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Construction and Standardization of Composite Sustainability Scale for GHRM practices with reference to Red Category Industry

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Abstract: This research paper describes the method of construction and standardization of a tool to measure the sustainability scale of GHRM practices Industry. One hundred twenty parties belonging to the specified four sectors participated in this research for the preparation of the initial draft of the sustainability scale included 89 items. The number of items was reduced to 36 after a review of the items done by item analysis. EFA was performed on the acquired data. EFA found that 14 items with factor loadings greater than 0.50 were chosen. These items are classified under organizational sustainability, social sustainability, and environmental sustainability. Further CFA was executed on 14 items, and the CFA results supported EFA results. All of the goodness of fit criteria indicated that the model is effective. The reliability coefficient of the sustainability scale using Guttman split half and Cronbach's alpha methods were 0.90, and 0.94respectively. Norms show that 22.5 percent of the factors belong to the high sustainability while 60 percent of the factors are in the average sustainability group, and 17.5 percent were in the low sustainability group.

Keywords: Sustainability factors, Industry, EFA, CFA model

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1. INTRODUCTION

Environmental contamination has increased in the recent decades as a result of rapid economic expansion. It is mostly owing to the manufacturing and industrial sectors, which serve as the foundation of a country's economy. According to statistics, industries and manufacturing units are responsible for around 50% of pollution. Industrial pollution has a negative impact on both biotic and abiotic environmental elements. It also endangers people's safety, lives, and riches and produces a slide of interconnected social problems. Industrial pollution changes many aspects of the natural environment, including energy patterns, radiation, and chemical and physical elements. This irreversible destruction which includes waste production, degrading soil, air pollution, and water bodies pollution, is a serious challenge to the natural ecosystem and human life that encourages people to change their views regarding the environment (Shah, Manzoor, & Asim, 2021).

As the globe faces urgent environmental, social and economic concerns the concept of sustainability has grown in relevance in recent decades. At its essence, sustainability refers to the ability to meet the requirements of the current generation without jeopardizing future generations' ability to meet their own needs (1987). It is about striking a delicate balance between human activity and the natural environment in order to ensure both parties' long-term well-being. Sustainability comprises three major pillars that are environmental, social, and economic indicators. It is increasingly being used to assess an organization's impact on the environment. In recent times

India's emissions have risen considerably in recent decades as a result of its growing population and economy. With this growth, India has surpassed China and United States to become the world's third-largest emitter of greenhouse gases (GHGs); in 2021 it emitted 3.9 billion metric tons of carbon dioxide equivalent (GtCO2e) accounting for nearly 7% of the global total. Nonetheless, India's per capita greenhouse gas emissions are significantly lower than the global average of 2.8 tCO2e. In comparison China and the United States had per capita emissions of 9.6 and 17.6 tCO2e, respectively. Furthermore, India's contribution to the historical cumulative CO2 emissions is significantly lower than that of other big economies, at less than 4% (Tiseo, 2023). India's electricity and heat sector produced 1.12 billion metric tons of carbon dioxide (GtCO2e) in 2020, making it the largest source of greenhouse gas emissions that year. Agriculture was once the largest emitter of GHGs in India, but while emissions from this sector have risen 30 percent since 1990, those from the electricity and heat sector have increased five-fold (Tiseo, Statista, 2023). Reducing the impact of a particular sector or industry needs to be a properly assessing and measuring tool which analyses the practices of the industries not only at the environmental level but also at organizational and social levels.

Nowadays various researches are done on sustainability measures. Many researchers spend their efforts on a basic understanding of sustainability and various indicators for sustainability assessment. On the global scale, sustainability tools such as the "United Nations Sustainable Development Goal" has been developed for measuring the country's sustainability level in all the dimensions, and " Dow Jones Sustainability Index" to evaluate the economic dimension of sustainability in particular companies and the " Global Report Initiative (GRI) to assesses the sustainability in a holistic manner (Chen, 2014). There is so much research done for measuring sustainability scale in different areas. (Balasubramanian & Balaji, 2022) This study developed a scale for measuring employees' perception of the service organization's sustainability with 26 items for organizational sustainability. (Larimian, 2021) developed a scale for measuring urban social sustainability at the neighborhood level with 25 items. Here all the scale and their indicators have their own focuses since each has been developed for its own reason. Actually, there are many more sustainability measures from the global viewpoint, however composite sustainability measures based on Indian perspectives are uncommon. As a result, the aim of this study is to create a scale that measures sustainability level of all industries.

The main purpose of the study is to construct a standardized composite sustainability scale for GHRM practices in red category industry. The study also aims to compute the reliability and validity of the scale.

