Green supply chain management practices in India: a confirmatory empirical study

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This paper illustrates the application of Structural Equation Modelling (SEM) to understand the green supply chain management (GSCM) practices relating to Micro Small Medium Enterprises (MSME) in India. Path Analysis as a special case of SEM has been used here in seeing that the sample moment matrix of our multivariate data fails to be positive definite. Although the research in the area of GSCM has grown in recent years, the literature has yet to furnish an accepted explanation for why green practices are to be manifested in supply chain management given external and internal pressures. This research intends to study whether the greening scores measure a common construct called GSCM and whether external and internal pressures due to stakeholders have any influence on GSCM practices when differences are controlled for different types of MSME and different nature of industries of MSME in India. This study confirms and validates that the lower level of GSCM involvement of Indian MSME can be attributed to lack of the necessary external and internal pressures.

Keywords: green supply chain management; India; MSMEs; path analysis; structural equation modelling; empirical research

1. Introduction

The age of globalization has had insightful implications for managing companies at the strategic and operational levels. Central to globalization has been a dramatic growth in the ‘cross-border movement of goods and the emergence of global competitors and opportunities across competing supply chains within an industry’ (Flynn, 2010; Mentzer, Myers, & Stank, 2007). With the benefits that companies have realized as a result of globalization have come significant increases in the strategic importance and complexity of the supply chain function (Mohanty & Deshmukh, 2013). Research has traditionally identified major risks and concerns that emerge in global supply chains, including supply chain disruption and discontinuity (Craighead, Blackhurst, Rungtusanatham, & Handfield, 2007), inconsistent or inadequate product quality (Foster, 2008), unpredictable delivery times (Levy, 1997), and substantial, unanticipated additional costs (Geary, Disney, & Towill, 2006). Alongside research on these ‘traditional’ aspects of the operations and supply functions, recently some researchers have started to pay increasing attention to the range of environmental or green issues firms are exposed to through their global supply chains (Carter & Easton, 2011; de Sousa Jabbour et al., 2013;
The definition of green supply chain management (GSCM) has been debated for some time. Many recognize that ‘most definitions of GSCM incorporate a consideration of at least environmental conceptualizations and operationalizations’ (Sarkis, Zhu, & Lai, 2011; Srivastava, 2007). There is relative lack of attention to theory seen in research relating to GSCM, where researchers, generally, have paid attention to the conceptual features and directions present in prior research (Sarkis et al., 2011; Srivastava, 2007). Only a few studies (see, e.g. Carter & Easton, 2011; Carter & Rogers, 2008; Mohanty & Deshmukh, 1998, 1999) focus on the development of the broader literature concerned with GSCM, together with the dominance of descriptive research in both theoretical and empirical terms by means of the growing incidence of Structural Equation Modelling (SEM) and greater use of theory in research since 2001.

Most data from Micro Small Medium Enterprises (MSME) in India with reference to GSCM practices are observational and multivariate. Although data reduction by categorization (classification) or by creation of synthetic continuous variables (ordination) is very efficient for identifying general patterns in the data from an exploratory and descriptive perspective, their capability for understanding functional links is limited because they cannot explicitly incorporate complex interrelationships between variables based on a priori knowledge (Hair, Black, Babin, Anderson, & Tatham, 2009). Finally, multiple regressions can test whether an estimated coefficient is significantly different from zero in a statistical sense, but they cannot draw causal conclusions from the test (Weston & Gore, 2006). As multiple regression models ignore the possibility that a predictor may indirectly influence the response through other predictors, they can be used to predict but not to explain.

SEM is an alternative method for testing our understanding of GSCM practices given external and internal pressures, which result in complex interactions to be translated into a network of directional paths linking variables for evaluation against multivariate data. These paths postulate direct and indirect effects. A direct effect describes direct outcome of a response variable (effect) by a causal variable, while an indirect effect implies that the outcome is mediated through other variables (Baron & Kenny, 1986; Grace & Bollen, 2005). Notably, mediation may be full or partial. That is, SEM is philosophically a confirmatory data analysis with applications extending to testing and verifying alternative a priori models or to model building, and can therefore be regarded as blending confirmatory and exploratory analyses. Therefore, the purpose of this research is to illustrate the application of SEM to understand the GSCM practices relating to MSME in India. This understanding intends to find out whether the greening scores measure a common construct called GSCM and whether external and internal pressures have any influence on GSCM practices when differences are controlled for different types of MSME and different nature of industries of MSME in India.

2. Review of literature

The motivation for corporations to improve their environmental performances using GSCM comes from globalization rather than localization (Sarkis & Tamarkin, 2005). Increasing environmental concern has gradually become part of the overall corporation culture and, in turn, has helped to re-engineer the strategies of corporations (Madu, Kuei, & Madu, 2002). Particularly, the primary goal of the European Union (EU) implemented directive on waste of electrical and electronic equipment (WEEE) is to reduce...
environmental damage by reusing and recycling electrical and electronic equipment, by which the volume of waste electrical and electronic equipment, and thus the capacity for handling it, can be reduced. On the other hand, the Restriction of Hazardous Substances (RoHS) directive prohibits electrical and electronic equipment containing lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls and polybrominated diphenylethers. Of the two directives described above, one stresses recycling, reuse and recovery and the other defines the restrictions on the substances used. Consequently, MSME in India have to include the two directives into the design and production of products and they have to respond by adopting GSCM practices.

