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ADOPTION AND ACCEPTANCE LEVEL OF SUSTAINABLE MANUFACTURING PRACTICES IN AUTOMOBILE INDUSTRIES AMONG WOMEN EMPLOYEES

Dr. K. Arumugam[1] & Dr. Vinayak M Bhandari[2]

[1]Post- Doctoral Fellow, Institute of Management and Commerce, Srinivas University, Mangaluru

[2]Professor and Research Supervisor, Srinivas University Institute of Management and Commerce Bangalore Campus

ABSTRACT

The empirical methodology is especially well-suited for the investigation of real-world phenomena, since it enables researchers to observe and analyse the dynamic interaction between sustainable practices and adoption level of women workforce in this sector. The empirical method which places a strong focus on direct observation and data collecting will be of great assistance in shedding light on the myriad of impacts that sustainable manufacturing frameworks have on women employees. With the purpose of providing a full knowledge of how these changes are seen and experienced by women, the research intends to investigate the many aspects of these consequences. It is important to investigate the difficulties they have while adjusting to new procedures, the possibilities that present themselves and the overall influence that these changes have on their professional life.

KEYWORDS: *Women fostering, Sustainable Manufacturing, Sustainable Development*

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INTRODUCTION TO SUSTAINBILITY

The manufacturing industry acts as the cornerstone of modern civilization which has undergone a series of transformative shifts since its inception. From the meticulous craftsmanship of early artisans to the mechanized efficiency of mass production, each era has left an indelible mark on the way to produce manufacturing goods. The late 20th and early 21st centuries witnessed a move towards mass customization, catering to individual consumer preferences while retaining the advantages of large-scale production. Today the manufacturing has transformed to digital manufacturing where the lines between the physical and digital realms blur, promising unprecedented levels of customization and responsiveness. However, this relentless pursuit of productivity and innovation has come at a cost. The environmental and societal impacts of traditional manufacturing practices have become increasingly apparent, casting a shadow over the industry's achievements. The depletion of natural resources, the generation of hazardous waste, and the emission of greenhouse gases have raised serious concerns about the long-term sustainability of our current production models.

This growing awareness of manufacturing's ecological footprint has spurred a paradigm shift in the automobile industry. No longer viewed as a mere compliance burden, sustainability is increasingly recognized as a strategic imperative which is driven by a convergence of factors. Consumers are now more environmentally conscious than ever before where there is necessity of demanding products and services that align with their values. Stakeholders, including investors,

regulators, and communities, are scrutinizing companies' environmental performance, holding them accountable for their impacts. This shift in perception is further fueled by the economic realities of resource scarcity and rising energy costs of automobile manufacturing. What was once seen as a social obligation is now understood as a competitive advantage. Companies that embrace sustainable practices are not only mitigating risks but also unlocking new opportunities for innovation, efficiency and market differentiation.

SUSTAINABLE MANUFACTURING

The concept of sustainability itself is versatile, encompassing ecological, human, and resource dimensions. It is not merely about reducing environmental harm; it is about creating systems that can thrive over the long term, meeting the needs of the present without compromising the ability of future generations to meet their own. The Organization for Economic Co-operation and Development (OECD) provides a comprehensive framework for understanding sustainable manufacturing, outlining its evolution from pollution control and cleaner production to more holistic approaches like life cycle thinking, closed-loop production, and industrial ecology of automobile industry. This evolution reflects a growing understanding that sustainability requires a systemic approach, addressing environmental impacts across the entire product lifecycle, from raw material extraction to end-of-life management.

Within this broad framework, research on sustainable manufacturing of automobile industry has focused on several key areas:

- **Resource Conservation:** Minimizing the use of finite resources like water, energy and raw materials through process optimization, material substitution, and waste reduction strategies.
- **Eco-efficiency:** Maximizing resource productivity while minimizing environmental impacts, achieving "more with less" through technological advancements and process improvements.
- **Product Sustainability:** Designing products with their entire life cycle in mind, considering factors like material selection, durability, repairability and end-of-life disposal.
- **Process Sustainability:** Developing and implementing manufacturing processes that minimize environmental impacts, focusing on energy efficiency, waste reduction and the use of renewable resources.

