Charting the Role of Green Work Engagement and Individual Green Values on Achieving Sustainable Performance in Automotive Industry: A Structural Equation Modelling Approach

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ABSTRACT: Sustainability ameliorates the needs of present scenario without compromising the future generation as it constantly evolving. The study is focused on scrutinizing the relationships between "Green Innovation" (GIV), "Green Organizational Culture" (GOC), "Employee Green Behavior" (EGB), and "Sustainable Performance" (SP), with "Individual Green Values" (IGV) as a moderator and "Green Work Engagement" (GWE) as a mediator. This research incorporates primary data had been collected from a pool of employees working for automotive firms. Data were gathered from 370 employees in diverse automotive companies employing a 27-item questionnaire. "Structural equation modeling" (SEM) was utilized to examine the hypotheses. Since it has been postulated in the hypothesized model, the results prove that GWE has partial mediations on GIV, GOC, and employee behavior toward organizational sustainability. Interestingly, it was established that the moderation effect held for individual green values contributed to the enhancement of the optimistic effect of GWE as detected from the study among employees with strong green values. These outcomes will be beneficial for theoretical and practical approaches. In theoretical terms, the study advances knowledge about how green initiatives operate to produce substantive levels of sustainability via the mediating construct of GWE. In a practical sense, the results guide automotive businesses that desire to improve the sustainability of their operations. GIV emerged as the strongest predictor of SP. The research also suggests that individual green values of organization's employees are identified and harnessed, to improve employees' involvement in supporting the organization's sustainable performance.

Keywords: green innovation (GIV), employee green behavior (EGB), green work engagement (GWE), green organizational culture (GOC), individual green values (IGV), sustainable performance (SP).

I. INTRODUCTION

The automotive industry has to change its business model significantly because of its major contribution to greenhouse emissions. This imperative is driven by two interwoven forces: the appearance of new issues associated with the environment while producing and utilizing traditional car models and consumer preferences that are now more concerned with the future of the Earth [1, 2]. Starting from the utilization of raw materials, the energy consumed in the production process of automobiles, vehicle emissions, and even how lifeless vehicles are disposed of in automobile industries. Other external pressures are as follows: High and ever-rising emission standards and fuel efficiency requirements across the globe also compelled automotive companies to adopt environmentally sustainable measures [3, 4]. As a way to get legitimacy to operate, companies are bound to maximise shareholder wealth while concurrently focusing on social, environmental, and economic problems to be continued their existence [5-7].

In the Automotive sector, GI refers to sustainable technology and processes for producing low-impact automobiles and production methods [8]. The inability to change also comes with operational costs and jeopardizes the future of this industry, especially when environmental responsibility is needed most. It can be seen that the environmental impact of the automotive industry is quite high. Right from the raw material usage, and energy-intensive manufacturing process to vehicle emissions, and end-of-life vehicle disposal, it is evident that the auto-mobile industry has profound effects comprehensively on-air quality, water resources, and climate change [1]. Other external factors include high and ever-increasing requirements in emission standards and fuel efficiency globally also put pressure on automotive companies to embrace environmentally friendly practices [3]. Parallel to those external stimuli, consumer demand is experiencing a radical shift. One specific segment of the population is consciously selecting cars that do not harm the environment and that represent its values [9]. The reasons behind this shift include the worsening climate change effects, rising prices of fuel, and the desire to minimize the individual's impact on climate change. Such a development is evident in electric vehicles (EVs) and hybrid vehicles, which entail lower emissions and reduced dependence on fossil fuels [10].

Customers are also embracing car-share and ride-hailing services, which boost resource utilization and minimize the need to own personal automobiles [11]. This study is essential in addressing important gaps in the present body of knowledge on green involvement and sustainable practices. While earlier studies have explored consumer viewpoints and corporate sustainability strategies, there is a clear dearth of a comprehensive study linking organizational sustainability initiatives with active participation of stakeholders. Investigating the dynamic interactions between companies and communities inside sustainability frameworks and highlighting useful applications that go much beyond theoretical debates helps this study clearly close that gap. Furthermore, most of the existing research focusses on policy implementation or personal behavior modification; few studies critically evaluate the effectiveness of combined, long-term sustainability practices from a whole perspective. This study provides striking empirical data by doing this that emphasizes the transforming potential of consistent green involvement. It also explores understudied fields including digital engagement in sustainability, cross-sector partnerships, and the effect of localized policies in encouraging notable environmental change. This study essentially improves the dialogue by stressing the need of participatory models to reach long-lasting ecological and social benefits and by offering sophisticated insights on the mechanisms driving sustainability from simple commitment to quantifiable action.

