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FACTORS OF GREEN INNOVATION IN PHARMA SECTOR: WITH REFERENCE TO SELECT PHARMA SECTOR COMPANIES IN NORTH COASTAL ANDHRA PRADESH, INDIA

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ABSTRACT

After covid-19 society's perspective towards environment is completely changed. People started purchasing environmentally friendly products. In this context, number of researchers on the green innovation also increased. People started investigating which are the factors influencing green innovation in the organization. Majority of the people understood green innovation in terms of the green product development. Therefore, green innovation outcomes are measured by number of green products invented, but it is partially correct. In the business environment it is said that when organizations looking for sea around change it is important that organization's policies and practices must be in accordance to the change. In this context the current research examines the company's administrative policies and practices applicability for the green innovation in the study area.

KEYWORDS: *Green Innovation, Green Policies, Green Practices, Environmental Impact, Green Products.*

INTRODUCTION

The term "green innovation" describes the creation and application of novel or markedly enhanced goods, procedures, services, organizational designs, or promotional strategies that are intended to prevent or lessen environmental damage, preserve natural resources, or promote sustainability. Both technological and non-technological developments are included.

Types of Green Innovation

1. **Green Product Innovation (Eco-Design):** New product/service development with minimize environmental impact throughout their lifecycle (e.g., eco-friendly materials, energy efficiency, recyclability, biodegradability).
2. **Green Process Innovation:** Moderation or enhancement of production, operational, or logistical processes to turn down environmental harm. Examples: Waste prevention in manufacturing, energy-efficient production lines, water recycling systems, green supply chain management, environment prevention technologies.
3. **Green Organizational Innovation:** The application of innovative organizational techniques that improve a company's external interactions, workplace structure, or business operations. Examples include corporate social responsibility (CSR) programs that emphasize sustainability, green HRM practices, staff environmental training, and environmental management systems (EMS) such as ISO 14001.
4. **Green Marketing Innovation:** Utilizing innovative marketing strategies that prioritize the environment in product design, packaging, pricing, distribution, and promotion. Examples include circular economy company concepts, eco-labelling, green branding initiatives, and the promotion of sustainable consumption.

Theoretical Foundations

Several theories carry the conceptualization of green innovation:

1. **The Natural Resource-Based View (NRBV) and Resource-Based View (RBV):**
   Core Concept: Businesses use resources and competencies that are distinct, valuable, uncommon, inimitable, and non-replaceable to gain a competitive edge.
   Application to GI: Chen (2008) suggests that green core competence and other green capabilities, such as green R&D and green knowledge management, are important assets that propel GI and result in enhanced environmental performance and competitive advantage.

2. **The Theory of the Triple Bottom Line (TBL):**
   Main Idea: Economic, environmental, and social performance are the three bottom lines that businesses should prioritize.
   Application to GI: The concurrent pursuit of these three goals is what motivates GI. Effective green innovations provide social well-being (e.g., green jobs, better public health), environmental protection, and financial viability (e.g., cost savings, new markets).
3. **Theory of Institutions:**
   Main Idea: In order to acquire legitimacy and comply with social norms, regulations, and pressures (coercive, mimetic, and normative), organizations adopt practices.
   Application of GI: To improve their legitimacy and reputation, businesses implement GI in response to industry best practices (mimetic isomorphism), regulatory demands (such as environmental regulations), or professional norms (normative isomorphism).
4. **Stakeholder Theory:**
   Main Idea: When making decisions, businesses must take into account the interests of all parties involved, including consumers, workers, investors, suppliers, communities, and the government.
   Application to GI: GI is significantly influenced by stakeholder expectations, including as investor pressure for ESG performance, consumer preference for green products, and community activity.
5. **Theory of Innovation Diffusion:**
   Main Idea: Describes how, why, and how quickly new concepts and technologies proliferate across cultural boundaries.
   Application to GI: By emphasizing elements like relative benefit, compatibility, complexity, trialability, and observability, this theory aids in understanding the adoption and dissemination patterns of green technology and practices within industries and across society.

LITERATURE REVIEW

Yahya, A.A., Zargar, P (2023) in their work investigating and analysing the interrelated functions of green innovation, GHRM and CSR in promoting corporate sustainability, specifically filled in the domain of banking sectors in developing nations. Both scholars and practitioners may clearly comprehend the interpretation of this well-defined research. In Future research this foremost field would be more robust and applicable if the recognized areas for improvement—specifically those related to methodological scope and situational factors—were addressed.

