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IS GREEN GREENER? DIMENSIONS OF A GREEN CORPORATION

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Abstract

Constructs are building blocks of any model. These constructs could be imaginary like Intelligence. The inter-relation between the constructs decides the complexity of a theory. The study proposes a construct for Green Corporation which analyzes the nature and contribution of each measured item. There is a debate on what makes companies green. Many scholars have defined green products from various perspectives. The definitions are diverse and there is little consensus. Many studies attempt to classify these definitions into broad themes, but few studies have already been undertaken to find out the inter-relations among the variables. The items of the constructed range from the procurement of raw materials to end customer perceptions. The present study explores the dimensions and existence of higher-order constructs. The study found four correlated factors without any higher-order factors. The results were confirmed by using confirmatory factor analysis.

Keywords - Green, Exploratory Factor Analysis, Confirmatory Factor Analysis, Bi-factor Model

Introduction

Going green is no more an option but a compulsion to organizations across the globe. Recently, there has been unprecedented economic growth catalysed by technology and globalization which have further fuelled excessive consumption and undue exploitation of natural resources. The environment has been exploited beyond what it can sustain. Off late consumers, activists, governmental and non-governmental agencies are concerned about the devastating effects of unsustainable consumption and production patterns. In the past few years, there has been an

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outcry from scientists, environmental activists about the irreversible impact on the environment owing to unnecessary human activity.

The present environmental hazards are compelling customers and companies to shift towards sustainable living by adopting and promoting products that are sustainable and pro-environment, commonly referred as “Green Products" (Wasik, 1996; Elkington and Makower, 1988; Unruh and Ettenson, 2010; Chen & Chai, 2010) The widespread phenomenon of consuming green products is a manifestation of customers' concern for the environment and his/her own wellbeing. To that extent, higher prices are no more a concern for consumers, who exhibit pro-environment behaviour. To encash the emerging opportunities, more and more companies are weaving their organizational strategies around pro-environmental practices (Unruh and Ettenson, 2010).

Marketers are challenged to produce and promote green products. Despite all the uproar for sustainable living via sustainable products, there is a lack of consensus on what actually constitutes a sustainable product, both from the manufacturer’s perspective as well as from the consumers perspective.

Review of Literature

There are myriads of concepts about green products put forth by several studies.The extant review of literature affirms lack of universal and coherent definition (Orsato, 2006; Albino et al., 2009; L´opez-Gamero et al., 2009;Ritter*et al.,*2015). There is ambiguity around the definition and scope of green products and moreover, the literature is also scattered over the concept of green product (Rivera-Camino, 2006).

Table No 1. Characteristics of Green product

Efficient products (V1)	Green Packing (V10)
Fewer resources to produce (V2)	positioning as green product (V11)
better quality products (V3)	Ethical Commitment by Corporate (V12)
Natural ingredients (V4)	
Recycled raw material (V5)	Local procurement (V13)
Nontoxic (V6)	sustainable practices (V14)
Biodegradable Raw material (V7)	socially conscience (V15)
Biodegradable product (V8)	Green manufacturing (V16)
Organic (V9)	Low carbon footprint (V17)

Source: Review of Literature

Product :

Products which are contributing to a sustainable world and meet the consumer needs without harming the environment are termed as green products (Shamdasami, 1993). Attributes such

as energy efficiency, environmentally friendly packaging, biodegradability, organic products are generally chosen dimensions to define a green product (Mangun & Thurston, 2002., Bearse et al., 2009., Chen & Chang 2013). Products which are produced employing procedures and processes which are energy efficient are also referred to as a dimension of a green product (Massawe& Geiser, 2012).

Inputs

Some studies tag products whose inputs are safe to the environment, recyclable and are less intensively packaged as green products (Chen, T, B.&Chai, L.T, 2010). The terms recyclable, environmentally safe, reusable, devoid of phosphate and ozone friendly usually mean green products (Khandelwal & Yadav, 2014;). Another term which is synonymously used to describe a green product is the word 'organic product' (Parker, Segev, & Pinto, 2009)

Green products can also be defined as products made out of non-renewable resources and nontoxicchemicals (Chen, 2001). Green products are endowed with several advantages, such as: low water and energy consumption leading to lower pollution. Also, their packaging can be recycled (Zappelli*et al*2016).

