SUSTAINABLE PRODUCTION FRAMEWORK FOR CEMENT MANUFACTURING FIRMS: A BEHAVIOURAL PERSPECTIVE

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Abstract

Understanding sustainable production is becoming increasingly important for production and operations managers, mainly due to a shortage in natural resources. Sustainability requires many changes in behaviour at all levels. Few studies within the sustainable production literature have empirically disentangled the underlying behavioural concepts of sustainable production. To address this gap, this study utilizes the theory of planned behaviour (TPB) to develop a theoretical framework to explain sustainable production behaviour. Survey data gathered from 128 Indian cement manufacturing units suggest that attitude, subjective norms or social pressures and perceived behavioural control are predictors of the intention for sustainable production which then predicts sustainable production behaviour. The research contribution of this study is twofold: firstly, the current study highlight that the influence of social pressures or subjective norms on intention is greater than attitude and perceived behavioural control; and secondly it may be noted that intention is not a strong predictor of the sustainable production behaviour. Finally, our study based on limitations offers extensive future research directions.

Key words: *Sustainable Production, Theory of Planned Behaviour(TPB), Confirmatory Factor Analysis(CFA), Hierarchical Regression Analysis, Empirical Research, Operations Management.*

1. INTRODUCTION

Due to unsustainable production and consumption practices, the planet is facing serious threats in terms of rapid depletion of natural resources (de Ron, 1998; Krajnc and Glavič, 2003; Liu et al. 2012; Eleftheriou and Iyanna, 2016; Velmurugan, 2017). Especially in developing economies Krajnc and Glavič (2003) have argued that unsustainable production is the main cause of environmental damage. O'Brien (1999) noted that producers are answerable to the society if they fail to strike a balance between economic growth without minimising negative impacts on planet. Thus, sustainable production has received serious attention from academics and practitioners over the past decades since the 1992 United Nations Conference on Environment and Development where it was identified as one of the important pillars of sustainable development, which helps to achieve social, environmental, and economic sustainability.

Despite the efforts taken by various agencies, the success rate of sustainable production initiatives in developing economies is low in comparison to developed economies (Qazi et al. 2017). In recent years, sustainable production and consumption has been the focus of the discussion amongst research communities (Boër and Jovane, 1996; de Ron, 1998; Geldermann et al. 2007; Garetti and Taisch, 2012; Despeisse et al. 2012; Chun and Bidanda, 2013; Huertas et al. 2013; Jaegler and Burlat, 2014; Garbie, 2014; Luthra et al. 2016). While there is a rich body of literature on sustainable production and consumption, the existing literature often lacks a theory focused approach to explain the complexity surrounding sustainable consumption and production related programs. This may be attributed to both the complexity of such programs, and to human behavioural issues. For instance, Bendoly et al. (2006) note in one of the seminal works on behavioural operations management that many operations management scholars have failed to address such behavioural issues. Dubey et al. (2016) attempted to explain sustainable consumption and production behaviour using an integrated theoretical framework grounded in institutional theory and agency theory. The research focusing on behavioural complexity governing the action of the producers towards sustainable production or consumption or both is still underdeveloped (Frederiks et al. 2015; Adnan et al. 2017). Corral et al. (2003) have further noted the importance of cooperation for change in sustainable consumption and production systems. Hence, the current study attempts to address two research objectives:

- To develop a theoretical model to explain cement industry sustainable production behaviour.
- To empirically validate the model and based on statistical analyses, some recommendations for further research and practice can be made.

Following Ajzen (1985) arguments, the theoretical framework is firmly grounded in the theory of planned behaviour (TPB) to explain sustainable production behaviour and its impacts on triple bottom line (TBL). In this way, this study aimed to explain how attitude, subjective norm and perceived behavioural control will predict the sustainable production behaviour. By empirically validating our theoretical framework, we make important contributions to the existing literature and theory on sustainable production. In addition, our findings offer insights for managers, supervisors or regulators who seek to better understand the link between behavioural intention and sustainable production behaviour. The rest of this article is organized as follows. The next section focuses on theoretical framework and hypothesis development. The third section focuses on our research design. The fourth section discusses our data analyses and results. The fifth section

discusses the findings and the sixth section presents the conclusions, our contributions to existing literature, managerial implications, limitations and further research directions.

2. THEORETICAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

The theoretical model consists of five constructs: attitudes towards behaviour, subjective norms, perceived behavioural control, intention to conduct sustainable production, and sustainable production behaviour (see Figure 1). These constructs form the basis of the theory of planned behaviour (TPB). The TPB is regarded as the extension of the theory of reasoned action (TRA) (see Fishbein, 1979; Ajzen and Fishbein, 1980). However, the basic underlying assumption of TPB is that behaviour is not a voluntary action but it is under control. Thus, TPB is a theory which predicts deliberate behaviour, because behaviour can be deliberative and planned (Ajzen, 1985). Thus, in addition to the TRA, TPB includes perceived control beliefs following arguments by Ajzen (1985). Considering TPB assumes that sustainable production behaviour is determined by individual intention to embrace sustainable production. The intention is a function of his/her attitude toward the behaviour, his/her subjective norms and perceived behavioural control (Ajzen, 1985, 1991). Intention is the cognitive representation of the person's readiness to demonstrate a behaviour, and it is regarded by many scholars and practitioners as the most salient antecedent of behaviour (Weigel et al., 2004).

2.1 Sustainable Production

Hopwood et al. (2005) noted that sustainable development has been used widely, often carries different meanings. Broadly, sustainable development is an attempt to address the pressing concern towards social, environmental and economic issues. Sustainable production has gained tremendous attention in recent years due to acute shortages of natural resources in terms of energy, safe drinking water and clean air (Krajnc and Glavič, 2003). Considering O'Brien (1999) and Krajnc and Glavič (2003) we outline the characteristics of sustainable production, which have been also examined by scholars in recent years (see de Ron, 1998; Geldermann et al. 2007; Pusavec et al. 2010a, b; Despeisse et al. 2012; Garbie, 2014). These characteristics are: reduction in the use of materials, reduction in the use of energy consumption, use of closed loop supply chains, minimization of waste, products reuse, product recycle, vehicle routing optimization for minimization of distance covered during transportation, use of cleaner and green technologies, conduct of life cycle assessment, and consideration of the social role played.

There is rich literature that has either focused on sustainable manufacturing (Despeisse et al. 2012; Garetti and Taisch, 2012; Garbie, 2014; Dubey et al. 2015a) or sustainable production (de Ron, 1998; O'Brien, 1999; Krajnc and Glavič, 2003). Most the contributions in these areas are primarily from a social science or engineering point of view, and there are few contributions aimed towards management issues. The literature does not pay attention to behavioural issues, giving us the impetus for this paper. To address this gap, we draw on TPB which is discussed next.

2.2 Theory of Planned Behaviour (TPB)

The theory of planned behaviour (TPB) has been extensively used in marketing, technology and innovation management and information system related research to explain behavioural intention, following its conceptualization by Ajzen (1985, 1991, 2011). TPB is an extension of the theory of reasoned action (TRA), which was developed by Fishbein (1979) to predict human behaviour. However, Ajzen (1985) argued that by including a third construct (i.e. perceived behavioural control), the efficacy of the theory can be improved. Thus, according to TPB, human behaviour can be explained by the three constructs: attitude, subjective norm and perceived behavioural control, which together lead to the formation of behavioural intention. The theory is efficacious in research on sustainability topics. For instance, Aboelmaged (2010) has used TPB to predict the adoption of e-procurement in a developing country. Tonglet et al. (2004) used TPB to explain recycling behaviour. Tonglet et al.'s (2004) arguments based on TPB have been supported by other scholars (see, Ramayah et al. 2012; Li et al. 2015; Botetzagias et al. 2015; Graham-Rowe et al. 2015; Zhang et al. 2016). Liang et al. (2012) predicted the inclination of employees to voice their concerns about their organisations. Hence, based on prior research we can argue that TPB can be useful theory to explain sustainable production behaviour.