Zhang, Chen, and Tang's (2024) paper makes a substantial contribution to this knowledge by clarifying the exact mechanism by which GHRM contributes to green competitive advantage. Their discovery that this relationship is totally mediated by green innovation emphasizes how crucial it is to have a workforce that can produce eco-friendly solutions. Making sure that GHRM practices successfully foster and support a culture of green innovation should be just as important for businesses looking to gain a sustainable competitive edge as putting them into practice.

The article by **Aneeta Rehman, Dr Muhammad Shahid Yaqub (2021)** explores different ways in which Pakistan's hospitality sector's environmental performance is clearly impacted by Green Transformational Leadership (GTL), Green Innovation, and Green Human Resource Management (GHRM), specifically during the COVID-19 pandemic. It also peeks into whether these relationships are controlled by the actions of specific employees during COVID. This research adds to the literature on organizational behaviour and sustainable tourism. It draws attention to the tangled relationship between human elements and green practices, more particularly in times of unpredictability like COVID-19. The conceptual clarity, contextual relevance, and empirical rigor make it an exceptional candidate for both academic citation and practical method.

Paul Kivinda Muisyo, Su Qin (2021) research targets to investigate how GHRM practices and green innovation culture impacts firm green performance. One is exploring green innovation culture on the interrelation between GHRM and green performance among Chinese manufacturing organizations.

RESEARCH GAP

There are many researchers conducted to examine the green innovation in various sectors but not much emphasis is given to identify the administrative factors contributing for green innovation in the organization. Therefore, the current article examines, weather the administrative practices contribute for green innovation in the organization or not.

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OBJECTIVES

- To study the administrative factors contributing for green innovation.
- To examine the level of administrative factors contributing for green innovation in the study area.
- To put forth suggestions based on the findings of the study.

SAMPLE AND DATA COLLECTION

A quantitative approach was followed in this exploratory study. The participants selected for this study consisted of employees working in the select Pharma Companies in North Coastal Andhra Pradesh, India. 810 questionnaires were distributed among the selected companies. Simple random sampling technique was deployed in the sample selection. The respondents were solicited to complete the green innovation questionnaire.

DATA ANALYSIS

KMO (Kaiser-Meyer-Olkin) and Bartlett's test

Kaiser-Meyer-Olkin (KMO) test is a proportion of how fit present information is for Factor Analysis. The test estimates sampling sufficiency for every factor in the model and for the total model. The measurement is a proportion of extent of variance among variance. The lower the extent, the more fit information is for Factor Analysis. Following Table- 1 shows the results of the KMO and Bartlett's test.

Table- 1: KMO and Bartlett's Test Relating to Green Innovation in the Study Area

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.946
Bartlett's Test of Sphericity	Approx. Chi-Square	27486.337
	df	136
	Sig.	.000

(Source: Primary Data)

The above Table- 1 reveals that KMO value i.e., .946 is neither nearer to zero nor close to one. So, the range is found to be good. Bartlett's test for Sphericity compares correlation matrix (a matrix of Pearson correlation) to the identity matrix. In other words, it checks if there is a redundancy between variables that can be summarized with some factors. Therefore, this test should be momentous (i.e., have a significant value less than 0.05). A significant value from chi-square test shows that for the present data R-matrix is not an identity matrix. Here Bartlett's test for Sphericity is highly significant ($p<0.001$), therefore it is concluded that the factor analysis is appropriate.

Communalities

Initial communalities estimate the differences among each factor accounted for, from all the variables. Extraction communalities values are estimates of the differences in each factor accounted for the variables in the factor solution. Below Table- 2 shows the particulars of communalities of Green Innovation the Study Area.

Table- 2: Communalities- Green Innovation in the Study Area

Communalities		
	Initial	**Extraction**
Your company has a formal green innovation policy integrated into the corporate strategy	1.000	.802
Company environmental compliance goes beyond minimum regulatory requirements.	1.000	.753
Your organization allocates a specific& sufficient budget for green R&D projects.	1.000	.873
Top management regularly reviews and updates green innovation policies.	1.000	.867
The organization partnerships with external agencies for green compliance and innovation are effective.	1.000	.904
Government incentives or subsidies are utilized for implementing eco-initiatives	1.000	.885
Environmental risk assessment is a regular part of product development planning	1.000	.857
Green objectives are included in employee Key Performance Indicators (KPIs)	1.000	.768
Company have adopted clean production technologies (e.g., solvent recovery systems, green chemistry).	1.000	.871

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Energy-efficient equipment is used across production and lab facilities.	1.000	.856
Water and effluent management systems are optimized to reduce environmental impact	1.000	.816
Company recycles and reuses materials wherever possible in production processes	1.000	.936
Green packaging materials are used for product distribution	1.000	.964
Employees are trained periodically on sustainable practices and waste reduction	1.000	.954
Emissions and waste tracking are performed digitally and in real time	1.000	.944
Your procurement process prioritizes eco-certified vendors and raw materials	1.000	.930
Company conducts internal green audits to improve operational sustainability	1.000	.933
Extraction Method: Principal Component Analysis.		