Communication

Sustainability can also be deciphered from the way where economic agents communicate their commitment to green products. One of the dimensions of sustainability is packaging that should not be overlooked (Jeevan P, et al., 2017). There is a dire need among business houses to weave their communication in accordance to the changing expectations among green consumers. The heightened concern among businesses and customers, for the environmental friendliness has led to increased green advertising (Leonidou et. al. 2011).

Commitment

People tend to associate an element of morality in consuming and promoting green products (Mazar & Zhong 2010; Bratanova et al.2012). Green consumer segmentation is a very compounded exercise, as consumers are scattered in their perception of green products. A wide range of environmental concerns exhibited by consumers spanning from energy efficient products to products with minimum hazards. Few past studies have demonstrated that virtuousness and the act of being virtuous are very significant elements in green consumerism. Over and above the intrinsic benefits, there is a holistic benefit associated with green consumerism (Spielmann, N, 2020). A strong and significant association has been found between undue consumption and its negative repercussions on the environment (Svensson& Wagner, 2012). A simple and a minor tweaking of the existing brown product and projecting it as a green product may not suffice the manufacturers, as consumers are viewing the corporated commitment to continuous innovation and sustainable practices (Yenipazarli, A 2015).

Consumers tend to adopt those products from the sources which are trustworthy,genuine and exhibit friendly relationships (Bezenc&Blili, 2010). By doing so, the satisfaction of aligning the behaviour with the beliefs is derived.

Green consumers when consuming green products tend to forego some of the expectations such as appealing packaging, fragrance, variety, design, style, etc (Pedro Pereira Luzio 2013).

Methodology

This section discusses the philosophical stand taken, extraction methods adopted and the reason for selecting them. In the later part of the section whether shortlisted items have any structure, if so the nature of their interrelations are explored.

Philosophical view

The philosophical stand that depends on what she thinks reality is. Either it is realism or relativism. In realism the researcher assumes that there is only one truth and in relativism many. This stand influences the way one enquires, measures, creates and applies the knowledge. If the researcher believes in independent truth not influenced by the observer it is called objectivism. On the other hand, if an observer creates the narrative and it is accepted as truth it is called subjectivism. The present study takes a structural realism approach which is a type of realism. Where it is believed that theory explains truth, but incompletely. Also, the study assumes that the theory is an interplay between the belief of an observer and the object under study (constructionism).

This assumption is essential in social sciences as most of the concepts like intelligence, loyalty, fairness etc are human abstracts of what exists. The concept is an abstraction and reality is a nexus of concepts. When the relationships between many such concepts are measured, it is known as grand theory(C. Wright Mills 1959).

The study assumes that there is an underlying construct called *green* and it could be measured. Also, it is assumed that the construct is influenced by the opinion of the observers and it is possible that what observers presently think as green could be a partial truth about what actually constitutes green. As a result, it will have true component, error component and random variation (Lawley, D. & Maxwell, A.,1973; Grace *et al* , 2008). If all the observer's belief about green is the same, then their views about green should also be the same. As a result, when their beliefs are measured, they all converge (Spearman,1904).

Sampling design

The study used simple random sampling. In total 125 responses were collected, of which ten were dropped due to insufficiency.In total 115 responses were collected and the sample size was sufficient to undertake the study (MacCallum et al 1999,2001).

Measurement

The present study explores the construct called ***"Green"***. The Green construct was defined by rationally selected items, which were well bounded rationality. These items were measured using a practical seven-point scale. (De Vellis, R. F. 2016). The summaries are as follows (Table No. 2).

Table No. 2. Data summary

Variable	n	Mean	Std. Dev	Median	Min	Max	25th	75th	Skew	Kurtosis	W-S test value	P value	Result
V1	106.00	5.75	1.20	6.00	2.00	7.00	5.00	7.00	-0.70	-0.26	0.87	<0.001	NO
V2	106.00	5.28	1.52	5.50	1.00	7.00	4.00	7.00	-0.61	-0.38	0.89	<0.001	NO
V3	106.00	5.65	1.30	6.00	1.00	7.00	5.00	7.00	-0.67	-0.07	0.86	<0.001	NO
V4	106.00	5.85	1.22	6.00	1.00	7.00	5.00	7.00	-1.19	1.69	0.83	<0.001	NO
V5	106.00	5.59	1.44	6.00	2.00	7.00	5.00	7.00	-0.85	-0.26	0.85	<0.001	NO
V6	106.00	5.74	1.40	6.00	1.00	7.00	5.00	7.00	-1.35	1.93	0.81	<0.001	NO
V7	106.00	6.09	1.12	6.00	1.00	7.00	5.25	7.00	-1.40	2.59	0.77	<0.001	NO
V8	106.00	6.03	1.28	6.00	1.00	7.00	5.00	7.00	-1.66	3.17	0.75	<0.001	NO
V9	106.00	5.93	1.20	6.00	2.00	7.00	5.00	7.00	-1.03	0.37	0.82	<0.001	NO
V10	106.00	4.72	1.95	5.00	1.00	7.00	4.00	6.00	-0.54	-0.82	0.89	<0.001	NO
V11	106.00	4.62	1.82	5.00	1.00	7.00	3.25	6.00	-0.52	-0.73	0.91	<0.001	NO
V12	106.00	5.75	1.21	6.00	1.00	7.00	5.00	7.00	-1.03	1.33	0.85	<0.001	NO
V13	106.00	4.67	1.79	5.00	1.00	7.00	4.00	6.00	-0.53	-0.64	0.91	<0.001	NO

