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# Effect of Green Practices on Organizational Performance: An Empirical Study

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**Abstract:**

Global manufacturing businesses have contributed to energy and resource consumption, pollution. Along with governmental legislation, social and market pressure that growing as awareness about environmental issues increases. To tackle such problems the study focuses on the analysis of the direct consequence of Green Manufacturing (GM) practices on operational performance in the manufacturing industry. A model for evaluating the effect of GM is developed taking into consideration as a fundamental variable that affects the causal relationship between GM practices and operational performance.

A structural equation model was proposed and investigated across the manufacturing industry in India. A structured survey questionnaire was used to gather empirical data from 400 Indian companies. A total of 203 usable responses were obtained giving a response rate of 53%. The data was analyzed using SPSS-AMOS software.

The results revealed that GM practices directly and positively affected operational performance. The results indicated that the structural equation model remained invariant across the Industry.

The implementation of Green practices in manufacturing has been recognized as a mean to improve economic and environmental performance that increases competitiveness and urge innovation.

The study provides further evidence to managers and practitioners on the effect of GM practices on operational performance in developing countries like India.

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## 1. INTRODUCTION

Sustainability concerns have increasingly gained an important role in societies and economies discussions over the final decades. However, there is tremendous pressure from the government, NGOs in the manufacturing industry to reduce waste, save energy and improve quality, reduce the cost of the products, and send products on time to the customer. GM covers the whole product life cycle from the applied plan of the product to the final disposal causing no unfavorable impact on climate by optimum utilization of resources and reduction of waste and contamination [1]. Green practices are concerned with recycling, environmental protection, conservation of energy, regulatory compliance, pollution control, and others types of issues. The goal of the GM practices is to design environmentally friendly products and deliver that product to the customer that minimizes negative effects on the surroundings through their production, use, and disposal.

First time in Germany the concept of GM originated in the late 1980s and early 1990s. From the 1980s, awareness regarding sustainable manufacturing started to focus on waste reduction, energy saving, process optimization in manufacturing. After this, the eras of sustainable manufacturing changed from process-oriented to product-oriented; and mainly focus on minimization of resources, reduction of toxic materials, energy-saving, and use of renewable energy sources [2]. Green manufacturing is a system that integrates product and process design aspects that affect the PPC (production, planning, and control) to identify, quantify, assess and manage the flow of environmental waste, to reduce waste, maximize resource utilization and subsequently minimizing the negative impact to the environment [3]. It reduces production waste while at the same time, creating less pollution to the environment. Waste refers to anything that takes up manufacturing time and cost without adding value to the product.

Rusinko [4] opined that Sustainable manufacturing practices such as energy substitution, waste reduction, hybrid energy technologies, cleaner production resource-efficient production, and recycling result in a noteworthy reduction of the production costs and improves product quality.Various researchers have defined the GM is as under.

Mendler *et al*. [5] opined that GM is concerned without compromising the ability of future generations to meet their needs; we have to fulfill the requirements of the present generation also. Cortellini [6] defined GM as a method of production that minimize wastage and pollution, also slows down the natural resource utilization in the process. Melnyk *et al*. [7] stress managing the flow of environmental waste by reducing environmental impact while maintaining resource efficiency. Different people have different meanings based on their training and discipline. Becoming a Green is a continuous journey, not a final destination. From the above discussion, it concluded that GM is a process that reduces environmental impact by minimizing pollution, wastages, and toxic during the production process. Refer to Figure **1**. GM literature taxonomy.


**Figure 1:** GM literature taxonomy.

It is also significant to note these industries have to abide by strict government regulations to remain operational. Manufacturing cost has to be reduced to sell the products at a competitive price. Hence there is a want for maximum utilization of resources and minimization of waste, that is, to do more with less. As a hybrid approach, GM takes into account the environmental and economic approaches [8]. This brings feasibility through environmentally friendly production processes, and it is very critical at this time when the manufacturing industry is facing pressure from supply-demand and severe climate change regulations. The world is ever-changing and customer requirements keep on changing. Competition for the market is becoming stiffer as companies are motivated to sustain themselves and this calls for resource-efficient production and sustainable products.