2. METHOD

2.1. Population

The population of the study includes Top-level Management respondents dealing with GRHM practices in the red category industry.

2.2. Sample

The sample of the study was selected from the selected four sector belonging to red category industry hospitality, health, automobile, and petrochemical industries. The selected sectors scored high on pollution index.

2.3. Construction of scale

The first step of constructing the sustainability scale was constructing the items. The constructed items show the sustainability practices done at the organizational, societal, and environmental levels. For the construction and collection of items review of literature was explored related to sustainability practices of Green HRM. Various government websites provided required information about sustainable practices for the specified industry. With the help of this information, the items were constructed which are the reflection of sustainability practices. The first draft of the sustainability scale was constructed. The first draft of the sustainability scale consisted of 89 items.

The sustainability scale was divided into three subscales or sections;

1. Organizational sustainability
2. Social sustainability
3. Environmental sustainability

2.4. Evaluation by Experts and Reconstruction of the Tool

The items were prepared and evaluated by respondents of the industry. The researchers followed their suggestions and made the required modifications to the sustainability scale. This modified sustainable scale consisted of 36 items.

2.5. Scoring Key

The scale consists of a 5-point Likert scale which ranged from strongly disagree to strongly agree. Table 1 shows the scoring code of items respectively.

Table 1 Scoring for Items

Types of rating	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
Score	1	2	3	4	5

Each response was weighted from 1 to 5 and the minimum sustainability scale (SS)total score thus obtained was 36 while the maximum total score was 180. The sustainability scale had three subscales within measure the three major pillars of sustainability. The subscales are: organizational sustainability (SS/OS), social sustainability (SS/ss), and environmental sustainability (SS/ES).

The items in the SS/OS subscale identified were 1,2,3,4,5,6,7,8,9,10,11,12,
The items in the SS/ss subscale identified were13,14,15,16,17,18,19,20,21,2223,24
The items in the SS/ES subscales identified were 25,26,27,28,29,30,31,32,33,34,35,36.

2.6. Administration of the Scale

The draft of sustainability scale (SS) consisted of 89 items and was administered to a group of 120 respondents belonging to the top-level management HR professionals in the red category industry for item analysis and exploratory factor analysis. The sample was drawn from the red category industry (petrochemical, automobile, hotel, health). The purpose of the study was clearly explained to the experts for questionnaire filling.

3. RESULTS

3.1. Item Analysis

On the basis of the total score of each respondent, the researcher calculates the correlation of each item with the total score of respondents. The items were selected with a significant correlation of 0.5 and above. The researcher selected 36 items that have significant correlation values of 0.5 and above and rejected 53 items that have less than 0.5.

Table 2 Correlation of Individual sustainability factors with the Total sustainability factors Score & Grand Total

Activities	Item	Correlation with Sustainability Factor Total	Correlation with Grand Total
1	1	.860	.819
	2	.789	.683
	3	.626	.599

	4	.892	.838
	5	.846	.812
	6	.802	.705
	7	.818	.709
	8	.874	.845
	9	.834	.729
	10	.819	.800
	11	.756	.738
	12	.765	.692
2	13	.806	.731
	14	.861	.817
	15	.868	.825
	16	.850	.778
	17	.761	.695
	18	.742	.709
	19	.809	.732
	20	.850	.749
	21	.795	.745
	22	.822	.750
	23	.797	.763
	24	.827	.848
3	25	.766	.711
	26	.782	.608
	27	.787	.762
	28	.823	.799
	29	.830	.826
	30	.859	.836
	31	.849	.838
	32	.870	.787
	33	.860	.706
	34	.813	.720
	35	.845	.722
	36	.861	.747

All correlations are significant beyond the $p<.01$ level

Table 3 Correlation between Individual Sustainability factors and Total Sustainability factors Score.

Sustainability Factor	Correlation
1 Organization Sustainability	.934
2 Social Sustainability	.935
3 Environmental Sustainability	.912

3.2. Validity

Creswell and Creswell (2017) interpreted validity as; “The extent to which a study accurately reflects or assesses the specific concept that the researcher is attempting to measure.” The validity of the sustainability scale was determined by the following method.

3.2.1.1. Exploratory Factor Analysis

The data for factor analysis was subjected to the principal component analysis. The Varimax technique was used for rotation. After analysis 22 items were deducted as they were distributed under multiple factors; their factor loadings less than .50. Only 14 items were selected for the final draft. The 14 items were distributed under were three factors.