2.3 Theoretical Model

Based on our theoretical proposition that intention to embrace sustainable production mediates the effect of attitude towards sustainable production, subjective norm and perceived behavioural control, we propose four research hypotheses grounded in TPB. These hypotheses are further developed in the remainder of this section.
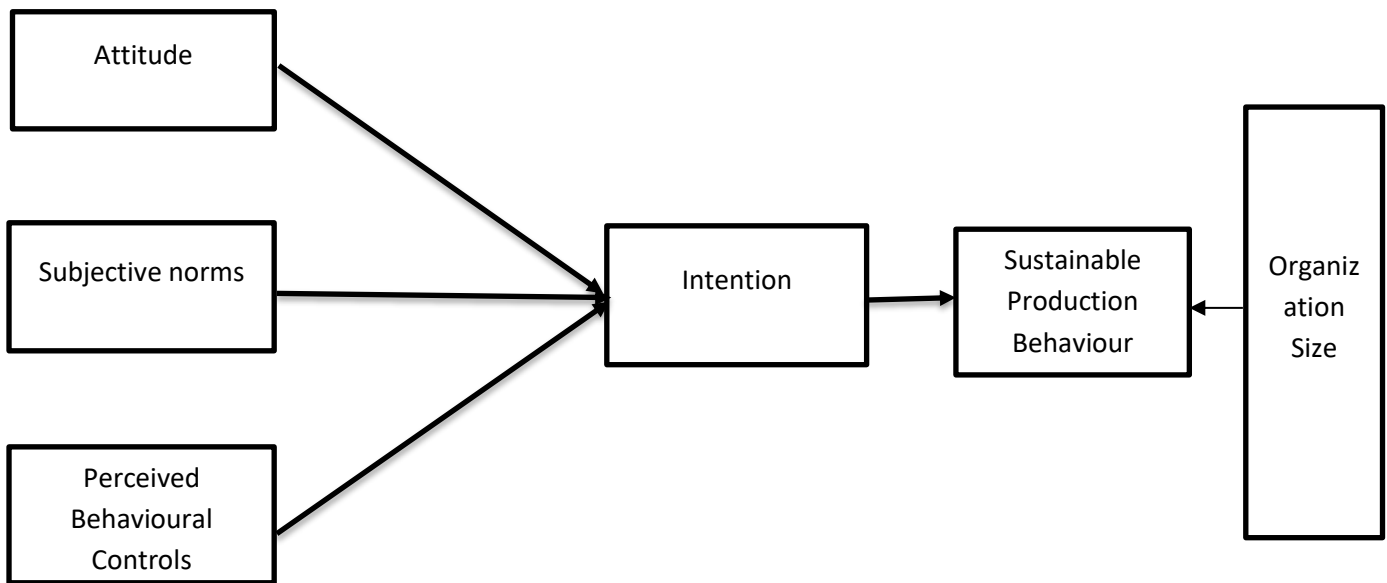
Figure 1: Theoretical Model

2.4 Research Hypotheses

2.4.1 Attitude towards sustainable production behaviour

According to Ajzen (1991), attitude toward behaviour is defined as the degree to which an organisation has a favourable or unfavourable evaluation or appraisal of the behaviour in question. It is assumed to have two components: beliefs about consequences of the behaviour (behavioural beliefs; e.g. referring to his/her colleague that sustainable production may help to reduce the negative impacts on environment, improves quality of work life and improves profitability of the firm) and the corresponding positive or negative judgements about each feature of the behaviour (outcome evaluations; e.g. 'decreasing future consultations is … desirable/undesirable'). Hence in this study attitude towards sustainable production refers to the organisation's positive or negative evaluation of sustainable production practices. Using TPB various scholars have attempted to predict recycling behaviour (see, Botetzagias et al. 2015; Zhang et al. 2016) and waste reduction behaviour (Graham-Rowe et al. 2015; Li et al. 2015). Hence, we hypothesise:

Hypothesis 1: *There is a positive relationship between an organisation's attitude toward sustainable production and intention toward sustainable production.*

2.4.2 Subjective norms about sustainable production

Ajzen and Fishbein (1980) and Ajzen (1991) describe subjective norms as the organisation's belief that the organisation should behave according to the norms accepted in society. This construct takes into the account what other organisations think about the behaviour under question. Griskevicius et al. (2010) and Zhang et al. (2016) have underlined the role of subjective (social) norms in cultivating pro-environmental behaviours. Drawing on their work, we argue that if sustainable production is being embraced by other organisations –the social norm that is, then an organisation might feel obliged to embrace sustainable production as an organisational philosophy. Therefore,