No, any research empirically demonstrated that the implementation of Green practices results in operational, environmental, social, and financial performance. This research helps to explore the effect of Green practices on organizational performance in the manufacturing industry.

## 2. LITERATURE REVIEW

There is the wide volume of literature available on GM dealing with numerous aspects. In this section of the paper an attempt is made to expansively and analytically review the literature on GM and categorize them so that it can be simply comprehended and applied.

Liu *et al*. [9] opined that Sustainable progress has become the key policy by which green control and resource convention can be done, despite continuous development. A comprehension of the fundamental relation between GM and corporate environmental execution, for example, Green innovation exercises is consequently exceptionally significant. Rising industrial activities drove the worldwide issue of unfavorable ecological effects. To ensure the world, it is important to receive a preventive way to deal with natural issues. To make the things better than ever, in term of its ecological globalization, has forced organizations to improve their environmental performance advocates [10; 11]. Tseng *et al*. [12] accept that decreasing wastes and discharges at source can improve the natural, just as the financial performance of an organization. Accordingly from the above-mentioned conversation, it is come to realize that GM is a significant issue and should be investigated in subtleties.

Exploration managing organization of different GM tools discernment incorporates topics such as the utilization of 4Rs, product/process change and alteration, waste isolation, and so on Analysts have created different ways to deal with track material, asset use, emanations, and the inferred natural effects of items for the duration of their life cycle counting; materials extraction, materials handling, item fabricating, circulation, use, and EOL [13]. Life cycle stock represents the sort and measure of materials, energy, and common assets utilized and the discharges created. Additionally, LCA instruments have been discovered to be helpful in surveying product design, processes, and systems. Following Table **1** highlights GM practices.

In India major companies focusing on reducing energy consumption, water consumption, waste, emission [32]. Mukherjee and Kathuria [33] opined that the firms are making efforts to prevent possible hazards to the environment as well as getting ISO 14001certification. In India, GM practices i.e. Green design, LCA, Green purchasing and marketing, ISO 14001, WEEE, RoHS are implemented in industries.

## 3. METHODOLOGY

The exact information utilized in this study was gathered through a survey appropriated to Indian manufacturers that all around carried out absolute quality management practices. The convenience sampling strategy was utilized to gather the responses of all manufacturing enterprises. This underlying sample comprised of 400 Indian manufacturing organizations, addressing a wide scope of areas and firm sizes. Supposedly, the underlying sample mirrors the Indian business. The link to the study was disseminated through email, and the sum of 212 responses was gathered through an online survey tool. This study along these lines wound up with a final

**Table 1: GM Practices**

| References | GM practices |
|---|---|
| Ijomah *et al*. [14], Wossen [15], Cagno *et al*. [16], Gaikwad and Sunnapwar [17] | Reduce, reuse, remanufacturing, recycle, Waste classification, Product/process change |
| Liu *et al*. [18], Thurston and Hoffman [19] | Multi-objective decision model weighting factor |
| Schiavone *et al*. [20], Harris and Crane [21], Gaikwad and Sunnapwar [22] | Regression analysis, confirmative factor analysis, Hypothesis testing |
| Yang *et al*. [23], Wu *et al*. [24], Madu *et al*. [25], | Integrating analytical network program (ANP) with DEA, multistage DEA, sustainable analysis |
| Lee *et al*. [26], Allen *et al*. [27], Durham [28], Madu *et al*. [25], Seliger *et al*. [2] | LCA, ECMPRO, AHP, DFE, EOL, LCI and EDIP |
| Zhu *et al*. [10], Gehin *et al*. [29], Gandhi *et al*. [30], Sroufe [31] | ISM, SWOT analysis REPRO (Remanf. Product profile) Mass balance concept, GPI indicator |

sample of 203 respondents and a response rate of 53% was noticed.