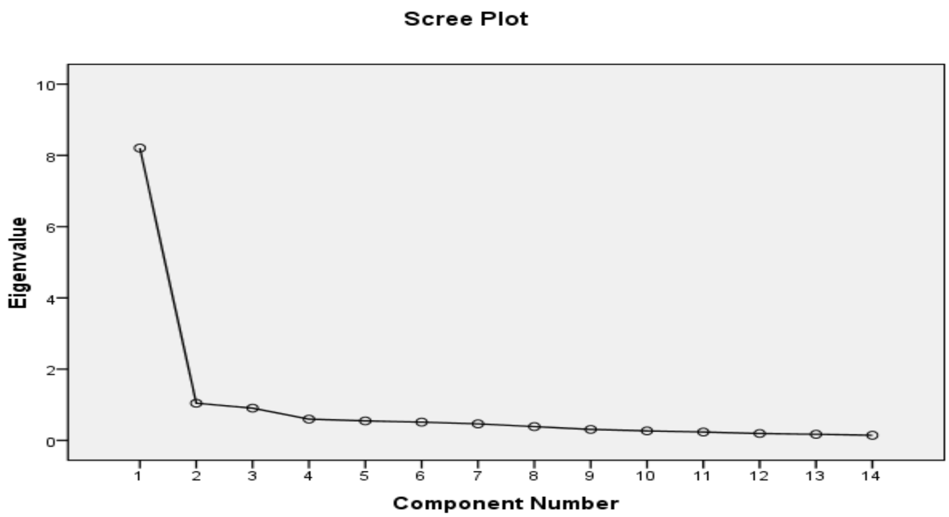


Figure 1 Screen Plot showing Three Factors

According to Figure 1 the first three components fell dramatically. They made a significant contribution in variance explanation. According to (Shrestha, 2021), the KMO measure value should be greater than 0.6. In study the KMO value was 0.924, which was greater than 0.60. It shows that each component predicts a sufficient number of items. Bartlett's test of sphericity was computed and at the 95% well significant level, the p-value was 0.00, which was less than 0.05. It shows that the research sample is suited for the study's analysis.

Table 3 Factor loading after varimax rotation and extracted communalities and eigenvalues

Items	Communality	Factor 1 (Organizational sustainability)	Factor 2 (Social sustainability)	Factor 3 (Environmental sustainability)
1	.720	.580		
2	.831	.836		
6	.728	.722		
12	.744	.745		
1	.681		.737	
2	.760		.732	
4	.812		.819	
6	.578		.627	
10	.722		.773	
11	.611		.601	

3 7 8 11	.718 .761 .686 .806			.734 .682 .675 .864
Eigen Value		**.907**	**8.205**	**1.046**
Explained Variance		**20.113**	**29.546**	**22.890**
Total Variance			**72.549**	

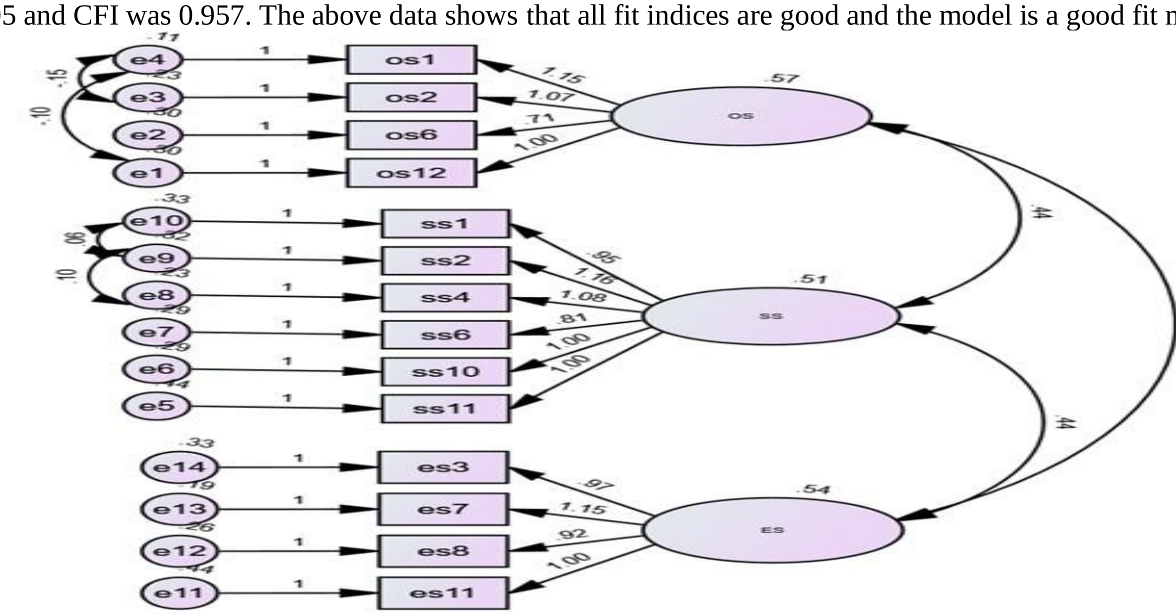
Table 3 shows the results of the factor analysis. Factor analysis revealed three significant components with eigenvalues larger than 1.00. The three factors were organizational sustainability, social sustainability, and environmental sustainability.