STATEMENT OF THE PROBLEM

The automotive sector in India is now experiencing a period of tremendous growth which is being driven by growing demand in the market as well as entry of global automotive giants that are establishing production facilities inside the nation. At the same time that it has been driving economic development, this expansion has also resulted in an increase in the number of concerns related to environmental degradation activities. These operations include transportation, warehousing, and material handling all of which contribute considerably to the environmental imprint that the sector leaves behind. As a consequence, there has been a rise in the production of greenhouse gases and the pollution of the air, which presents a significant risk to the environmental sustainability of India. The automobile industry has been placing a greater focus on environmentally responsible production techniques as a direct reaction to the concerns that have been raised. However, the success of these efforts is contingent not only on their physical execution but also on the women workforce's acceptance and adoption of them.

This is especially true among women workers who constitute a substantial demographic within the business. There is a notable effect on workforce acceptability that particularly examine the adoption and acceptability levels of sustainable manufacturing frameworks among women employees in the Indian automotive sector. This is despite the fact that there is research on green supply chain management and sustainable logistics. It is essential to have a thorough awareness of the elements that influence women's adoption of sustainable manufacturing practices in order to guarantee the successful implementation of these practices and their incorporation into the culture of the organisation.

It is possible that the adoption and acceptability levels of sustainable manufacturing frameworks among women working in the automobile sector might be influenced by a number of different factors. The amount of awareness and knowledge that women employees have when it comes to sustainable manufacturing processes is a significant component that plays a significant role in the effective adoption of these practices. The factor that contributes significantly to the formation of women's perspectives is the perceived advantages and disadvantages. Adoption may be hindered by perceived hurdles such as greater burden, changes in work procedures, lack of recognition despite the fact that advantages such as better working conditions, health and environmental protection may stimulate adoption.

RESEARCH QUESTIONS

- What are the diverse sustainable manufacturing practices those are followed in automobile industries?
- What is level of adoption and acceptance among women employees towards sustainable manufacturing practices?
- What are the vital modifications that are made towards manufacturing operations based on the ideas of sustainability?
- What is the effect caused by government measures and operations in promoting sustainable manufacturing among automobile industries?
- What are the various bottlenecks those are hindering the shift towards sustainable manufacturing practices in automobile industries?

IMPORTANCE OF THE STUDY

When it comes to the global market that exists today, the automobile sector is making significant efforts to enhance its profitability and boost its level of competitiveness. In order to accomplish such goals, the majority of the workforce that is employed in the automotive industry has to work towards a common goal. However, it is quite obvious that the women employees, in addition to not having any job security or opportunities for competency development are also deprived of any type of operational autonomy or any role in the decision-making process. In light of the rising significance of sustainability and the intensity of green manufacturing processes organisations are searching for methods that are both more efficient and effective in managing their corporate operations in order to progress towards sustainability. This is due to the fact that organisations are under pressure to generate outcomes that are both effective and efficient from a sustainable standpoint.

On the other hand, such measurement models often suffer from a lack of guidance on the accessible performance indicators and the ways in which they may be made tangible in real practice in assessing the perception of women employees towards sustainability. The reduction of waste and emissions, recycling and use of renewable resources in manufacturing processes are some of the measures that are employed in automobile sector. When it comes to the utilisation

of raw materials, sustainable practices include the utilisation of recycled materials, biodegradable materials, ecologically benign materials and replacement of items that are environmentally dubious. The conventional manufacturing process has undergone a transformation as a result of the enhancement of sustainable design and development approaches.

OBJECTIVES OF THE STUDY

- To assess the diverse sustainable manufacturing practices those are followed in automobile industries operating in the study area.
- To evaluate the adoption and acceptance level of women employees towards sustainable manufacturing practices in automobile industries.
- To identify the significant changes in the manufacturing operations based on the ideas of sustainability.
- To examine the effects of government measures in ensuring sustainable manufacturing among automobile industries.
- To scrutinize the various bottlenecks those are hindering the shift towards sustainable manufacturing practices in automobile industries.