Hypothesis 2: *There is a positive relationship between an organisation's subjective norm toward sustainable production and intention toward sustainable production.*

2.4.3 Perceived behavioural control

Perceived behavioural control refers to an organisation's belief regarding how easy or difficult it might be to engage in a given behaviour (Ajzen, 1991). Cordano and Frieze (2000) have investigated the role of perceived behavioural control in the pollution prevention preferences of environmental managers in a developed country, while later studies (e.g. Mannetti et al., 2004; Li et al., 2015; Zhang et al., 2016; have looked at the role of facility accessibility in the realization of a behaviour. In this research, perceived behavioural control relates to opportunities and constraints to embracing sustainable production. For instance, this would encompass whether or not an organisation believes there are adequate facilities for sustainable production, as well as opportunities to reduce, reuse and recycle waste materials, energy and water within the organisation. On the other hand, constraints could include how an organisation is not yet geared for reducing, reusing and recycling of resources. Therefore,

Hypothesis 3: *There is a positive relationship between an organisations' behavioural control regarding sustainable production and intention toward sustainable production.*

2.4.4 Intention and behaviour

Ajzen (1991) argues that behavioural intention is the immediate antecedent of behaviour. Following Ajzen (1991) study, Li et al. (2015) have noted that intention has significant influence on the behaviours of the designers towards the construction of waste minimization. In another

study Botetzagias et al. (2015) noted that intention is an immediate antecedent of the recycling behaviour. Graham-Rowe et al. (2015) have further predicted using TPB theory how intention explains the reduction of food waste behaviour. Hence on the basis of TPB, intention toward sustainable production will be positively related to sustainable production. Therefore,

Hypothesis 4: *An organisation's intention toward sustainable production is positively related to sustainable production behaviour.*

3. RESEARCH DESIGN

In this section, we discuss our instrument development followed by sampling design, data collection and non-response bias test.

3.1 Construct Operationalization

We used a survey method to test our research hypotheses. We have developed our instrument by identifying appropriate measures in literature. Some modifications were made in the existing scales in consideration of the research context. The target organisations consist of cement manufacturing companies in India. In India, the respondents are well versed with British English so the questionnaire was developed and delivered in English. All of the exogenous constructs were operationalized as follows.

3.1.1 Attitude towards sustainable production

Attitude is measured using four questions (adapted from Kelly et al. 2006). The questions have the same structure and similar wording, namely, "sustainable production is good", "sustainable production is useful", "sustainable production is rewarding", and "sustainable production is responsible." All items were assessed on a five-point Likert scale with anchors ranging from strongly disagree (1) to strongly agree (5).

3.1.2 Subjective norms about sustainable production

Items for subjective norms were adapted from Tonglet et al. (2004) and Knussen and Yule (2008). The items are: "most organisations within our industry think that we should embrace sustainable production", "most of the organisations within my industry would approve our sustainable production philosophy", "most stakeholders important to our organization want us to engage in sustainable production" and "our organisation's employees feel that sustainable production is a good thing to do. All items were assessed on a five-point Likert scale with anchors ranging from strongly disagree (1) to strongly agree (5).

3.1.3 Perceived behavioural control

We examined perceived behavioural control using five items drawn from Tonglet et al. (2004). The items are: "there are plenty of opportunities for our organisation to engage in sustainable production", "it will be easy for our organization to engage in sustainable production in the future; "sustainable production is comfortable in our organization", "our organization has enough resources to engage in sustainable production", and "the people of this organization are completely aware of sustainable production". All items were assessed on a five-point Likert scale with anchors ranging from strongly disagree (1) to strongly agree (5).

3.1.4 Intention toward sustainable production

We examined intention toward sustainable production using three items adapted from Tonglet et al. (2004). The items are: "how likely my organization will engage in sustainable production in six months", "how likely my organization will engage in sustainable production in next month", and "how likely my organization will engage in sustainable production every day". These three items were measured on a five-point Likert scale with anchors from extremely unlikely (1) to extremely likely (5).