The total item loading exceeded .50. In the final version of the scale, 14 elements were chosen. All the three factors accounted for 72.549% of total variation. The first, second and third components explain 20.113, 29.546, and 22.890% of the total variations. When the three components were separated, item 2 had the highest commonality of 0.831, while item 6 had the lowest commonality of 0.578.

3.3. Confirmatory factor analysis

Confirmatory factor analysis was used to evaluate the construct validity of the SS and to ensure that the items fit within the three-component model.

Confirmatory factor analysis was run through Amos 26.0 software. The values obtained of RMSEA, GFI were 0.078 and 0.874 while that of AGFI, NFI were .811 and 0.905 respectively. Further NFI value obtained were 0.905 and CFI was 0.957. The above data shows that all fit indices are good and the model is a good fit model.



Source- Self Constructed

3.4. Reliability

(Drost, 2011) have opined in context to reliability that "Reliability refers to the extent to which measurements are repeatable – when different persons perform the measurements, on different occasions, under different conditions, with supposedly alternative instruments which measure the same thing.

3.4.1. Cronbach's alpha and split-half coefficient

From Table 4, it is seen that the reliability of the sustainability scale (SS) by Cronbach's Alfa is 0.945 and by using Guttman split-half method it was 0.900. Each method shows a reliability of more than 0.70. hence we can conclude that the composite sustainability scale is highly reliable.

Table 4 Correlation coefficient by Cronbach's Alpha and Split- Half method

Method	Reliability Value
Cronbach's Alfa	0.945
Guttman Split Half	0.900

3.5. Details of the Final Draft

Table 5 reveals that 14 items were kept for the composite sustainability scale for arriving at the final draft while 22 items were eliminated.

Table 5 Distribution of selected or rejected items for the final draft of the composite sustainability scale.

S. No	Item Number	*f*	Remarks
1	1,2,6,12,13,14,16,18,22,23,27,31,32,35	14	Selected
2	3,4,5,7,8,9,10,11,15,17,19,20,21,24,25,26,28,29,30,33,34,36	22	Rejected

Table 6 demonstrates that 4 items were chosen for the organizational sustainability subscale and 6 items for the social sustainability subscale. For the environmental sustainability subscale 4 items were selected.

Table 6 Distribution of three subscales of the sustainability scale

Sl. No	Subscale	Item No.	Total Items
1	Organizational Sustainability	1,2,6,12	4
2	Social Sustainability	1,2,4,6,10,11	6
3	Environmental Sustainability	3,7,8,11	4
	Total		14

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3.6. Standardization of sustainability scale

For the calculation of norms Z scores were calculated for each raw- score.

