic features on low-carbon consumption. Future research can consider a larger and more representative sample of consumers from different countries and regions with different backgrounds. This could facilitate identification of the influence of unique social, cultural and economic contexts in defining the determinants of low-carbon consumer behaviour in developing countries. This is an important consideration as developing countries have diverse characteristics. Second, this study was designed to capture consumers' consumption behaviour in respect of low-carbon products in general. However, consumers may exhibit different decision-making processes depending on product category. Thus, to cross validate the results of this study against different product categories, it is recommended that consumption behaviour in respect of various types of low-carbon products be investigated in future studies. Third, our study considered only a limited number of variables associated with low-carbon consumption to the neglect of other factors that can be of equal importance. Taking our model as a starting point, future research should integrate these additional variables such as descriptive norms, environmental concerns, environmental responsibilities and low-carbon awareness (or environmental knowledge) in order to establish the effect of these factors on consumers' low-carbon purchasing.

In this study we used consumers' self-reported purchasing behaviour to measure low-carbon consumption behaviour rather than actual purchase behaviour. This is a common approach followed in behavioural research as it enables the researcher to investigate such behaviour which may not be generally practically feasible to measure

otherwise (Yadav and Pathak 2017). Future studies can consider the actual low-carbon consumption behaviour rather than the self-declared behaviour. In addition, although, we have taken the best possible efforts to select a random sample which is representative, our sample was collected through self-reporting of other variables too. This however leaves room for the possibility of method bias. Hence, future researchers can conduct "post-hoc statistical control of common method bias" in confronting similar situations (Podsakoff et al., 2003). Since our "one-factor" model resulted in poor fit with the data, the famous "Harmon's single-factor test" was not necessarily attractive for the study (Podsakoff et al., 2003). It is our contention that the study proceeded with satisfactory resistance against method bias in view of the four reasons given by Conway and Lance (2010). First, self-reporting is naturally the best and possibly the only option available for collecting data for the measurement of constructs, such as attitude, intention and low-carbon-self-identity (except the actual purchase behaviour, as explained already). Second, as mentioned in the Analysis and Results Section, the model validity measurement of both the TPB and modified/proposed model have revealed construct validity. Third, when developing the questionnaire, we paid meticulous attention to avoid any possible conceptual overlaps in questions of different constructs. For instance, the revisions made consequent to the pilot study were aimed at this. Finally, in our sampling all necessary steps were taken to avoid convenient sampling techniques completely.

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