V14	106.00	5.68	1.26	6.00	1.00	7.00	5.00	7.00	-0.99	0.87	0.86	<0.001	NO
V15	106.00	5.58	1.25	6.00	1.00	7.00	5.00	7.00	-0.77	0.57	0.88	<0.001	NO
V16	106.00	5.24	1.47	5.00	1.00	7.00	4.00	6.00	-0.57	-0.41	0.91	<0.001	NO
V17	106.00	5.75	1.37	6.00	1.00	7.00	5.00	7.00	-1.07	0.96	0.83	<0.001	NO

Source: Output of MVN package (Korkmaz S *et al* ,2014)

Principal component extraction methods

The sample size of ***115*** was sufficient to undertake this study (MacCallum et al 1999,2001). The data adequacy of sample (MSA 0.88) and sphericity of data (K=101.41, df=16, p=0) were adequate to continue with the analysis (Bartlett, M. S. 1951; Kaiser, H. F1974, 1992). Also, it was observed that the data was not normally distributed (Madria Skewness =2281, Madria Kurtosis =20.3, p<0). Based on these findings the study used "Principal Axis (PA) Analysis" (Kim, J.-O*et al* 1978,1987; Fabriga*et al* 1999). Throughout the study oblique rotation was used as the underlying structure was unknown and "Promax rotation" was used to get "simple structure" (Bryant and Yarnold 1995, Revelle and Rocklin 1979; Thurstone 1947).

As the underlying structure of ***Green*** is unknown the following questions were answered,

1. Whether these shortlisted items have any underlying structure?
2. Whether the structure is unidimensional or multidimensional?
3. Are these dimensions single order or have higher order?

Whether the shortlisted items have any underlying structure?

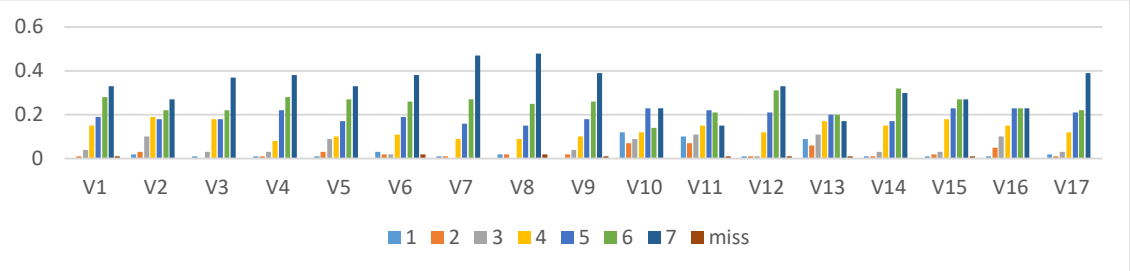


Figure No 1. Response Details of the Respondents Source: Primary data

The average Inter -rater reliability was more than 90%. This indicated that respondent's views about what they believed about *Green* converged (Shrout 1979;MacGraw& Wong,1996). Also, the internal consistency among the items was measured using *alpha* (Cronbach, L. 1951). For the data collected, alpha values were (0.9, 0.92, 0.94) at 95% confidence interval. The high value of alpha indicated high internal consistency among items. Based on these results further analysis was carried out.

Whether the structure is unidimensional or multidimensional?

The knowledge of dimensionality of a construct helps understand it better (Law*et al*, 1998). The factor analysis was used to understand the contextual structure of the data (McGrath R. E. ,2005; Spearman1904;Hair *et al*2014:Morrison, 1990; Lawley, D., & Maxwell, A. 1973).