The survey instrument was approved by examining three viewpoints: content, construct validity, and reliability. To guarantee content validity, a draft questionnaire was pre-tried by two free scholastics with experience in both exploration activities and industry. Moreover, the survey depended on all around tried and perceived things that have been utilized effectively in different examinations. To survey the construct validity, we thought about two angles: convergent validity and discriminant validity [34]. To survey convergent validity, we initially examined the unidimensionality of the measures through principal component analysis.

Following the ideas of Carmines and Zeller [35], the things for every one of the constructs were examined independently. For the entirety of the construct, the Kaiser-Meyer-Olkin measure of sampling adequacy was over the suggested limit of 0.5, and Bartlett's test of sphericity returned p-values underneath 0.001. For all of the autonomous constructs, the items stacked on a single factor, the eigen value surpassed 1.0, the all-out difference clarified surpassed half, and every one of the items' factor loadings was above 0.5, supporting unidimensionality. As an added test of convergent validity, the average variance extracted (AVE) and composite reliability (CR) were determined. The proposed thresholds for good convergent validity for these two tests are AVE > 0.5 and CR > 0.7 (Hair *et al.*, 2010). Given these tests, we expected adequate construct validity. To test dependability, Cronbach's alpha coefficient was determined for every one of the summated scales. Every one of the summated scales has values over the recommended edge of 0.6 Forza [34] and, likewise, ought to be dependable for additional analysis.

## 4. RESULTS AND DISCUSSIONS

The responses received were calculated to be 53 % of total targeted manufacturing industries in India in which Green manufacturing practices are implemented into their operation. The assumptions of outliers, constant variance, and normality of data that followed normal distribution and homogeneity were evaluated and were found valid. The instrument reliability was verified by performing Cronbach's alpha test and found that all the constructs were within the parameters.

The confirmatory factor analysis (CFA) test confirmed the convergent validity of the instrument. The goodness of fit model was also confirmed through the indices obtained from the structural equation modeling (SEM) analysis.

Below the Figure **2** represent the conceptual framework of Green practices in which Green practices such as 3 R (Reuse, Recycle, and Reduce), green packaging, EMS certification, Green transportation, etc. plays an important role to enhance social, environmental, financial, and operational performance that results in overall business excellence in the manufacturing industry.