(Source: Primary Data)

The above table-2 gives the communalities of initial and extraction. Principal component analysis deals with the initial hypothesis that all factors are common; so, in the table, values for the initial communalities are 1 for all the factors. The value in the column titled extraction shows the common differences in the data structure. For, "Green packaging materials are used for product distribution" explains 96.4 percent of variance observed is common difference. There is second dimension for observing these communalities is in terms of the ratio of difference explained by the underlying variables.

To understand about the exact level of difference among factors is initially assumed as all communalities are "1". But after the analysis the differentiated values for each variable are found. "Your company has a formal green innovation policy integrated into the corporate strategy" has 80.2 per cent, "Company environmental compliance goes beyond minimum regulatory requirements" has 75.3 per cent, "Your organization allocates a specific& sufficient budget for green R&D projects" has 87.3 per cent, "Top management regularly reviews and updates green innovation policies" has 86.7 per cent, "The organization partnerships with external agencies for green compliance and innovation are effective" has 90.4 per cent, "Government incentives or subsidies are utilized for implementing eco-initiatives" has 88.5 per cent, "Environmental risk assessment is a regular part of product development planning" has 85.7 per cent, "Green objectives are included in employee Key Performance Indicators (KPIs)" has 76.8 per cent, "Company have adopted clean production technologies (e.g., solvent recovery systems, green chemistry)" has 87.1 per cent, "Energy-efficient equipment is used across production and lab facilities" has 85.6 per cent, "Water and effluent management systems are optimized to reduce environmental impact" has 81.6 per cent, "Company recycles and reuses materials wherever possible in production processes" has 93.6 per cent, "Employees are trained periodically on sustainable practices and waste reduction" has 95.4 per cent, "Emissions and waste tracking are performed digitally and in real time" has 94.4 per cent, "Your procurement process prioritizes eco-certified vendors and raw materials" has 93.0 per cent, and "Company conducts internal green audits to improve operational sustainability" has 93.3 per cent. Above variables shows the variance in structure. It is shown in Total variance Explained table which is following.

Table- 3: Total Variance Explained- Green Innovation in the Study Area

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.870	75.706	75.706	12.870	75.706	75.706	7.962	46.838	46.838
2	1.943	11.428	87.134	1.943	11.428	87.134	6.850	40.296	87.134
3	.634	3.732	90.866						
4	.414	2.434	93.301						
5	.261	1.534	94.835						
6	.170	1.002	95.837						

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7	.127	.745	96.582						
8	.107	.630	97.212						
9	.102	.598	97.810						
10	.092	.538	98.348						
11	.087	.513	98.861						
12	.058	.340	99.201						
13	.054	.315	99.516						
14	.033	.195	99.711						
15	.021	.125	99.836						
16	.016	.094	99.929						
17	.012	.071	100.000						
Extraction Method: Principal Component Analysis.									

(Source: Primary Data)

The above Table- 3 shows that Eigen values related with each factor displays the differences explained by that particular linear factor. This table also shows the Eigen values in terms of percentage of difference explain. So, factor 1 explains 75.706 per cent, factor 2 explains 11.428 per cent of total variance; it should be clear that these two factors explain relatively large amount of variance of 87.134. Finally, it is concluded that the initial two variables explain relatively major part of difference whereas subsequent variables explain only small part of difference. There are two variables among all with Eigen value greater than 1. The Eigen values related with these variables are again shown and the percentages of difference explained in the columns are labelled extraction sums of squared loadings.

Form the above table-3 it is identified that only first two factors in Green Innovation in study area are highly impacting aspect and the residual were of not that much. Because it only exceeds Eigen value more than 1.