Since, the structure of the data collected decides the underlying construct (M. Sarsted*etal*,2017). It would be improper to assign dimensionality to a construct as it is context dependent (Bollen, 2011). Thus, tests were conducted to ascertain its dimensionality.

Test for unidimensionality

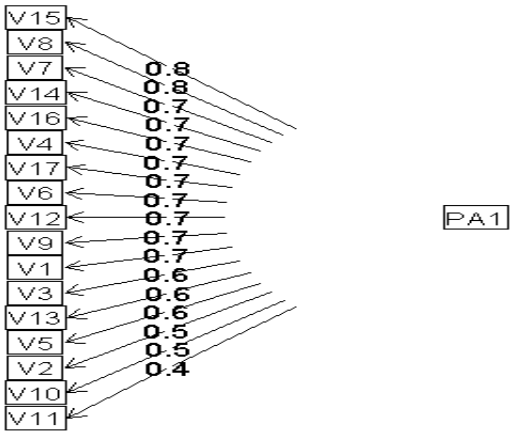


Figure No. 2 Single Factor Construct for ***Green*** Source: Output of psych Package (Revelle W (2021).

To abide by the rule of parsimony, we started with a single factor (unidimensional) construct using the "Principal Axis Method". The factor loadings are shown in the figure No. 2. The total variance explained was 43%. Which is less than recommended 60%. We decided to explore multidimensional constructs to explain more variance (Nunnally and Bernstein ,1994; Hair et al. 2014).

Test for multidimensionality

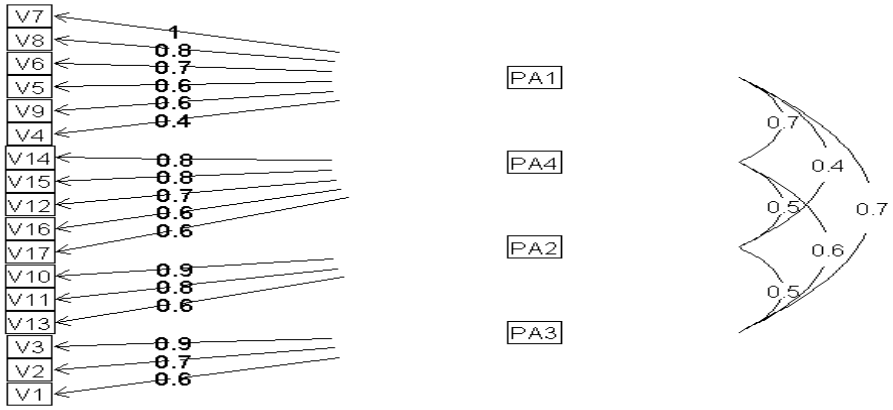
Table No3. Number of dimensions to extract

	n_Factors	Method	Family
1	1	Acceleration factor	Scree
2	1	R2	Scree_SE
3	1	TLI	Fit
4	1	RMSEA	Fit
5	2	Bentler	Bentler
6	3	CNG	CNG
7	4	beta	Multiple_regression
8	4	Optimal coordinates	Scree

9	4	Parallel analysis	Scree
10	4	Kaiser criterion	Scree
11	4	SE Scree	Scree_SE
12	4	BIC	Fit
13	6	CRMS	Fit
14	8	t	Multiple_regression
15	8	p	Multiple_regression
16	15	Bartlett	Barlett
17	15	Anderson	Barlett
18	15	Lawley	Barlett

Source: Output of a Parameters package (Lüdecke D et al 2020)

Though the decision with respect to number of factors to extract has been discussed at length, there is no agreement among scholars with respect to exact number to extract (Kaiser HF 1992, Horn, John L.,June 1965). Also, many methods of factor extraction have been used (Lawley and Maxwell, 1963; MacCallum and Tucker, 1991, MacCallum et al., 2007). The above table (No.3) lists some popular methods of factor extraction and numbers of factors to extract. About 33.33 % methods (i. e six out of 18) suggested four factors for the given data. The further analysis was performed using four factors.



Source:Ouput of psych package (Revelle W (2021).

Figure No.3 Exploratory Factor Analysis with Four Correlated Factors

The factor loadings are shown in the above figure No 3 However, factors share correlation between them, eg. correlation between PA1 and PA4 is 0.7. There is a possibility of higher dimension (Zinbarg, R. E *et al* 1997). The study proceeded to check whether higher dimensions exist.