RESEARCH METHODOLOGY

In the context of research, research methodology serves as the scientific procedure that directs the whole research process by establishing a methodical and rigorous approach to answering the research questions. In addition to guaranteeing that the results are legitimate and dependable, it also ensures that they make a significant contribution to the existing body of knowledge. Within the scope of this specific research, the primary objective is to get knowledge of the influence that sustainable manufacturing frameworks have on women workforce who are engaged in the automobile sector within the Kancheepuram district. In light of the fact that this influence might be complex and multidimensional, the research approach used in this study is empirical research. .

The empirical methodology is especially well-suited for the investigation of real-world phenomena, since it enables researchers to observe and analyse the dynamic interaction between sustainable practices and adoption level of women workforce in this sector. The empirical method which places a strong focus on direct observation and data collecting will be of great assistance in shedding light on the myriad of impacts that sustainable manufacturing frameworks have on women employees. With the purpose of providing a full knowledge of how these changes are seen and experienced by women, the research intends to investigate the many aspects of these consequences. It is important to investigate the difficulties they have while adjusting to new procedures, the possibilities that present themselves and the overall influence that these changes have on their professional life.

One of the most important aspects of this empirical inquiry is the gathering of field information from women employees who are employed in the automotive business. By soliciting their perspectives, the research endeavours to capture the lived experiences of those who have been directly impacted by the transition towards environmentally responsible production. When it comes to understanding the human element of sustainability projects, these qualitative data will prove to be helpful. They will shed light on the subtleties and complexity that may be missed by techniques that are only grounded in quantitative analysis. The research will investigate the perspectives of women as well as in larger context of sustainable manufacturing within the Kancheepuram district. The study intends to present a comprehensive assessment of the landscape of sustainable manufacturing by taking into consideration the aforementioned variables.

SAMPLING FRAMEWORK

The framework acts as the foundation for choosing a survey sample is referred to as the sample design. The sample design also has an impact on a great deal of other key features when it comes to collection of primary data. The amount of money, time and effort that the researcher would need to put in to gather the main data is calculated based on the sample size of the research involving women employees working in the Kanchipuram district. An issue is created when there is an inadequate sample, which may be caused by either extremely small sample sizes or very high sample sizes. This generates the problem and prevents the analysis from producing accurate data. The selection of women employees working at various management levels was accomplished via the use of the simple random sampling approach. The population frame consists of 20 automobile companies that are working within the jurisdiction of Kanchipuram district which is clearly explained in the following table

Table 1: Population Frame

S. No	Company Name	Population	Women Population
1	DELPHI-TVS	1,500	79
2	Hyundai Transys Lear Automotive India private limited	323	45
3	HundaiMobis	1,800	65
4	Myoung shin	700	49
5	Daimler India commercial vehicles private limited	705	38
6	Mobis India limited	987	58
7	Hwashin automotive India private limited	610	44
8	SungwooHitech India private limited	408	75
9	Hyundai Wia India private limited	239	56
10	DaeseungAutoparts India private limited	240	45
11	Sllumax limited	562	37
12	Sakura Autoparts India private limited	414	18
13.	SS Manufacturing private limited	120	35
14.	Hitachi automotive systems (India) private limited	250	35
15.	Yorozu JBM automotive Tamil Nadu private limited	200	29
16	IHD industries private limited	156	46
17	IP rings limited	337	33
18	Valeo friction materials India private limited	379	41
19	Doowon electronics India private limited	120	29
20	Jin tech automotive India private limited	222	55
Total		**10,972**	**912**

(**Source:** Collected from District Industrial Centre, Kanchipuram)

The selected methodology is suitable for this research as it seeks to depict the long-term development of women fostered in Kanchipuram's automobile industry. A methodical overview and evaluation approach was used to guarantee that the results represent the viewpoints of female employees and can be extrapolated to a larger population. The simple random sample approach was used to complete the sampling procedure, which reduced bias in the selection process and gave all participants an equal chance of being included.

For purposes of validity and relevance, the sample size was established using particular standards. The representative group for this study was determined to be women employed in Tamil Nadu's automotive industry. Only employees working in the automotive industry's manufacturing sector were contacted under this framework; those working in the service sector were not included in the study. This approach matched the study's goals on sustainability and nurturing by enabling the research to document the experiences and difficulties faced by women directly participating in production and industrial operations.