Table- 4: Rotated Component Matrix[a] – Green Innovation in study area

Rotated Component Matrix[a]		
	Component	
	1	2
Employees are trained periodically on sustainable practices and waste reduction	.909	
Green packaging materials are used for product distribution	.905	
Emissions and waste tracking are performed digitally and in real time	.897	
Company recycles and reuses materials wherever possible in our production processes	.895	
Your procurement process prioritizes eco-certified vendors and raw materials	.890	
Company conducts internal green audits to improve operational sustainability	.888	
Water and effluent management systems are optimized to reduce environmental impact	.827	
Company have adopted clean production technologies (e.g., solvent recovery systems, green chemistry).	.826	
Energy-efficient equipment is used across production and lab facilities.	.824	
The organization partnerships with external agencies for green compliance and innovation are effective.		.893
Government incentives or subsidies are utilized for implementing eco-initiatives		.875
Your organization allocates a specific& sufficient budget for green R&D projects.		.873
Top management regularly reviews and updates green innovation policies.		.854
Environmental risk assessment is a regular part of product development planning		.852
Your company has a formal green innovation policy integrated into the corporate strategy		.785
Company Environmental compliance goes beyond minimum regulatory requirements.		.769
Green objectives are included in employee Key Performance Indicators (KPIs)		.730
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.		
a. Rotation converged in 3 iterations.		

(Source: Primary Data)

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Above Table- 4 shows the Rotated Component Matrix[a] – Green Innovation in the study area. On the basis of Oblimin with Kaiser Normalization, two groups emerged. These two groups consist of all those factors that have factor loadings greater than or least equal to 0.5. Thus, the first group there are nine dimensions and this group is titled as Green Innovation Practices. For second component there are eight dimensions and these eight dimensions are combined together to get one group extracted and it is conceptualized as Green Innovation Policies. These two groups are considered for further study.

Table- 5: Component Transformation Matrix- Green Innovation in study area

Component Transformation Matrix		
Component	1	2
1	.742	.670
2	.670	.742
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.		

(Source: Primary Data)

The final part of the factor analysis output is a component Transformation matrix between the factors. This matrix contains the correlation coefficients between the factors. From Table- 5 it is understood that all these factors are interrelated with each other to some degree. The fact that these correlations exists tells that the constructs measured can be interrelated. If the constructs are independent then the component correlation matrix should have been identity matrix. Therefore, from this final matrix it appears that the independence of the factors cannot be assumed.

FINDINGS

- Total 17 items are considered for green innovation study and all the 17 items are significantly influencing green innovation in the study area.
- According to the employee's perception among the 17 items "Green packaging materials are used for product distribution" found to be highly significant item.
- After explanatory factor analysis the 17 items are grouped into two factors.
- First nine items are grouped as green innovation practices and other eight items are titled as group innovation policies.
- Among the green innovation practices, "Employees are trained periodically on sustainable practices and waste reduction" found to be highly influencing item.
- Among the green innovation policies, "The organization partnerships with external agencies for green compliance and innovation are effective" found to be highly recommended item.

SUGGESTIONS

- ✓ Among the 17 items "Green packaging materials are used for product distribution" found to be highly significant. In the current era of global markets, pharma sector products are distributed across the globe. It is most important to pack the product both environmentally friendly as well as safely. Therefore, organizations should encourage employees to innovate environmentally friendly packing materials.
- ✓ Employees also felt that there is a need for reinforced motivation for green innovation. So, they have highlighted the item called "Employees are trained periodically on sustainable practices and waste reduction" among green innovation practices. Therefore, the companies aiming to boost the motivation in terms of green innovation should conduct training sessions time to time on sustainable practices and waste reduction.
- ✓ From the analysis it is found that there is a need for partnerships with specialised agencies to increase the green innovations in the organization. When organization establishes partnerships with specialized agencies, then their expertise and their updated knowledge in the field will give broader view of the environment and employees can imagine the innovation probabilities without any pseudo limitations.

CONCLUSION

The research is conducted to examine the administrative factors contributing for the green innovation in the pharma sector. Pharma companies in the north coastal Andhra Pradesh are considered for the study. After reviewing the literature 17 item scale is considered for the study. To examine the applicability of the items in the study area, exploratory factor analysis test is administered and found that all 17 items are significantly contributing for green innovation in the study area. Among the 17 items "Green packaging materials are used for product distribution" found to be the highly significant factor. The test is also conducted to group the items and found that there are two broader groups among the items. First group consists of nine items and the group is entitled as green innovation practices. Among the green innovation practices, called "Employees are trained periodically on

sustainable practices and waste reduction" found to be the highly significant item. Second, group consists of 8 items and it is entitled as green innovation policies. Among the green innovation policies, "The organization partnerships with external agencies for green compliance and innovation are effective" found to be the highly significant factor.

Scope for Future Research

1. The research is confined to the pharma sector only; in the future the research can be extended to other sector like cement industry which equally pollutes the environment.
2. The current research confirmed the role of administrative practices in green innovation; in future the researchers may examine these factors' role in reduction of pollution.

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