3.1.5 Sustainable production behaviour

We examined sustainable production behaviour using three items adapted from Tonglet et al. (2004). The items are: "our organization engaged in sustainable production in last six months", "our organization engaged in sustainable production in the past month", and "our organization engaged in sustainable production on daily basis". All items were assessed on a five-point Likert scale with anchors ranging from strongly disagree (1) to strongly agree (5).

3.1.6 Organisation size

We used number of employees and revenue as two measures of organisational size (see Liang et al., 2007). We argue that larger organizations attract more media attention and they are more particularly concerned to protect and enhance their reputations with the broader public and as well as key-stakeholders (Smith, 2013). Hence, organisation size is an important control variable.

3.2 Data Collection

To test our research hypotheses, we selected the Indian cement industry as our focal context. Asad (2011) reports that cement manufacturing requires sustained supply of raw materials from limestone quarries. CEMBUREAU (2008) has expressed pressing environmental concerns in the cement industry. Uson et al. (2013) argues that the proper use of alternative fuels and materials in the cement industry is essential for sustainable production. Historically the cement industry is also considered to be one of the main contributors to carbon dioxide emissions leading to climate change (Wang et al. 2015; Shen et al. 2015, 2016; Thomas and Gupta, 2016; Lin and Zhang, 2016). However, in recent years, continuous awareness and efforts towards sustainable cement production has improved the image of the industry (Hasanbeigi et al. 2012; Gao et al. 2017). However, despite visible efforts from global cement manufacturing firms towards sustainable production, considerable work remains.

The survey was administered to managers in cement firms in India. The sample was selected from the Cement Manufacturers Association (CMA), India database. We asked CMA marketing executives to distribute 200 questionnaires across 200 cement manufacturing plants. These 200 cement manufacturing units are distributed across India, with an estimated production capacity of 270 million tonnes (CMA Annual Report, 2016), representing a wide range of geographical and cultural diversity. In India, the relationship and power distance index plays a significant role. Hence the involvement of CMA in data collection process helped us immensely in gathering response from senior level respondents from these manufacturing units. Indeed, CMA helped to gain access to key personnel involved in framing sustainable production strategies for their manufacturing units, and who interacted with other members of the top team frequently with respect to sustainable production challenges in their organisations.

Of the 200 questionnaires sent, 135 questionnaires were returned, 128 of which were completed and usable for analysis, showing an effective response rate of 64 percent (see Table 1).

Table 1: Sample Profile (N=128)

Number of employees		
Less than 100	6	4.69
101-500	26	20.31
501-1000	75	58.59
1000 or more	21	16.41
Annual Sales (USD)		
100 million and above	35	27.34
more than 75 million and less than 100 million	75	58.59
Less than 75 million	18	14.06
Position of the respondents		
Director	35	27.34
Vice-President	35	27.34
General Manager	48	37.50

3.3 Non-response bias

Several statisticians have noted that non-response bias can impact results (Armstrong and Overton, 1977). Hence in survey-based studies, it is important to ensure that data gathered are free from non-response bias, or that non-response bias does not significantly affect the results (Lambert and Harrington, 1990). To estimate the impact of non-response bias in our gathered data we have carried out wave analysis suggested by various scholars (see Armstrong and Overton, 1977; Lambert and Harrington, 1990; Chen and Paulraj, 2004; Dubey et al. 2016). In the wave analysis, the data collected over a period is divided into two halves known as early wave and late wave (non-respondents). Following Armstrong and Overton's (1977) suggestions, we used demographic variables (Chen and Paulraj, 2004), as well as other randomly selected variables (Chen and Paulraj, 2004; Eckstein et al. 2015) to test for non-response bias. The t-test conducted on two waves (i.e. the early-wave (74 responses) and late-wave (54 responses)) yielded p>0.32 which is far above threshold value (p≤0.05). We interpret the results that there is significant difference between two waves. Hence, we conclude that non-response bias is not an issue in our study.

4. DATA ANALYSES AND RESULTS

The statistical assumptions test for normality, constant variance and outliers were conducted before moving to next level statistical analyses like reliability and validity. We noted the maximum value of skewness and kurtosis in the remaining datasets were 1.64 and 2.44, respectively. These values are well within limits (univariate skewness ≤2, kurtosis ≤7) recommended by past research (Curran et al. 1996; Dubey et al. 2015; Eckstein et al. 2015). Neither the plots nor the statistics indicated any significant deviations from statistical assumptions.