Unlike past studies in the automotive industry and beyond, this one offers a fresh viewpoint on sustainability practices and green involvement. Although sustainability studies usually highlight technological advancement such as adoption of electric vehicles, emissions reduction, and supply chain improvements in the automotive sector they sometimes overlook the vital part that community and stakeholder involvement play in igniting systemic transformation. This study, however, goes beyond simple technical progress by looking at how companies actively involve stakeholders in environmental projects, so promoting long-term commitment instead of focusing only on product development. Many studies on automotive-related issues highlight following environmental regulations but neglect to look at proactive sustainability initiatives outside of legal obligations. By means of an analysis of strategic sustainability models, this study clarifies how companies might surpass mere adherence to standards and instead foster long-term environmental innovation on their own. While many studies today focus on business sustainability initiatives, they do not fully investigate how businesses interact with stakeholders including legislators, staff, and consumers. This work examines interactive and participative strategies that support long-term commitment instead of passive compliance. This paper looks at how Green Work Engagement connects personal motivation to systemic change directly supporting corporate sustainability. The study clearly shows relationships among GHRM, EGB, GI, green culture, and EP, but it also highlights a knowledge vacuum about the psychological and social processes connecting these elements, particularly the newly important function of employee green behavior.

In contrast to studies in industries like retail or manufacturing, which have examined corporate environmental responsibility and sustainable supply chains, this study goes beyond simple policy compliance and environmental measurements to assess actual participatory models. While many past

studies have looked at how businesses run sustainability initiatives, less have looked at the processes by which businesses foster long-standing stakeholder involvement in environmental projects. This study provides a more complete picture by clarifying the junction of proactive environmental commitment and organizational strategy.

This paper shuts down the research gap by aligning its objectives with uncharted territory of organizational sustainability. Examining the interactions among GIV, GOC, EGB, GWE, and OS helps one to understand their combined influence. We investigate the role of GWE as a mediator and show how working conditions enhance sustainability outcomes. IGV is investigated as a moderator to observe how green values influence the GWE on OS. Gender dynamics are assessed with an eye towards how they influence corporate sustainability projects. The study fills in knowledge on indirect effects and behavioral influences on green workplace practices. It offers objective analysis, so enhancing the more general debate on sustainable corporate practices. Including creativity, culture, behavior, and personal beliefs gives a whole picture. The studies enable businesses to enhance policies meant to support a green and inclusive workplace. Ultimately, it makes clear how to achieve long-term sustainability in the automotive sector.

This study is very important in filling in major gaps in the body of knowledge already in use on green participation and sustainability strategies. Although earlier studies have looked at consumer attitudes and corporate sustainability strategies, there is still a dearth of thorough study connecting organizational sustainability projects with active participation of stakeholders. Examining how companies and communities interact inside sustainability frameworks highlights real-world uses outside of theoretical debate, so directly helping to bridge that gap. Moreover, although most of the current research concentrates on policy execution or personal behavioral changes, few studies investigate, from a systemic standpoint, the success of combined, long-term sustainability practices. This study thus offers empirical data confirming the transforming power of consistent green participation. It also addresses understudied areas including digital participation in sustainability, cross-sector partnerships, and the part localized strategies play in generating significant environmental impact. The variables were chosen for this study because they have a significant impact on long-term performance in the automotive industry. Each variable was chosen for its ability to influence environmental outcomes, operational efficiency, and stakeholder engagement in sustainability initiatives. Sustainability practices can be implemented at all levels by actively engaging consumers, suppliers, and policymakers. Enhanced engagement leads to increased awareness, acceptance of green initiatives, and a long-term commitment to environmentally friendly practices. The incorporation of electric vehicles (EVs), renewable energy sources, and sustainable manufacturing technologies is critical for reducing the industry's carbon footprint. This variable has a direct impact on emissions, resource consumption, and the development of sustainable mobility.