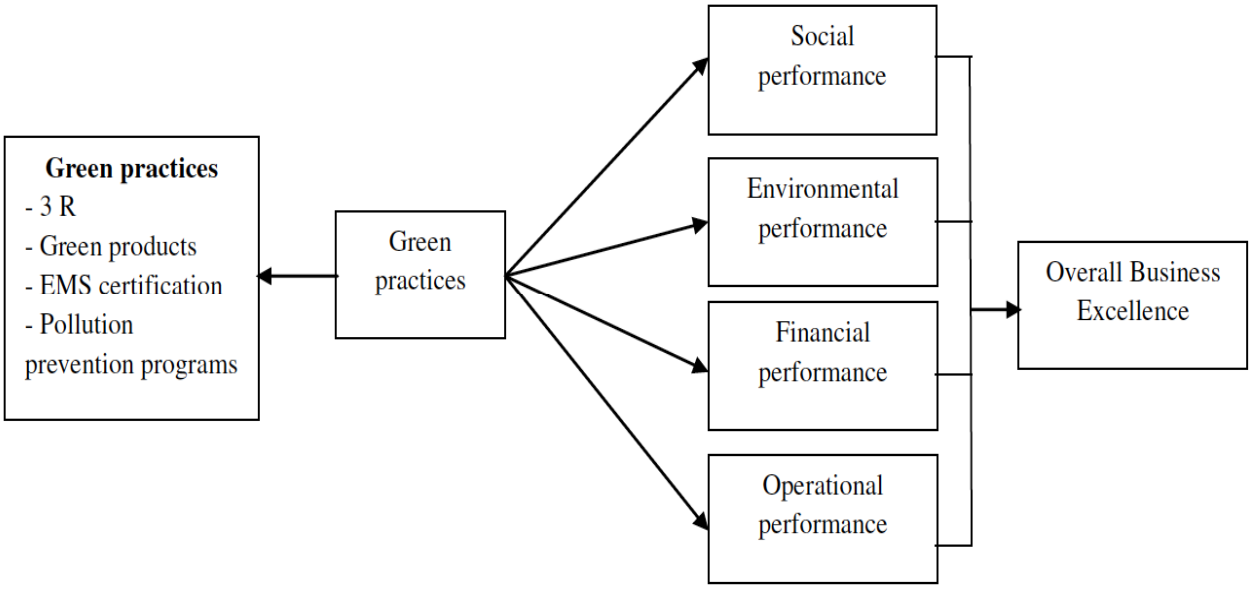


**Figure 2:** Conceptual framework of Green practices.

### 4.1. Structural Equation Model (SEM) for Green Practices and Performances

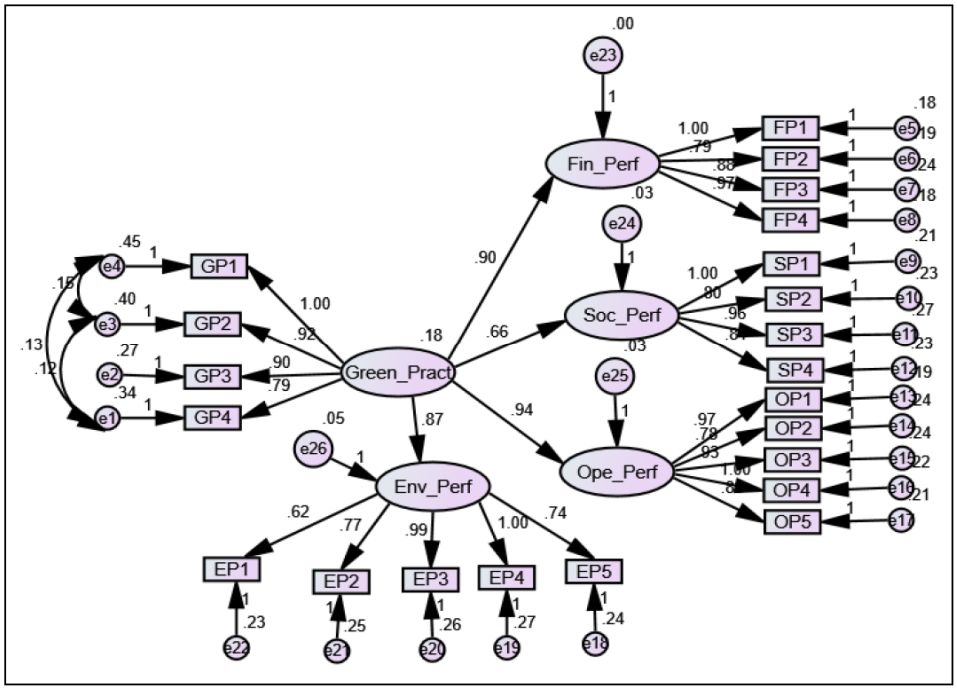


**Figure 3:** Structural equation model for Green practices and performances.

### *Model Fit Summary*

**Table 2: Summary Results Model Fit Parameters**

| The goodness of fit statistics | Recommended values | Proposed model |
|---|---|---|
| Chi-square/df (Marsh and Hocevar [36]) | < 3 | 1.388 |
| Chi-Square (Wheaton *et al*. [37]; Hair *et al*., [38]) | >0.05 | 280.290 |
| Degree of freedom (df) | - | 202 |
| P-value | - | < 0.05 |
| Comparative Fit Index (CFI) (Bentler, [39]; Hair *et al*., [38] ) | >0.9 | 0.939 |
| Tucker Lewis Index (TLI) Bentler and Bonett, [39] | >0.9 | 0.930 |
| Incremental Fit Indices (IFI) Hair *et al*., [38] | >0.9 | 0.788 |
| Normed Fit Index (NFI) Bollen, [40]; Hair *et al*., [38] | >0.9 | 0.814 |
| Goodness-of-Fit Index (GoFI) Joreskog and Sorbom, [41] | >0.9 | 0.889 |
| Adjusted Goodness-of-Fit Index (AGFI) Tanaka and Huba, [42] | >0.9 | 0.861 |

### 4.2. Maximum Likelihood Estimates

### *Regression Weight*

Table **3** is the AMOS output for independent Green practices and performances which shows the standard errors, critical ratio, and statistical significance. In addition, Table **3** shows that there was a statistical significance at the P < 0.05. Green practices had a significant effect on financial, social, operational, and environmental performance.

From the above table, hypothesis H1 proposed that Green practices have a positive effect on financial performance was found to be significant (β = 0.904, Cr = 0.135, P< 0.05). Therefore, hypothesis H1 is accepted. Similarly, hypothesis H2: proposed that Green practices have a positive effect on Social performance, hypothesis H3: proposed that Green practices have a positive effect on operational performance, and hypothesis H4: proposed that Green practices have a positive effect on environmental

**Table 3: Regression Weights of Green Practices and Performances**

| Factors | | Independent variable | Estimate (β) | S.E. | C.R. | P | Result |
|---|---|---|---|---|---|---|---|
| Financial Performance – H1 | <--- | Green_Pract | .904 | .135 | 6.702 | *** | Accepted |
| Social Performance – H2 | <--- | Green_Pract | .664 | .118 | 5.622 | *** | Accepted |
| Operational Performance – H3 | <--- | Green_Pract | .944 | .145 | 6.499 | *** | Accepted |
| Environmental Performance – H4 | <--- | Green_Pract | .871 | .144 | 6.054 | *** | Accepted |