Following Chen and Paulraj (2004), we adopted three-stage process that met the requirements of reliability, validity and unidimensionality of the constructs (see Figure 1). We estimated the reliability following (Cronbach, 1951; Nunnaly, 1978). We noted that the Cronbach's alpha values (α) for each construct is greater than 0.70 (see Hair et al. 2006) (see Table 2). Following Loehlin (1998), we initially performed exploratory factor analysis (EFA). Since the number of constructs was determined prior to the analysis, the exact number of factors to be extracted was provided in this analysis (Chen et al. 2004). Next, we performed confirmatory factor analysis (CFA) to assess construct validity and unidimensionality. Gerbing and Anderson (1988) argued that CFA provides a stricter and more precise test of unidimensionality of latent constructs.

We tested the unidimensionality following works (see Bentler and Bonnet, 1980; Bentler, 1990; Hu and Bentler, 1999; Chen et al. 2004; Hussain et al. 2016), multiple fit criteria were utilized to assess model fit (see Appendix B).

4.1 Measurement Model

We found that all of the scale composite reliability (SCR) coefficients are above 0.70, each of the constructs average variance extracted (AVE) is above 0.50, and standardized factor loadings are greater than 0.50 (see Table 2), indicating that our constructs possess convergent validity (see Fornell and Larcker, 1981; Chen and Paulraj, 2004).

Table 2: Loadings of the measuring items (scale composite reliability and average variance extracted)

Constructs	Items	Factor Loadings	Variance	Error	SCR	AVE
Attitude (α=0.87)	ATD1	0.79	0.63	0.37	0.91	0.73
	ATD2	0.80	0.65	0.35		
	ATD3	0.83	0.69	0.31		
	ATD4	0.97	0.94	0.06		
Subjective Norms(α=0.73)	SN1	0.96	0.92	0.08	0.97	0.89
	SN2	0.95	0.90	0.10		
	SN3	0.98	0.96	0.04		
	SN4	0.88	0.78	0.22		
Perceived Behavioural Control(α=0.95)	PBC1	0.91	0.83	0.17	0.96	0.82
	PBC2	0.99	0.98	0.02		
	PBC3	0.76	0.58	0.42		
	PBC4	0.95	0.90	0.10		
	PBC5	0.90	0.82	0.18		
Intention(α=0.97)	INT1	0.99	0.98	0.02	0.92	0.80
	INT2	0.97	0.94	0.06		
	INT3	0.69	0.48	0.52		
Sustainable Production Behaviour(α=0.99)	BEHAV1	0.98	0.97	0.03	0.99	0.96
	BEHAV2	0.97	0.95	0.05		
	BEHAV3	0.99	0.97	0.03		

We also found the square root of AVEs is greater than all the inter-construct correlations (see Table 3), which indicates that our constructs possess discriminant validity (Fornell and Larcker, 1981).

Table 3: Correlations among Major Constructs

CONSTRUCTS		SN	INT	BEHAV	ATD	PBC
	SN	.943*				
	INT	.676	.894*			
	BEHAV	.243	.372	.980*		
	ATD	.148	.141	-.007	.854*	
	PBC	.055	-.054	.136	.036	.906*

* square root of AVE

4.2 Common Method Bias

Podsakoff and Organ (1986) noted that in the case of self-reported data, there is very high chance that common method biases resulting from multiple sources may confound the results. Following suggestions by Podsakoff et al. (2003) we attempted to enforce procedural remedies such as requesting respondents to respond the questionnaire not based on their experience, but to get the information from archival documentation such as meeting minutes. In addition, we further performed statistical analyses to assess the criticality of common method bias. We conducted Harman's one-factor test (Podsakoff and Organ, 1986) on the dataset. Results suggest that all five factors in our model are present and the most covariance explained by one factor is 21.60 percent, indicating that common method biases are not a significant threat to the validity of our study (see Appendix A).