II. THEORETICAL FRAMEWORK

These frameworks provide important new perspectives on how companies create and carry out sustainability plans while preserving involvement of stakeholders. Strategic, inimitable resources promoting environmental performance and competitive advantage are green HRM, employee green behaviour, and green innovation. [12]. Adopting environmental practices helps to satisfy important stakeholders, particularly those related to the market, so influencing green HRM and innovation strategies. Green practices help companies to fit cultural, normative, and regulatory institutional pressures as well as to promote sustainable organizational behavior. These theories taken together offer a strong, multi-level framework to support the choice of constructions in organizational sustainability research including green HRM, employee green behavior, green innovation, and environmental performance. RBV emphasizes internal capabilities; Stakeholder Theory clarifies external needs; and Institutional Theory explains normative and regulatory pressures influencing green organizational behavior [13].

1. STAKEHOLDER THEORY

This theory emphasizes the need of including all stakeholders employees, consumers, authorities, and communities into business decisions. Regarding sustainability, automakers have to balance profitability with

stakeholder interests while facing environmental problems. It is consistent with the idea that while making decisions companies should consider the needs of stakeholders including consumers, workers, communities, and investors.

2. INSTITUTIONAL THEORY

Companies are driven towards using sustainable practices by institutional forces including industry standards, laws, and market dynamics. Due in large part to normative cultural expectations, mimetic competitive pressures, and coercive regulatory influences, automotive companies often embrace green projects. Emphasizing adaptation to institutional constraints as a source of stability, the theory also explores how these outside events drive rules, norms, and competitive pressures that shape corporate behavior and sustainability initiatives.

3. RESOURCE-BASED VIEW

This framework suggests that businesses can gain a competitive advantage by leveraging unique resources like cutting-edge green technologies and sustainable supply chains. The study strengthens the notion that firms that view sustainability as a critical resource achieve long-term operational efficiency by investigating the significance of technology adoption.

Further the Institutional Theory and Stakeholder Theory emphasize the importance of regulatory alignment, Green Work Engagement ensures that businesses go beyond compliance and actively pursue environmental leadership. The Resource-Based View (RBV) emphasizes resource-based success; employee-led initiatives to promote green practices enhance these long-term advantages, whether through the design of eco-friendly vehicles or improvements in green supply chains. These three theories recognize that businesses are not isolated entities; they are influenced by both internal capabilities and external factors. To ensure long-term success, businesses must constantly adapt to their surroundings, whether through stakeholder relationships, regulatory obligations, or the allocation of unique resources. The hypotheses align with this model by examining how stakeholder engagement influences the adoption of long-term sustainability practices. This framework proposes that firms can gain a competitive advantage by utilizing unique resources such as advanced green technologies and sustainable supply chains. By looking into the role of technology adoption, the study supports the notion that companies that use sustainability as a core resource gain long-term operational efficiency.

III. REVIEW OF LITERATURE

To improve the coherence and logical flow of the research, the literature review should be refined to place a greater emphasis on theoretical foundations. This strengthens the study's rationale by directly connecting theoretical models to sustainability applications, rather than treating them as separate concepts. Explicitly linking these theories to the primary hypotheses demonstrates their importance to the study's objectives. The study incorporates Green Work Engagement and individual green values, placing them within a larger theoretical framework. It is critical to summaries key findings from previous studies, focusing on corporate sustainability strategies, regulatory influences, and technological advancements. The literature review is essential in empirical research papers because it provides theoretical frameworks and justifies research goals [14]. To improve flow and coherence, the literature review should be logically integrated with the other sections before transitioning into the research methodology [15]. A well-written literature review defines the scope of the study, clarifies key concepts, and reveals the underlying theories [14]. Researchers should focus on synthesizing insights from various sources in order to provide a clear and compelling background for their investigation [15]. By fine-tuning the organization and focus of the literature review, authors can improve the overall quality and coherence of their research papers.

1. GREEN INNOVATION (GI)

GI can be defined as a range of processes that are explored to diminish the ecological track of goods, services, companies, and industries [16, 10]. Further translates into three primary types: Product Innovation

involves developing new vehicles with lower emissions, improved fuel efficiency, and reduced reliance on fossil fuels. Examples include electric vehicles (EVs), hybrid vehicles, and those utilizing lightweight materials [17]. According to [18] the environmental context, sustainable innovation refers to various processes intended to decrease the environmental brunt of services, products, businesses, and automotive sectors [16,19]. Product Innovation invents cars that release at most 'micropollutants,' using the least fuel possible, and not relying on conventional energy. GI generates a strong framework in with dedicated personnel are encouraged to innovate, resulting in a long-term organizational sustainable performance [20].