GSCM, also known as environmental supply chain management or sustainable supply chain management (Chien & Shih, 2007; Kleindorfer, Singhal, & Wassenhove, 2005; Linton, Klassen, & Jayaraman, 2007), combines green purchasing, green manufacturing/materials management, green distribution/marketing and reverse logistics (Sarkis, 2005). The scope of GSCM practices is very wide and includes external and internal pressures of environmental management together with investment recovery and eco-design or design for environmental practices (Chien & Shih, 2007; Liu et al., 2012; Liu, Wang, Dong, Yang, & Bao, 2011). However, one of the aims of the present research is to discuss the GSCM practices using SEM after the EU implementation of the RoHS and WEEE directives for MSMEs in India to include only external and internal pressures of environmental management.

In introductory SEM books (see, e.g. Hair et al., 2009; Hoyle, 1995; Kline, 1998; Maruyama, 1998; Raykov & Marcoulides, 2000), a simple and accurate definition of SEM is hard to find. SEM takes a confirmatory (hypothesis testing) approach to the multivariate analysis of a structural theory, one that stipulates causal relations among multiple variables. The causal pattern of intervariable relations within the theory is specified a priori. The goal is to determine whether a hypothesized theoretical model is consistent with the data collected to reflect this theory to be called as default model. The consistency is evaluated through model-data fit, which indicates the extent to which the postulated network of relations among variables is plausible.

SEM is a large sample technique (usually \(n > 200\); e.g. Hair et al., 2009) and the sample size required is somewhat dependent on model complexity, the estimation method used, and the distributional characteristics of observed variables that involve the evaluation of two identified models using ‘positive definite sample moment matrix’: a measurement model and a structural (path) model. If the sample moment matrix fails to be positive definite or remains unidentified, then path analysis (PA) can be considered as a special case of SEM in which only identified relations as measurement part and/or structural part among observed variables are modelled. The most common type of estimating parameters and computing model fit is the Maximum Likelihood Method (ML) requiring multivariate normally distributed continuous variables to analyse the means, allowing for estimation of means and intercepts. In other words, PA, an extension of multiple regressions, lets us look at more than one dependent (criterion, endogenous) variable related to multiple independent (predictor, exogenous) variables, whereas SEM extends PA when sample moment matrix is positive definite and identified. Notably, a standard multiple regression analysis involves one dependent (criterion, endogenous) variable to be related multiple independent (predictor, exogenous) variables.

Whenever a classification variable is understood to be of continuous nature in the default model, bootstrapping analysis becomes important as the multivariate normality, and is not taken for granted (Bollen & Stine, 1992; MacKinnon, Lockwood, & Williams, 2004). Bootstrapping analysis is a stochastic process and it is also seen to be
important when there is less number of samples, as the best known application of the bootstrap is to estimate the mean of a sample from data drawn by sampling randomly from that sample called as re-sampling (Carlstein, 1986; Hall, 1985). This test aims to ascertain multivariate normality for the correct default model and organizes the default model to establish nomological validity (Prakash & Mohanty, 2013). However, if there is acceptable level of multivariate normality with large sample size, bootstrapping analysis is not required as it would lead to give the wrong impression about the default model (Hall, 1985; Politis, Romano, & Wolf, 1999).

3. Research methodology

In this study, a survey questionnaire for measurement of greening of the supply chain in MSME of India was developed based on the research of Rao (2007), Handfield, Sroufe, and Walton (2005), Zhu, Sarkis, and Geng (2005), Rao (2002), and Young and Kielkiewicz-Yuang (2001). It was pilot tested with 47 respondents working in MSME having sound knowledge of SCM practices, which helped including external and internal pressures for GSCM in the study.

The survey for studying GSCM practices were carried out in two stages. Data were collected from questionnaires administered from 20 June 2012 to 20 July 2012 for identifying factors of GSCM in the first stage of the survey. The questionnaire used in this research had 15 statements (see Table 2) for mapping the profile of the target respondents in and around Pune in terms of environmental actions taken by their organizations in the past two years, where the respondents had to agree on a scale of 1 to 5, where 1 = No, 2 = Little, 3 = Moderate, 4 = Very much, and 5 = Great.

In order to improve the content validity after the first stage of survey, the measurement items relating to critical GSCM practices (see Table 1) were assessed by four senior academic experts in SCM, who accepted for critical GSCM practices/measures to include six sub-constructs, namely reverse logistics greening, inbound greening, compliance greening, ecological greening, outbound greening and technology greening as a result of the factor analysis of the first stage of survey (see Table 2).