Table 7 Z Score of Each Raw Score

S. No.	Raw Score	Z Score	S No.	Raw Score	Z Score	S. No.	Raw Score	Z Score	S. No.	Raw score	Z Score	S. No.	R Score	Z score
1	58	-0.11	**2**	62	0.30	**3**	56	-0.31	**4**	54	-0.51	**5**	61	0.20
6	70	1.12	**7**	55	-0.41	**8**	66.3	0.74	**9**	49	-1.03	**10**	43	-1.64
11	70	1.12	**12**	48	-1.13	**13**	69	1.02	**14**	61	0.20	**15**	39	-2.05
16	62	0.30	**17**	69	1.02	**18**	66	0.71	**19**	70	1.12	**20**	70	1.12
21	48	-1.13	**22**	42	-1.74	**23**	57	-0.21	**24**	64	0.51	**25**	66	0.71
26	58	-0.11	**27**	59	0.00	**28**	59	0.00	**29**	64	0.51	**30**	64	0.51
31	44	-1.54	**32**	70	1.12	**33**	68	0.92	**34**	56.3	-0.28	**35**	57	-0.21
36	62.1	0.31	**37**	55.2	-0.39	**38**	70	1.12	**39**	65	0.61	**40**	68	0.92
41	62	0.30	**42**	27	-3.27	**43**	25	-3.48	**44**	35	-2.46	**45**	62	0.30
46	62	0.30	**47**	63	0.40	**48**	55	-0.41	**49**	56	-0.31	**50**	61	0.20
51	61	0.20	**52**	57.2	-0.19	**53**	53	-0.62	**54**	56	-0.31	**55**	61	0.20
56	55	-0.41	**57**	58.4	-0.07	**58**	70	1.12	**59**	70	1.12	**60**	70	1.12
61	70	1.12	**62**	70	1.12	**63**	70	1.12	**64**	70	1.12	**65**	70	1.12
66	70	1.12	**67**	70	1.12	**68**	70	1.12	**69**	70	1.12	**70**	70	1.12
71	60	0.10	**72**	66	0.71	**73**	50	-0.92	**74**	48	-1.13	**75**	62	0.30
76	43	-1.64	**77**	52	-0.72	**78**	62	0.30	**79**	49	-1.03	**80**	57	-0.21
81	50	-0.92	**82**	52	-0.72	**83**	60	0.10	**84**	68	0.92	**85**	53	-0.62
86	64	0.51	**87**	64	0.51	**88**	64	0.51	**89**	66	0.71	**90**	64	0.51
91	64	0.51	**92**	64	0.51	**93**	64	0.51	**94**	64	0.51	**95**	70	1.12
96	48	-1.13	**97**	49	-1.03	**98**	43	-1.64	**99**	41	-1.84	**100**	57	-0.21
101	70	1.12	**102**	56	-0.31	**103**	56	-0.31	**104**	53	-0.62	**105**	46	-0.62
106	70	1.12	**107**	58	-0.11	**108**	49	-1.03	**109**	42	-1.74	**110**	55	-0.41
111	69	1.02	**112**	60	0.10	**113**	58	-0.11	**114**	59	0.00	**115**	69	1.02
116	56	-0.31	**117**	70	1.12	**118**	43	-1.64	**119**	70	1.12	**120**	43	-1.64

Table 7 represents the Z-score for each raw score for all the sustainability factors. As indicated in the Table 8 the range of Z-scores was separated into three levels based on the matching raw scores after calculating the Z-scores for all the raw scores. Table 8 denotes those factors which have scores greater than 70 had a high sustainability level; factors with scores ranging from 25 to 70 had an average sustainability level and factors with scores lower than 25 had a low sustainability level.

Table 8 Norms for interpretation of Z score

Sl. No.	Range of Raw Score	Range of Z Score	Level of Sustainability
1	Below 25	Below -1	Low sustainability
2	25 to 70	-1 to +1	Average sustainability
3	Above 70	Above 1	High sustainability

Table 9 findings demonstrate that 22.5% of industrial experts fall into the category of high sustainability level, 60% of industrial experts fall into the category of average sustainability level and 17.5% of industry experts remain in the low sustainability level category.

Table 9 Distribution of the sample in different levels of sustainability

Sl. No.	Levels of Sustainability	No. of experts	Percentage
1	High	27	22.5
2	Average	72	60
3	Low	21	17.5

4. Discussion and conclusion

This study is successful in its attempt to quantify the sustainability scale for the industry by respondents with years of experience in the specified industry. The built sustainability scale (SS) which consists of 14 items has a high completion rate signifying that the scale may be administered quickly and with little monitoring. Construct validity has been investigated using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Three factors— organizational sustainability, social sustainability and environmental sustainability —were identified using exploratory factor analysis. The EFA also produced 14 items which were included in the final draft of the sustainability scale. The factor loading for each item is higher than 0.50. It was discovered that the final SS explained 72.549% of the entire variation.

The final scale was used on a sample of 120 industry respondents and thus confirmatory factor analysis was conducted. All fit indices, including χ^2/Df, RMSEA, GFI, AGFI, and CFI were higher than acceptable levels. After computing covariance between the unobserved variable the CFA result supported the EFA result and demonstrated that the SS model is a good fit. Due to its great split-half reliability (0.900) and Cronbach alfa reliability test (0.945) the created composite sustainability scale (CSS) effectively measures the sustainability level of the industries. According to this scale norms 22.5% of respondents fall into the category of having a severe sustainability level, 60% fall into the category of having an average sustainability level and 17.5% fall into the category of having a low sustainability level.

This research study aids in identifying the indicators that help in measuring the level of sustainability in the industry, at the organizational, social, and environmental levels. This study also helps in maintaining and improving the sustainable performance of any industry by providing a relevant indication of sustainability and also helps the researcher go for further research on sustainability.

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