Are these dimensions single order or have higher orders?

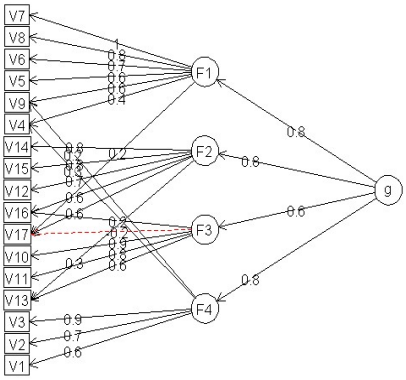


Figure No. 4 a Hierarchical Model

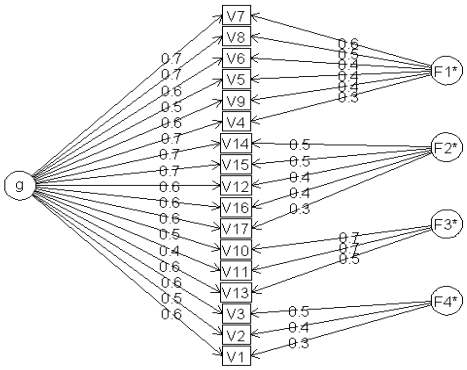


Figure No.4 b Common Factor Model

Source: Output of psych package (Revelle W 2021).

The bi factor model captures the underlying common factor for correlated latent variables (LV) The higher dimensional models can be either hierarchical or may have a common factor (Zinbarg, R. E et al 1997). Both the higher order models are shown in the figure No4 a and b. In hierarchical models LV create their own LVs (Fig No 4a). The higher order LV partially captures the correlation among the lower LVs (Holzinger&Swineford, 1937). On the other hand, the common factor model explains the underlying common structure among all the items and the interactions among LVs (Fig No 4 b). The remaining variance is explained by the orthogonal group factors and the error terms. (Schmid &Leiman, 1957).

Which is a better model?

The fit indices indicate that the correlated four factor model is better than the other two (χ^2 =129.79, df= 114, RMSE = 0.08, BIC = -221.33). as it has a smaller chi square, value lower RMSE index and BIC. The single factor model (χ^2=431.02, df= 119, RMSE = 0.151, BIC = -133.63) is slightly better than higher order model (χ^2=447.9, df= 119, RMSE = 0.155, BIC = -116.75) However, Chi square difference test (χ^2=2.642,df=5,p=.978) indicates that there is no significance difference between single factor model and correlated four factor model. But, RMSE index and BIC are in favour of the latter (Hu &Bentler, 1998, Kline, R. B. 1998; Kenneth A. Bollen et al ,2014,) . The four-factor model with correlation was adopted with following changes.

The variables V4 and V5 were removed from the list as first one had < 0.5 loading on PA1 . and second had communality <0.5. After this iteration variable V9 was removed for both of the above reasons. The revised model was obtained as shown below,

Table No. 4. Four Factor Correlated Model

	item	PA1	PA4	PA2	PA3	h2	u2	com
V15	12	0.92				0.78	0.22	1
V14	11	0.9				0.71	0.29	1
V12	9	0.67				0.56	0.44	1.3

V16	13	0.57				0.57	0.43	1.3
V17	14	0.53				0.57	0.43	1.9
V8	6		0.95			0.89	0.11	1
V7	5		0.93			0.83	0.17	1
V6	4		0.61			0.52	0.48	1.1
V10	7			0.9		0.73	0.27	1.1
V11	8			0.84		0.68	0.32	1
V13	10			0.54		0.57	0.43	1.6
V3	3				0.88	0.71	0.29	1.1
V2	2				0.76	0.56	0.44	1.3
V1	1				0.59	0.54	0.46	1.1

	PA1	PA4	PA2	PA3
SS loadings	3.05	2.41	1.97	1.79
Proportion Var	0.22	0.17	0.14	0.13
Cumulative Var	0.22	0.39	0.53	0.66
Proportion Explained	0.33	0.26	0.21	0.19
Cumulative Proportion	0.33	0.59	0.81	1

With factor correlations of

	PA1	PA4	PA2	PA3
PA1	1	0.67	0.54	0.61
PA4	0.67	1	0.29	0.58

PA2	0.54	0.29	1	0.47
PA3	0.61	0.58	0.47	1

Source: Output of psych package (Revelle W 2021)

All the loadings and communalities of the revised model were above 0.5. In total 66% of the variance was explained by these four factors. The model fit statistics were (χ^2= 52.23, df=41,p=.11,RMSE =0.048,BIC=-142.31). The Tucker Lewis index was 0.971. The overall fit of the model was good.