Participants were chosen using the basic random sampling method, and the sample size was calculated according to the total population.

$$n = \frac{N}{1 + N (e)^2}$$

Where,

n = sample size

N = Population size

e = Margin of error

$$= \frac{912}{1 + 912 (0.05)^2}$$

$$= \frac{912}{1 + 912(0.0025)}$$

$$= \frac{912}{1 + 2.280}$$

$$= \frac{912}{3.280}$$

n = 278.04 (determined sample size)

According to the Cochran sample size calculation algorithm mentioned above, the study's sample size was set at 278. The survey included 278 female employees from 20 car businesses in Kanchipuram. The study's sample size was determined using a scientific technique that confirms the accuracy of the results.

FINDINGS

- The Age of women employees working in automobile sector is highly associated with the Nature of Work in which they are employed which is explained by their association.
- The Age of women employees working in automobile sector is statistically associated with the Initiatives for Women for Career Development which reflects the impacts caused by the age on perception towards the career development initiatives.
- The Salary categories of women employees working in automobile sector are significantly associated with the Initiatives for Women for Career Development as per the outcome of observed and expected values calculated using the participants' opinions.
- The diverse Area of Residence of women employees working in the automobile sector are highly associated with the Nature of Gender Pay Gap based on the outcome of association testing using responses.
- The varied levels of Income Support from Family among women employees in automobile sector are statistically associated with the Nature of Work performed by them.
- The different groups of Remuneration Packages among women employees working in automobile sector is significantly associated with the Impact of Automation on Female Employment in Automobile Sector
- The various classes of Remuneration Packages among women employees working in automobile sector is highly associated with the Skills important for Women in Automobile Sector.
- The varied categories of Approximate Percent of Women Employed in the Industry are statistically associated with the Initiatives for Women for Career Development.
- The different groups of Approximate Percent of Women Employed in the Industry are significantly associated with the Impact of Automation on Female Employment in Automobile Sector.
- The forms of Current Trend of Women Employment in Automobile Industry are highly associated with the Strategies for Women Employee Retention in Automobile Sector.
- The diversified opinions on Automobile Department in which Women are Highly Employed is statistically associated with the Nature of Gender Pay Gap.
- The various categories of responses given towards Automobile Department in which Women are Highly Employed is strongly associated with the Increasing Focus on Sustainability impacting Women Roles.

SUGGESTION

- **Leadership Development & Advancement Programs:** Design leadership development programs specifically tailored to the needs of women in the automotive industry. These programs should focus on building leadership skills, confidence, and strategic thinking.
- **Public Speaking & Communication Training:** Offer public speaking and communication training to empower women to effectively articulate their ideas, present their work, and advocate for themselves and their teams.

- **Networking & Collaboration Opportunities:** Create opportunities for women to network and collaborate with other professionals within the industry, such as conferences, workshops, and industry events.
- **Personal Branding & Career Coaching:** Provide personal branding and career coaching services to help women develop their professional image, build their network, and advance their careers.
- **Mentoring Circles & Peer Coaching:** Establish mentoring circles and peer coaching programs to facilitate knowledge sharing, skill development, and mutual support among women in the organization.
- **Celebrating Achievements & Recognizing Contributions:** Actively celebrate the achievements and contributions of women in the automobile industry through awards, recognition programs, and internal communications. Highlighting success stories can inspire and motivate other women.

CONCLUSION

The sustainable development of the automobile industry hinges on its ability to attract, retain and empower a diverse workforce with women playing a crucial role. Fostering an inclusive environment where women can thrive is not just a matter of social responsibility; it's a strategic imperative for driving innovation, enhancing competitiveness and ensuring long-term sustainability. The recommendations outlined above provide a roadmap for creating such an environment, focusing on skill development, resilience, gender non-discrimination and self-efficacy. The automobile industry is undergoing a period of rapid transformation, driven by technological advancements, changing consumer preferences and increasing environmental concerns. To navigate these challenges successfully, the industry needs a skilled and adaptable women workforce. Investing in women's skill development through targeted training programs, mentorship initiatives and cross-functional experiences is essential for equipping them with the expertise needed to excel in this evolving landscape. By providing women with opportunities to develop future-focused skills in areas such as AI, data analytics, and electric vehicle technology, the industry can unlock their full potential and drive innovation.

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