In the first stage of survey based on convenience sampling, 114 completed questionnaires comprising of 15 items revealed a six-factor structure that explained 76.404% of total variance is shown in Table 3. The general purpose of factor analysis is to condense the information into a smaller set of new dimensions with minimum loss of information. The criteria for retaining the eight factors were eigenvalues greater than one and the ability to describe and label each factor. To assess the reliability of responses, Cronbach’s alpha coefficient was calculated, and is found to be acceptable for the items within each factor solution. Also, Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was found to be .494, which is considered adequate. There is the obligatory requirement of .60 or above for Cronbach’s alpha coefficient to demonstrate internal consistency of the established scales (Nunnally, 1988). Internal consistency using Cronbach’s alpha is considered excellent for $\alpha \geq .9$, good for $.7 \leq \alpha < .9$, acceptable for $.6 \leq \alpha < .7$, poor for $.5 \leq \alpha < .6$ and unacceptable for $\alpha < .5$ (Flynn, Schroeder, & Sakakibara, 1994; George & Mallery, 2003; Hair, Anderson, Tatham, & Black, 1998; Indrayan & Parmar, 2001; Kline, 1999; Malhotra & Birks, 2007, p. 358). Higher value for Cronbach’s alpha coefficient may be desired for science relating to life (medicine or pharmacy) in comparatively very large sample size. Therefore, these values of Cronbach’s alpha coefficient (see Table 2) are adequate and sufficient. Likewise, the minimum
acceptable value of KMO is .5 (Prakash, Mohanty, & Kallurkar, 2011). KMO measure of sample adequacy is very close to the minimum acceptable value, and it is adequate for declaring that the factor matrix did not suffer from multicollinearity or singularity.

This establishes the face validity of GSCM factors (Table 2), which are briefly described below:

- **Reverse logistics greening** – Using re-manufacturing and recovery of the end-of-life products in cost-effective manner through an organized network.
- **Inbound greening** – Choosing of suppliers by environmental criteria in order to use of waste of other companies and urging supplier(s) to take environmental actions. It is fundamentally about green purchasing strategies adopted by the firms in response to the ever-growing concerns of environmental sustainability all over the world. Greening this phase would involve green sourcing, green purchasing and greening suppliers, and business partners.
- **Compliance greening** – Including processes to reduce noise and to comply with emission standards by means of environmental friendly raw materials. This is mainly the part of complying the greening of production phase initiatives.
Ecological greening – Including processes to reduce solid wastes, water use and air emissions for healthier ecosystem. This is as well the part of greening the production phase initiatives.

Outbound greening – Recycling of waste materials internal to the company and informing consumers on environment-friendly products by considering aspects of sales and marketing.

Technology greening – Applying environmental improvement of packaging and cleaner technology processes to make savings. This is also called as ‘green manufacturing’, which is the part of production phase initiatives.

In order to show sequentially connected organizations and activities (Stock & Lambert, 2001), it is stated that ‘Reverse logistics greening’ is re-manufacturing and recovery of the end-of-life products in cost-effective manner through an organized network; ‘Inbound greening’ is about green sourcing, green purchasing, and greening suppliers and business partners; ‘Compliance greening’ is mainly the part of complying the greening of production-phase initiatives; ‘Ecological greening’ is as well the part of greening the production-phase initiatives; ‘Outbound greening’ is about recycling of waste materials internal to the company and informing consumers on environment-friendly products by considering aspects of sales and marketing; and finally ‘Technology greening’...
greening’ is applying environmental improvement of packaging and cleaner technology processes to make savings which is also called as ‘green manufacturing’, which is the part of production phase initiatives (see Mohanty & Prakash, 2013). The grouping of these factors has been done looking at factor pattern depending on responses from respondents in our sample.

Greening has been understood to be linked with a strong colour often associated with life, fertility and health. Being green has long been a battle cry of environmental activists. Most recently, being green has become an important marketing tool for businesses (Kilbourne, 1998; Rettie, Burchell, & Riley, 2012). Some inherent benefits of greening the supply chain are making it convenient, safe, economical, clean and reliable. Therefore, the results of the factor analysis has established for professionals in SCM that it is becoming increasingly important to be green by applying the greening principles to all facets of the supply chain: sourcing, purchasing, manufacturing and reaching the customer with green products using not only green technology to achieve economy of scale and scope, but also they must be certified as environmentally compliant (de Sousa Jabbour et al., 2013; Johnson, 2010; Rettie et al., 2012).

Generally, when measures are developed, some type of pretest should be performed. It ensures that items not behaving statistically as expected may need to be refined or deleted. The pretest is carried out building the Confirmatory Factor Analysis (CFA). At this stage, each scale dimension of GSCM was subjected to PAF using varimax rotation on data of 114 respondents, which had provided the results of EFA as ‘reverse logistics greening’, ‘inbound greening’, ‘compliance greening’, ‘ecological greening’, ‘outbound greening’, and ‘technology greening’. The purpose of subjecting the items in a sub-scale to PAF was to verify if all of the items loaded highly on a single factor. The final loadings for each sub-scale are summarized in Table 3. A total of 13 items were retained with final loading having value more than .50 (Prakash, Mohanty, Kumar, & Kallurkar, 2011).