performance. All the stated hypotheses are accepted as p-value is less than 0.05.

## 5. CONCLUSION

It reveals how Green practices impact sustainable performance. By analyzing data from 203 manufacturing industries, it shows that the firm should manage Green practices in an integrated and coordinated way. A GM process involves a sufficient and holistic loom that encompasses all a business does those impacts the environment. Thus, it assists companies in making systematic changes in areas like product design, emissions, energy, transportation, water, and waste.

This study adds to explore manufacturing improvement activities by researching the impact of both Green manufacturing on operational performance. This examination pointed toward covering the exploration gap concerning the intelligent impacts of Green manufacturing on operational execution. The operational advantages of utilizing Green manufacturing have been demonstrated in various past examinations and the aftereffects of the current investigation uphold those discoveries.

The findings from the SEM affirmed that Green manufacturing is still a relevant cause of competitive advantage. Albeit a significant number of the thoughts and strategies in Green manufacturing can be followed far back, the attention on making an incentive for the customer and decreasing waste and contamination are thoughts that won't get out of date, paying little heed to the technological advances that occur.

More research and analysis are needed by utilizing various tools for exploring GM. Although standardized sustainable best practices are still in their formative stage of development, some basic practices help businesses become more environmentally sustainable.

### 5.1. Unique Contribution

The contribution of this model would be in two ways are a contribution to theory and practice. The present study evidenced practicing various Green manufacturing practices in a compound manner. This will help the organization by satisfying its primary goals to achieve manufacturing performance. The key aspect of the study is to signify our contribution towards the theory of integrated manufacturing concepts.

Secondly, the proposed model is empirically tested using primary data collected from executives of the manufacturing industries. The findings provide a positive and interesting result to achieve manufacturing excellence and guidance to the management and integrated practitioner of various manufacturing organizations.

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## DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author(s).

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