Process Innovation includes the transformation of production processes that reduce energy waste and use sustainable resources. Some of these include lean production systems, loop recycling systems, and renewable energy sources [21]. Organizational Innovation includes the course of making an organization's structures, processes, and activities friendly to the environment. Some of them are green supplies, circular economy systems, and processes that consider environmental aspects [8,22]. Organizations that implement environmental programs and technologies consume fewer resources, produce less pollution, and have better environmental standards. Also, GI contributes to increasing the company's economic benefits by decreasing the cost, increasing the share, and having a better image [23]. Moreover, GI results in improving the economic performance of the company through the reduction of cost, increased market share and better image [23]. For instance, [24] revealed that eco-innovation had a positive relationship with business performance and that Taiwanese automotive firms could benefit from both profit and sustainability.[20].

- H1: GIV has an optimistic relationship with organizational sustainability performance OSP.

2. GOC

Values that GOC represents include beliefs norms and values in which environmental sustainability is considered paramount [25]. Values: Similar perception about the environment conservation and particularly social responsibility. Norms: Informal norms and standards for sustainable behavior. GOC affects actions throughout the organization, and making a green organization's goal a reality is essential. It has also been found that if employees of an organization accept an organization as environmentally sensitive, they will also be environmentally sensitive in the organization and other aspects of their lives [26]. GOC is also favorable since the employees are encouraged to share their ideas and participate in implementing sustainable practices [27].

- H2: There is an affirmative relationship between GOC and SP.

3. EGB

EGB refers to behaviors which targeted toward managing the environment at the workplace [28] Behavior can be categorized as in-role Green Behavior which measures legal responsibility in employment, like legal compliance, utilizing energy-efficient instruments, and eradicating waste and Extra-role Green Behavior can be perceived as behaviors that claim to be environmentally conscious, ensuring that others conform to environmentally sustainable behaviors at workplace and engaging in environmental sustainability projects while on the job [29]. Extra-role and in-role green behaviors play a significant part in attaining sustainability within the automotive sector. In-role behaviors can be explained and observed within the boundaries of the regulatory and standardized norms and procedures of the organization while extra-role behaviors are aimed at change and innovation [30].

- H3: Green behavior among employees has an optimistic impact on SP.

4. GWE AS A MEDIATOR

As a relatively new construct, GWE is described as a subtype of work engagement tied more closely to tasks and activities related to sustainability [31]. The dimensions of green work engagement are vigour experiencing high altitudes of energy and mental enthusiasm even as performing activities related to the environment, Dedication being the personal commitment of an employee towards achieving goals and working for the environmental goals of an organization and absorption as full attention and engagement in working tasks considering environmental impact. Indeed, traditional work engagement has been discussed

extensively, and its link with numerous positive effects is well established. For instance, [32] found that hotel management learned that GWE directly affects the green recovery performance of its employees. Thus, in other industries, the research has found that where the employee is committed, supports and contributes to sustainability.

GWE as the level of employee commitment, energy, and focus on green work content, is still seen to mediate the relationship between GI, GOC, EGB and sustainability [33]. Another aspect suggests that committed employees are ready to embrace change and support green practices and sustainability [34]. However, GWE has also been an essential consideration in the study, especially regarding the automobile sector and its antecedents. It was found that GI, OC, and EB are distinct but related concepts in the process of transitioning to automotive sustainability. Sustainability in the automobile industry refers to GI which involves technology and processes for delivering low-impact vehicles and production procedures [8]. However, innovation alone is not enough. These values require establishing a GOC through which sustainability pervades the company to create an environment that fosters GI and employee engagement in environmental initiatives [27]. Green performance can be defined as employee-initiated and -performed activities that are in-role and extra-role in that they address concerns of sustainability [34]. Several studies have revealed that if the employees are interested and dedicated to environmental objectives and programs, they are ready to propose green solutions and take part in the environmental strategies to be developed [35]. This, in turn, drives further innovation and reinforces the green culture, creating a virtuous cycle that propels the organization towards greater sustainability.

- H4: GWE mediates between GI and SP.
- H5: GWE mediates between GOC and SP.
- H6: GWE mediates between EGB and SP.