Table 3. Scale purification.

| Scale/subscale                      | Final loading |
|-------------------------------------|---------------|
| **Factor 1: [F1] REVERSE LOGISTICS** |               |
| 1. [VAR10] Use of re-manufacturing  | .698          |
| 2. [VAR12] Recovery of the end-of-life products | .698 |
| **Factor 2: [F2] INBOUND GREENING**  |               |
| 1. [VAR11] Choice of suppliers by environmental criteria | .884 |
| 2. [VAR08] Use of waste of other companies | .319 |
| 3. [VAR13] Urging supplier(s) to take environmental actions | .630 |
| **Factor 3: [F3] COMPLIANCE GREENING** |               |
| 1. [VAR05] Processes to reduce noise | .609          |
| 2. [VAR01] Processes to comply with emission standards | .682 |
| 3. [VAR06] Use of environment friendly raw materials | .535 |
| **Factor 4: [F4] ECOLOGICAL GREENING** |               |
| 1. [VAR02] Processes to reduce solid wastes | .827 |
| 2. [VAR03] Processes to reduce water use | .812 |
| 3. [VAR04] Processes to reduce air emissions | .292 |
| **Factor 5: [F5] OUTBOUND GREENING**  |               |
| 1. [VAR09] Recycling of waste materials internal to the company | .679 |
| 2. [VAR15] Informing consumers on environmental friendly products | .679 |
| **Factor 6: [F6] TECHNOLOGY GREENING** |               |
| 1. [VAR14] Environmental improvement of packaging | .691 |
| 2. [VAR07] Cleaner technology processes to make savings | .691 |
In the second stage of survey, we have selected our respondents across India who believed that some environmental actions have been taken by their organizations in the past three years. We have used purposive non-probability sampling in this study, as we believed that some specific people can have only the information required in the survey. We had distributed 800 questionnaires in the independent sample; out of which 426 completed questionnaires were collected and analysed successful with the reliability test (Table 4). In this stage, we had also included external and internal pressures as was suggested formerly in the pilot testing.

For the second stage of survey, only pretested dimensions along with measures for the external pressures comprised the requirements of governmental regulations, domestic clients, foreign clients, competitors and neighbouring communities; and measures for the internal pressure comprised the requirements of support of top managers, professional education and on-the-job training were as well assessed for their appropriateness judgmentally by three industry experts in automotive parts industry in India.

Data were collected using independent samples in the second stage of survey from questionnaires administered from 1 September 2012 to 30 November 2012 for studying the research hypotheses. That is, we have mostly followed the methodology of Mohanty and Prakash (2013), but this data has now been subject to PA. We have applied PA as the sample moment matrix failed to be positive definite for SEM. Since PA is a special case of SEM, this part of research has used the cut-off criteria applicable for SEM process in line with Prakash et al. (2011).

4. Results and discussion

The total size of the independent sample was 426. 13.8% of the micro-sized companies, 53.3% of the small-sized companies and 32.9% of the medium-sized companies have participated in the survey. Notably, 36.4% of the MSME participating in the survey had characterized their operations as services, whereas others were labelled as manufacturing. 56.8% of these MSME were from Automotive parts industry, 17.1% of these MSME were from Electrical and Electronics industry, 10.3% of these MSMEs were from Chemicals and Plastics industry, 15.7% of these MSME were from Furniture industry and the remaining were from Consumer packaged goods industry. It can be seen that the sample represents all types of industries adequately either by size or by type.

This study has used four identified alternative models for PA, which is listed below:

- Model 1: Observed endogenous variables as GSCM, F1, F2, F3, F4, F5, and F6; observed exogenous variables as REGULATORY, FCLIENT, DCLIENT,

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Table 4. Reliability analysis.

| Dimension             | Cronbach alpha |
|-----------------------|----------------|
| Reverse logistics greening | .621           |
| Inbound greening      | .711           |
| Compliance greening   | .628           |
| Ecological greening   | .804           |
| Outbound greening     | .618           |
| Technology greening   | .645           |
| External pressures    | .657           |
| Internal pressures    | .687           |

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COMMUNITY, and COMPETITOR; and unobserved exogenous variables as eGSCM, eF1, eF2, eF3, eF4, eF5, and eF6.

- Model 2: Observed endogenous variables as GSCM, F1, F2, F3, F4, F5, and F6; observed exogenous variables as TRAINING, TSUPPORT and EDUCATION; and unobserved exogenous variables as eGSCM, eF1, eF2, eF3, eF4, eF5, and eF6.
- Model 3: Observed endogenous variables as GSCM, F1, F2, F3, F4, F5, and F6; observed exogenous variables as REGULATORY, FCLIENT, DCLIENT, COMMUNITY, COMPETITOR, TRAINING, TSUPPORT, and EDUCATION; and unobserved exogenous variables as eGSCM, eF1, eF2, eF3, eF4, eF5, and eF6.
- Model 4: Observed endogenous variables as GSCM, F1, F2, F3, F4, F5, and F6; observed exogenous variables as REGULATORY, FCLIENT, DCLIENT, COMMUNITY, COMPETITOR, TRAINING, TSUPPORT, EDUCATION, INDUS, and TYPE; and unobserved exogenous variables as eGSCM, eF1, eF2, eF3, eF4, eF5, and eF6.