4.3 Hypothesis Testing and Results

We tested our research hypotheses using multiple hierarchical regression analysis following Brandon-Jones et al. (2014) and Eckstein et al. (2015) arguments in favour of regression analysis over covariance based structural equation modelling. To ensure that multicollinearity is not an issue in our analyses we calculated the variance inflation factors (VIF). The VIF values range between 1.008 and 1.066, which is significantly lower than the recommended threshold of 10 (Hair et al. 2006). Tables 4 and 5 provide the results of the multiple regression analyses. Table 4 shows the hypothesized linkages between attitude, subjective norms and perceived behavioural controls with intention towards sustainable production, is shown as H1-H3.

Addressing H1 first, we noted support for the linkage between attitude towards sustainable production and intention toward sustainable production ($\beta=0.15$, $p<0.01$). For H2 and H3, we noted support (Table 4) for both subjective norms ($\beta=0.35$, $p<0.001$) and perceived behavioural control ($\beta=0.24$, $p<0.001$) as predictors of intention for sustainable production. The control variable, organisational size, does not have significant effect in this model ($\beta=0.105$, $p>0.15$). Together with the control variable, the predictors (attitude, subjective norms and perceived behavioural control) explain a significant portion of intention towards sustainable production ($R^2=0.25$).

Table 4: Multiple Regression Results for Intention for Sustainable Production

Variables	DV= Intention	
Controls	β	t-value
Organization Size	0.105	0.15
Antecedent		
Attitude	0.15	0.006
Subjective Norms	0.35	0.001
Perceived Behavioural Control	0.24	0.001
R^2	0.25	
Adj R^2	0.23	
Model F	10.37	

H4 was tested via hierarchical regression analysis. Table 5 shows that intention for sustainable production is a predictor of behaviour towards sustainable production (β=0.39, p<0.001). The control variable "organisational size" does not have a significant effect on this model (β=-0.18, p>0.25). The intention towards sustainable production with a control behaviour explain nearly 12 percent (R^2=0.12). These findings of ours is consistent with the prior findings of Ajzen (1985, 1991) and other scholars who have used TPB to explain behaviour of the users or adoption (see Kelly et al. 2006; Aboelmaged, 2010). However the moderate value of R^2 indicates that intention towards sustainable production is one of the antecedents of the sustainable production behaviour.

Table 5: Multiple Regression Results for Sustainable Production Behaviour

Variables	DV= Sustainable Production Behaviour	
Controls	β	t-value
Organization Size	0.18	0.26
Antecedent		

Intention	0.39	0.00
R^2	0.12	
Adj R^2	0.09	
Model F	5.36	

5. DISCUSSION

Our interest in investigating sustainable production behaviour using TPB was triggered by two aspects: firstly, the attitude towards sustainable production translating into sustainable production behaviour, an important aspect, has not gained much attention from academia. However, there is growing literature (see Tonglet et al. 2004; Kelly et al. 2006; Li et al. 20015; Graham-Rowe et al. 2015; Botetzagias et al. 2015; Zhang et al. 2016) using TPB to predict recycling behaviour and waste reduction behaviour. The literature focusing on predicting organizations' behaviour towards sustainable production in the context of developing countries and in particular of Indian organizations is still underdeveloped.

Secondly, we are extending Ajzen's TPB theory (1991) to predict organizations' sustainable production behaviour and offer a rich set of results. Broadly, we have noted that subjective norm is a significant construct that influences the intention whereas the intention which has been argued in literature as the immediate construct of the behaviour, has been found in this study to be a moderate construct.

5.1 Empirical and Theoretical Implications

Following Liang et al. (2012) we attempted to predict sustainable production behaviour among cement manufacturing organisations in developing countries. In this way, we have attempted to extend the existing studies surrounding TPB from a human to a group (organisation) working towards a common goal. Firstly, we found that 'subjective norms' (i.e. social pressures) has higher influence on intention for sustainable production. Hence, we can argue that external pressures in case of cement manufacturing units have stronger influence on intention than attitude and perceived behavioural control. Our results are slightly different from Li et al. (2015) who observed that 'subjective norms' or 'social pressures' was a weak antecedent of intention in comparison to

'attitude' and 'perceived behavioural control'. The findings call for comparison between developed and developing economies to further explore how organizational culture, cooperation between individual and groups, networks structures within a firm, training program, performance evaluation system, may influence sustainable production intention. Thus, our results further open the debate of using TPB to predict intention and behaviour for sustainable production. Secondly, the 'intention toward sustainable production' has a moderate influence on the sustainable production behaviour, further confirming the findings by Kor and Mullan, (2011). Finally, our current attempt further opens the door for exploring the role of external (institutional) pressures in sustainable production intention by using theories such as institutional theory (DeMaggio and Powell, 1983) to predict the intention. Our study extends previous work (Dubey et al. 2016) attempting to explain sustainable consumption and production behaviour by integrating institutional and relationship management theories.