Confirmatory Factor Analysis

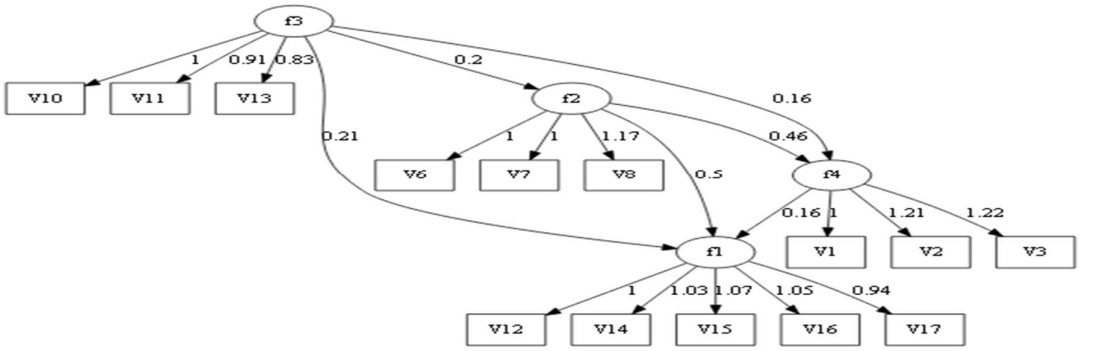


Figure No. 5 Confirmatory Factor Analysis Source: Output of sem Plot (Epskamp, S. 2015)

The dual approach of EFA followed by CFA is strongly recommended for structural analysis. In CFA, we try to *confirm* the item variables obtained from literature review and EFA .The above exploratory model was further subjected to rigorous testing using Confirmatory Factor Modelling. In CFA, model fit is measured. A measurement model fit should be assessed to ensure structural model fit. Model fit is a measure of fit between theoretical model and observed data model. The measurement model is assessed for goodness of fit. The goodness of fit is ascertained by CMIN/df ratio. The CMIN/df ratio should be between 3.0- 5.0 (Hair, *et al* 2014). Additionally, model fit is ascertained by values of CFI, TLI. The values for CFI and TLI of 0.95 were considered ideal. But, now any values greater than 0.9 are accepted. However, there is no change in acceptable values of. RMSEA (0.08) (Schumacker& Lomax, 2010; Huand Bentler 1999). The present measurement model yielded an acceptable model fit (CFI=.948, TLI =0.933 and RMSE = 0.077)

Discussion

Table No.5 Factors and Items

Commitment (PA1)	Ethical Commitment by Corporate (V12)
	sustainable practices (V14)
	socially conscience (V15)
	Green manufacturing (V16)

	Low carbon footprint (V17)
Green Practice (PA2)	green packing (V10)
	positioning as green product (V11)
	Local procurement (V13)
Product (PA3)	Efficient products (V1)
	Fewer resources to produce (V2)
	better quality products(V3)
Inputs (PA4)	Non-toxic (V6)
	Biodegradable Raw material (V7)
	Biodegradable (V8)

Source: compiled by authors

The four-factor correlated model sheds light on what makes products green. The four factors are commitment, sustainable practice, product and inputs. The number of items reduced from 17 to 14. This indicates that the initial selection of items based on review of literature was good.

Commitment (PA1)

Social conscience (V15) and sustainable practices (V14) of the management outweigh their Ethical commitment (V12). The respondents believe that both the parties exceeded ethical commitment by the firms. Whereas, green manufacturing (V16) and low carbon footprints (V17) did not matter much as they are already a part of sustainable practice.

Green Promotion (PA2)

The green packaging (V10) helps companies to position (V11) themselves as committed. Customers are not much concerned about the local procurement (V13). But consider it important.

Product (PA3)

All believed that the green products essentially mean better quality products (V3) and consume less resources for manufacturing (V2) and perform better (V1).

Inputs (PA4)

The green products are biodegradable (V8) as they make use of biodegradable raw materials (V7). Also, green products use non toxic (V6) materials.

At factor level Company's commitment (PA1) is most important followed by which type of inputs (PA4) they use. Later it is important for the firm to promote itself as a green company (PA2) and deliver quality products (PA3). Since all these factors are correlated, companies cannot neglect any one of them.

The company should not only walk its talk but should also talk its way.

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