As these models are identified, every model parameter can be uniquely estimated. In PA and SEM, we do not talk about ‘independent’ and ‘dependent’ variables. Instead, we talk about exogenous variables and endogenous variables. An exogenous variable has paths coming from it and none leading to it, whereas an endogenous variable has at least one path leading to it. Note also that all endogenous variables have an error term tacked on, which corresponds to the assumption in multiple regressions that the dependent variable is measured with some degree of error. Exogenous refers to an action or object coming from outside a system. It is the opposite of endogenous, something generated from within the system.

Keeping F1, F2, F3, F4, F5, F6, REGULATORY, FCLIENT, DCLIENT, COMMUNITY, COMPETITOR, TRAINING, TSUPPORT, EDUCATION, INDUS, and TYPE as observed exogenous variables and only GSCM as observed endogenous variable with unobserved exogenous variables as eGSCM makes the $\chi^2$ value to be .0 with df as 0 because of which $\chi^2$/df becomes meaningless and probability level cannot be computed. Therefore, the defined four identified alternative models for PA are conceivable both theoretically and empirically.

Chi-Square statistic is in essence a statistical significance test, which is highly sensitive to sample size, which means that the chi-Square statistic nearly always rejects the model when large samples are used (Bentler & Bonnet, 1980; Jöreskog & Sörbom, 1993). On the other hand, where small samples are used, the chi-Square statistic lacks power and because of this may not discriminate between good fitting models and poor fitting models (Kenny & McCoach, 2003). The general rule of thumb suggests that at least one absolute fit index and one incremental fit index, in addition to the chi-square result should be relied upon (Hooper, Coughlan, & Mullen, 2008; Prakash et al., 2011; Steiger, 2007); as the chi-square result is difficult to be used as the sole indicator of SEM fit as it is seen to be biased against larger samples and increased model complexity. Researchers have developed many alternative measures of fit to correct for such bias. These fit indices collectively indicate that overall fit of the measurement model is acceptable. Moreover, the lower values of Chi-square per degree of freedom are desired. It is finally to be noted that the presented default model has been executed and has not been obtained as unidentified (see Figure 1).

The values for RMSEA, TLI, NFI, and CFI are fully satisfactory for research in social science. Chi-square per degree of freedom and PNFI has suffered little due to bias.
owing to complexity in the model and the larger sample size. All fit indices will rarely get to be under acceptable limit in research relating to social science (Hair et al., 2009). Most of the indices should be found to be acceptable. It is to be noted that there always remains the element of bias in social science research owing to complexity in the model and the larger sample size (Hair et al., 2009). There is an encouragement for statistics of Model 4 with the lowest value of chi-square/df.

Therefore, the Model 4 is the best acceptable model (see, Table 5), which is to be considered as the default model to imply discriminant validity (see, Figure 1), which explains the extent to which a measure does not correlate with other constructs from which it is supposed to differ.

For the default model, because most of skew and kurtosis figures across a number of variables are outside critical value of 1.96 at level of significance as .05, it provides very less biased estimates for normal distributions (see, Table 6). That is, any number of usable bootstrap re-samples can be obtained. Therefore, bootstrapping is not required to be performed for the default model, which is to be considered correct with not as much of bias (Bollen & Stine, 1992). This test was to be required as ‘TYPE’ and ‘INDUSTRY’ has been taken as classification variable, which are seen to be present in the default model. Note that bootstrapping analysis becomes important mostly when the multivariate normality is not taken for granted (Bollen & Stine, 1992; MacKinnon et al., 2004).

Figure 1. Default model of GSCM.
Table 7 displays the maximum likelihood regression weights and their associated t-values. Table 8 displays the maximum likelihood intercepts and their associated t-values. Regression weights and intercepts are mostly seen to be significant to provide the nomological validity of the model, which is the extent to which the scale correlates in theoretically predicted ways with measures of different but related constructs.

PA approach of SEM has specified the adequate model from four identified alternative models comparing four plausible theories stipulated a priori to tell the relationships among variables. We now need to test the causal relationship significance in the sample under study for the default model, which suggests testing the following hypotheses (Table 9).

Most of the hypotheses relating to the default model have been supported. Still there is relatively low level of GSCM involvement of MSME, which employ a very large part of working population, operate in highly competitive markets but attain only poor profit margins. Because of their lack of awareness on environmental initiatives and funding limitations, these MSME have not shown much interest in greening their operations. Thus, on one side, MSME contribute significantly toward the total production of goods.