5.2 Managerial Implications

The results of our study offer several useful implications for manufacturers or regulators. Firstly, cement manufacturing organisations may observe gaps between their desire to use sustainable production practices and their actual sustainable production policy and implementation. For these organisations, there is a need to invest in the right training and awareness among the stakeholders to achieve a desirable outcome, namely the closing of the execution gap.

Secondly, understanding the positive influence of social pressures on intention is critical. We note that social pressures play a significant role in influencing intention for sustainable production. We recognize that the idea that recommending organizations to actively expose themselves to social pressures may sound ill-advised but since they may often end up being exposed anyway (through various media) it may be preferable to anticipate to avoid potentially disruptive and brutal reactions from society, regulators or clients. Li et al. (2015) that social pressures have a little role to play in intention. our findings are based on cement manufacturing units operating in India. Considering their environment, it is undoubtedly in their best interest to endeavour towards sustainable production. Social pressures may be very positive and beneficial to companies struggling to embrace sustainable production.

6. Conclusions

Drawing broadly on TPB, we explain sustainable production behaviour and developed a theoretical framework. We further tested our hypothesized relationships by data collected using a reliable instrument. The statistical analyses were based on 128 cement manufacturing firms. Based on our statistical analyses we conclude that *attitude*, *subjective norms* and *perceived behavioural control* are significant predictors of the intention for sustainable production. However, our results also suggest that intention may likely not be the only predictor of the sustainable production behaviour. Consequently, although TPB is useful for predicting human behaviour, it may be integrated with other organisational theories to better predict the organisational behaviour.

As common with cross-sectional survey design, this study was constrained using single respondents and the well-known shortcomings of survey-based research. mixed-research methods may be most appropriate (Boyer and Swink, 2008). Mixed methods might help in further exploring sustainable production, since it is still in infancy stage. Following Ketchen and Hult (2007) we explain sustainable production using TPB, however we realised that there is need to use alternative theories (Eisenhardt, 1989; Meredith, 1998; Voss et al. 2002; Pagell and Wu, 2009; Childe, 2011) to explain sustainable production related phenomena. Integrating organisational theories with TPB may further improve the predictability of Ajzen's theory (1985, 1991) to explain organisational behaviour.

Appendix A: Common Method Bias Test (Harman's one factor test)

	Constructs				
	SN	INT	BEHAV	ATD	PBC
ATD1				0.79	
ATD2				0.80	
ATD3				0.83	
ATD4				0.97	
SN1	0.96				
SN2	0.95				
SN3	0.98				
SN4	0.88				
PBC1					0.91
PBC2					0.99
PBC3					0.76
PBC4					0.95
PBC5					0.90
INT1		0.99			
INT2		0.97			
INT3		0.69			
BEHAV1			0.98		
BEHAV2			0.97		
BEHAV3			0.99		
Variance	3.56	2.40	2.89	2.91	4.10
%	18.73	12.61	15.19	15.33	21.60
Variance					

Appendix B: Unidimensionality Test (Fit indices and their acceptable limits)

Absolute fit index	Acceptable threshold levels	Our observed values	Description
Relative(x^2/df)	2:1 (Tabachnik and Fidell, 2007) 3: 1 (Kline, 2005)	1.43	This value represent adjusts for sample size.
CFI (Comparative fit index)	Values should be greater than 0.98	0.98	
GFI (goodness of fit)	Values should be greater than 0.95	0.96	The GFI values lies between 0 to 1, with higher values reflecting better model fit
AGFI (Adjusted goodness of fit)		0.97	
RMSEA (Root mean square error of approximation)	Values less than 0.07 (Steiger, 2007)	0.06	Represent that sample has known distribution. Favours parsimony.
NFI (Normed fit index)	Values greater than 0.95	0.95	Assesses fit relative to baseline model which assumes no covariance's between the observed variables.

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