Table 5. Results of fit indices.

| Goodness-of-fit statistics          | Symbol | Model 1     | Model 2     | Model 3     | Model 4     |
|------------------------------------|--------|-------------|-------------|-------------|-------------|
| Chi-square test                    | $\chi^2$| 2113.984    | 539.829     | 2238.463    | 2333.913    |
| Degree of freedom                  | df     | 45          | 18          | 63          | 95          |
| Chi-square/degree of freedom ratio | $\chi^2/df$ | 46.977     | 29.991      | 35.531      | 24.568      |
| Root mean square error of approximation | RMSEA | .352        | .289        | .310        | .190        |
| Turker-Lewis index                 | TLI    | .064        | .302        | .042        | .733        |
| Normed fit index                   | NFI    | .361        | .479        | .425        | .720        |
| Comparative fit index              | CFI    | .362        | .488        | .425        | .722        |
| Parsimonious normed fit index      | PNFI   | .246        | .351        | .255        | .587        |

Table 6. Assessment of normality.

| Variable | Min | Max | Skew | C.R. | Kurtosis | C.R. |
|----------|-----|-----|------|------|----------|------|
| TYPE     | 1.000 | 2.000 | .566 | 4.769 | -1.680   | -7.077 |
| INDUSTRY | 1.000 | 5.000 | .605 | 5.098 | -7.878   | -3.314 |
| EDUCATION | 1.000 | 5.000 | .284 | 2.397 | -6.387   | -2.689 |
| TSUPPORT | 1.000 | 3.000 | -.221 | 1.864 | -7.39   | -3.114 |
| TRAINING | 1.000 | 5.000 | -.520 | 4.384 | -9.95   | -4.192 |
| COMPETITOR | 1.000 | 5.000 | -.026 | -2.19 | -2.61   | -1.101 |
| COMMUNITY | 1.000 | 5.000 | .373 | 3.145 | -3.59   | -1.511 |
| DCLIENT  | 1.000 | 5.000 | .725 | 6.108 | .513    | 2.163 |
| FCLIENT  | 2.000 | 5.000 | .551 | 4.644 | .216    | .910  |
| REGULATORY | 1.000 | 5.000 | -.581 | 4.892 | .297    | 1.251 |
| GSCM      | 2.000 | 4.000 | -.142 | 1.94 | .903    | 3.805 |
| F6    | 1.000 | 5.000 | .493 | 4.158 | -.725   | -3.055 |
| F5    | 1.000 | 5.000 | .820 | 6.912 | -.444   | -1.870 |
| F4    | 2.000 | 5.000 | .705 | 5.939 | .062    | .261  |
| F3    | 2.000 | 5.000 | -.177 | 1.491 | -.993   | -4.182 |
| F2    | 1.000 | 5.000 | .131 | 1.105 | -.958   | -4.038 |
| F1    | 1.000 | 5.000 | .255 | 2.149 | -.341   | -1.436 |
| Multivariate |       |       | -.525 | .619  |          |      |
On the flip side, they have accused of being the biggest polluters. This study confirms and validates that the lower level of GSCM involvement of Indian MSME can be attributed to lack of the necessary external and internal pressures. As in many respects, mediational models are the foundation of SEM, the PA as a special case of SEM also allows examining mediation. In a mediation relationship, there is a direct effect between an exogenous variable and an endogenous variable. There are also indirect effects between an exogenous variable and a mediator variable, and between a mediator variable and an endogenous variable. The mediation function of external and internal pressures does occur with respect to our default model (see, Tables 10 and 11).

5. Managerial implications

The GSCM can be seen as a development tool for MSME to make them organizationally healthier and more effective. There is potential development of gaining competitive advantages using a GSC. This study has considered the determining reasons of GSCM adoption classified as ‘External Pressures’ mostly related to governmental regulations, domestic clients, foreign clients, competitors and neighbouring communities; and

| Table 7. Regression weights of the default model. |
|-----------------------------------------------|
| Estimato | S.E. | C.R. | p   |
| GSCM <- REGULATORY | .231 | .020 | 11.331 *** |
| GSCM <- FCLIENT | -.067 | .025 | -2.736 .006 |
| GSCM <- DCLIENT | .323 | .028 | 11.375 *** |
| GSCM <- COMMUNITY | -.207 | .063 | -3.309 *** |
| GSCM <- COMPETITOR | .077 | .027 | 2.835 .005 |
| GSCM <- EDUCATION | .035 | .014 | 2.564 .010 |
| GSCM <- TSUPPORT | .196 | .037 | 5.249 *** |
| GSCM <- TRAINING | .116 | .013 | 8.791 *** |
| GSCM <- INDUSTRY | .085 | .037 | 2.274 .023 |
| GSCM <- TYPE | -.016 | .031 | 4.96 .620 |
| F1 <- GSCM | .872 | .090 | 9.702 *** |
| F2 <- GSCM | .534 | .108 | 4.955 *** |
| F3 <- GSCM | .949 | .084 | 11.259 *** |
| F4 <- GSCM | .916 | .070 | 12.999 *** |
| F5 <- GSCM | -.107 | .101 | -1.055 .291 |
| F6 <- GSCM | .658 | .117 | 5.625 *** |

***Significant at p < 0.001.

| Table 8. Intercepts of the default model. |
|-----------------------------------------|
| Estimato | S.E. | C.R. | p   |
| GSCM | .659 | .124 | 5.333 *** |
| F1 | .556 | .267 | 2.084 .037 |
| F2 | 1.754 | .320 | 5.479 *** |
| F3 | .803 | .251 | 3.204 .001 |
| F4 | .383 | .209 | 1.829 .067 |
| F5 | 2.969 | .300 | 9.897 *** |
| F6 | .562 | .348 | 1.615 .106 |

***Significant at p < 0.001.

and services. On the flip side, they have accused of being the biggest polluters. This study confirms and validates that the lower level of GSCM involvement of Indian MSME can be attributed to lack of the necessary external and internal pressures.

As in many respects, mediational models are the foundation of SEM, the PA as a special case of SEM also allows examining mediation. In a mediation relationship, there is a direct effect between an exogenous variable and an endogenous variable. There are also indirect effects between an exogenous variable and a mediator variable, and between a mediator variable and an endogenous variable. The mediation function of external and internal pressures does occur with respect to our default model (see, Tables 10 and 11). There exists generally significant positive control for the mediation function of external and internal pressures except for the variable ‘TYPE’ (see, Tables 10 and 11).
Table 9. Results showing some significant relationships in the default model.

| Sr. No. | Regression relations                                                                 | C.R.   | Supported  |
|---------|--------------------------------------------------------------------------------------|--------|-----------|
| H₁      | External pressures of government regulations lead to GSCM practices                  | 11.331 | Yes*      |
| H₂      | External pressures of domestic clients lead to GSCM practices                        | −2.736 | Yes**     |
| H₃      | External pressures of foreign clients lead to GSCM practices                         | 11.375 | Yes***    |
| H₄      | External pressures of neighbouring communities lead to GSCM practices                | −3.309 | Yes***    |
| H₅      | External pressures of competitors lead to GSCM practices                             | 2.835  | Yes**     |
| H₆      | Internal pressures of top managers’ support lead to GSCM                              | 2.564  | Yes**     |
| H₇      | Internal pressures of on-the-job training lead to GSCM practices                     | 5.249  | Yes***    |
| H₈      | Internal pressures of professional education of employees lead to GSCM practices     | 8.791  | Yes***    |
| H₉      | There is a significant difference in the mean greening scores for different nature of MSMEs industry in respect of different factors affecting GSCM | 2.274  | Yes**     |
| H₁₀     | There is a significant difference in the mean greening scores for different types of MSMEs in respect of different factors affecting GSCM | −.496  | No***     |
| H₁₁     | GSCM practices of MSMEs lead to Reverse Logistics Greening                           | 9.702  | Yes***    |
| H₁₂     | GSCM practices of MSMEs lead to Inbound Greening                                     | 4.955  | Yes***    |
| H₁₃     | GSCM practices of MSMEs lead to Compliance Greening                                  | 11.259 | Yes***    |
| H₁₄     | GSCM practices of MSMEs lead to Ecological Greening                                  | 12.999 | Yes***    |
| H₁₅     | GSCM practices of MSMEs lead to Outbound Greening                                    | −1.055 | No***     |
| H₁₆     | GSCM practices of MSMEs lead to Technology Greening                                  | 5.625  | Yes***    |
| H₁₇     | There is a significant difference in mean greening scores on pressures from foreign clients for adopting GSCM practices | 85.963 | Yes***    |
| H₁₈     | There is a significant difference in mean greening scores on pressures from domestic clients for adopting GSCM practices | 49.533 | Yes***    |
| H₁₉     | There is a significant difference in mean greening scores on pressures from neighbouring communities for adopting GSCM practices | 66.409 | Yes***    |
| H₂₀     | There is a significant difference in mean greening scores on pressures from competitors for adopting GSCM practices | 60.044 | Yes***    |
| H₂₁     | There is a significant difference in mean greening scores on pressures from governmental regulations for adopting GSCM practices | 79.474 | Yes***    |
| H₂₂     | There is a significant difference in mean greening scores on pressures from on-the-job training for adopting GSCM practices | 62.090 | Yes***    |
| H₂₃     | There is a significant difference in mean greening scores on pressures from top-managers’ support for adopting GSCM practices | 68.776 | Yes***    |
| H₂₄     | There is a significant difference in mean greening scores on pressures from professional education of employees for adopting GSCM practices | 44.393 | Yes***    |
| H₂₅     | There is a significant difference in mean greening scores on pressures from different nature of industries for adopting GSCM practices | 43.745 | Yes***    |
| H₂₆     | There is a significant difference in mean greening scores on pressures from different types of industries for adopting GSCM practices | 58.441 | Yes***    |

*Based on t-tests for null hypothesis, t-value greater than 1.96.

**are significant at p > .05; t-value greater than 2.567.

***are significant at p > .01; and t-value greater than 3.29.

*are significant at p > .001 (Hatcher, 1994).
Table 10. Direct effects of the default model.

| Type | Industry | Education | Tsupport | Training | Competitor | Community | Delient | Fclient | Regulatory | GSCM |
|------|----------|-----------|----------|----------|------------|-----------|---------|---------|------------|------|
| GSCM | -0.016   | 0.085     | 0.035    | 0.196    | 0.116      | -0.207    | 0.323   | -0.067  | 0.231      | 0.000|
| F6   | 0.000    | 0.000     | 0.000    | 0.000    | 0.000      | 0.000     | 0.000   | 0.000   | 0.000      | 0.658|
| F5   | 0.000    | 0.000     | 0.000    | 0.000    | 0.000      | 0.000     | 0.000   | 0.000   | 0.000      | -0.107|
| F4   | 0.000    | 0.000     | 0.000    | 0.000    | 0.000      | 0.000     | 0.000   | 0.000   | 0.000      | 0.916|
| F3   | 0.000    | 0.000     | 0.000    | 0.000    | 0.000      | 0.000     | 0.000   | 0.000   | 0.000      | 0.949|
| F2   | 0.000    | 0.000     | 0.000    | 0.000    | 0.000      | 0.000     | 0.000   | 0.000   | 0.000      | 0.534|
| F1   | 0.000    | 0.000     | 0.000    | 0.000    | 0.000      | 0.000     | 0.000   | 0.000   | 0.000      | 0.872|
Table 11. Indirect effects of the default model.

| Type | Industry | Education | Tsupport | Training | Competitor | Community | Delient | Felient | Regulatory | GSCM |
|------|----------|-----------|----------|----------|------------|-----------|---------|---------|------------|------|
| GSCM | .000     | .000      | .000     | .000     | .000       | .000      | .000    | .000    | .000       | .000 |
| F6   | -.010    | .056      | .023     | .129     | .076       | .051      | -.136   | .213    | -.044      | .152 |
| F5   | .002     | -.009     | -.004    | -.021    | -.012      | -.008     | .022    | -.034   | .007       | -.025 |
| F4   | -.014    | .077      | .032     | .180     | .106       | .071      | -.190   | .296    | -.062      | .212 |
| F3   | -.015    | .080      | .034     | .187     | .110       | .074      | -.197   | .307    | -.064      | .219 |
| F2   | -.008    | .045      | .019     | .105     | .062       | .041      | -.111   | .172    | -.036      | .123 |
| F1   | -.014    | .074      | .031     | .171     | .101       | .068      | -.181   | .282    | -.059      | .201 |
‘Internal Pressures’ linked to a set of business-led strategic motives comprising the requirements of support of top managers, professional education and on-the-job training.

The survey analysis has provided some insights based on which fundamental improvement can be done. The results show the lower level of GSCM involvement of MSME in India can be attributed to lack of the necessary external and internal pressures. Therefore, there is a need for managers of these MSME to become better educated in developing collaborating relationship with regulators, domestic clients, foreign clients, competitors and neighbouring communities for the common greening objectives. Also, there needs to be full support of top managers in greening endeavour. The capacity for implementing innovative environmental approaches can be enhanced by employees’ professional education and on-the-job training. This study has validated the multiple-item scale for measuring performance of GSCM practices. Furthermore, this study has investigated mediating relationship that may live among the different factors of GSCM, and different pressures for adopting GSCM practices. This study intends to persuade MSME in India for adopting green practices so that their actions become environmentally correct.

6. Concluding remarks

Because PA as a special case of SEM is a confirmatory technique, this research has specified a full GSCM model a priori and tested that model based on the sample and variables included in its measurements. This research has used default model specified with parameters to be estimated – including covariances, path coefficients and variances based on GSCM theory. This research has used PA as one of the tools for confirmatory empirical modelling because our multivariate normal data fails to be positive definite for applying complete extent of the SEM.

Both external and internal pressures force companies to adopt GSCM practices for MSME in India. Also, the mediation function of external and internal pressures does occur with respect to our default model of GSCM practices. In addition, there exists generally significant positive control for the mediation function of external and internal pressures for different nature of industries under these MSME. The empirical work carried out allows understanding of how the MSME population is dealing with environmental matters in a generic sense. This research has established key decision areas for GSCM, which are validated factors of GSCM.

This research has some key limitations. These include the acute shortage of correct participant database, weaknesses associated with cross-sectional surveys and constraints on the depth of information provided in survey methodology research. Further research in the area of GSCM should identify some more linkages of GSCM such that the degrees of freedom of model may increase to further lower the values of chi-square/df in order to induce lesser bias. Future research in this area of GSCM is promising not only for academics interested in exploring emerging areas in SCM, but also for practitioners seeking to find benefits of greening in the management of their supply chain operations in increasingly challenging and competitive global business markets. To truly measure the attitudes of managers at global firms and thus, improve the external reliability and generalizability of this research, participants from both developed and developing countries firms should be included in the sample.
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