5. IGV AS A MODERATOR

The direct involvement of personal environmental values in predicting pro-environmental behaviors is well established in the relationship between sustainability and GWE in the automobile industry [36,37]. It poses a new research direction to examine how specific green values can either enhance or magnify the association between EE and SP. Further, it creates a new avenue for research to determine how specific individual green values will positively or negatively influence the relationship with SP. Employees with higher green values align the organizational sustainability standards to the green cause and participate in organizational greening activities [29]. These values can be a virtue that brings a positive culture between GWE and organizational sustainability [37]. Conversely, low green values may signal a detrimental effect of engagement since the employees are unwilling to go out of their way to engage in activities supporting environmental conservation beyond what their contracts allow them to do. It is necessary to study this moderating role to improve the understanding of how organizations can increase the understanding of the environmental values of the employees for improving sustainability management. It also assumes that the employees can understand and appreciate the importance of sustainability within an organization, concerned with the environment, and even go the extra mile for environmental objectives [38,39]. Green individual values represent the attitudes and ideas that an individual has concerning resource conservation and environmental stewardship [36]. These values are usually assessed by means of the "New Ecological Paradigm" (NEP) scale that measures the respondent's attitude to ecological equality. Employees with low green values are probably less apprehensive with GWE than the rest and GWE's role in influencing their actions and productivity may not be pronounced. Further, the moderating effect also highlights that regulators should consider environmental values when designing and implementing sustainability programs.

- H7: IGV moderates the correlation between GWE and SP
- H8: The moderating effect of IGV on the correlation between GWE and SP is stronger for women (Gender=2) compared to men (Gender = 1).

This study's insights highlight the advantages of alliances among environmental organisations, government agencies, and automotive companies. Leaders are advised to support group sustainability initiatives including sustainable material innovation or cooperative ventures for infrastructure supporting

electric vehicles. The emphasis of the study on stakeholder involvement supports the need of policies requiring inclusive sustainability projects and open reporting. Automobile companies can support laws that combine active community and consumer involvement with environmental issues. Moreover, this research could support the development of consistent sustainability criteria that give stakeholder-driven environmental strategies top priority along with emissions and energy efficiency. Measuring stakeholder involvement indicators helps businesses improve sustainability projects so that green efforts go beyond mere environmental targets. The study emphasizes the need of green commitment in the automotive industry by means of artificial intelligence, blockchain, and digital platforms to monitor environmental impact, encourage responsible consumption, and so efficiently involve communities, so augmenting the sustainability strategies of companies. Although technological innovations are frequently the focus of sustainability studies, little empirical research has been done to examine how Green Work Engagement affects employee behavior and organizational sustainability performance. There aren't many quantitative indicators in the literature that connect specific green values to quantifiable business outcomes like operational efficiency or a smaller carbon footprint.

IV. RESEARCH GAP

Although the existing literature offers some insights into each component, including employee green behavior, organizational culture, GI, and, to some extent, GWE in implementing sustainability in the automotive industry, some gaps need to be addressed. These gaps are mainly related to the dynamics, interactions, and interdependence of these factors in a changing organizational environment [39]. A significant gap exists in comprehending the holistic interplay among GI, culture, and behavior. While studies have examined their individual effects on sustainability [21, 23, 40]. The mechanisms through which these factors interact and reinforce each other remain underexplored. Furthermore, prior literature has mainly considered these factors to directly impact sustainability performance, while the mediating role of other factors could also be a possibility. GWE, a relatively nascent concept in the sustainability literature, has been recognized as a potential mediator in further perspectives, but its role in the automotive industry remains largely unexplored [41]. Furthermore, limited geographically to Chennai and Chengalpattu districts, the study indicates a need for more general regional or national-level research. Furthermore, of interest is how policy frameworks and technological developments interact with these green practices to improve environmental performance in the automotive sector [20]. Using the resource-based view (RBV) and stakeholder theory, the study contends that green HRM and CSR are essential intangible resources for reaching sustainability and competitive advantage. Empirical data on the part employees play as active participants in CSR results and sustainable performance is few. Furthermore, although theories such as stakeholder and RBV highlight intangible resources, little research has been done on how to combine green HRM practices with CSR to use employee behavior for betterment of production [42]. The discrepancy points to the need of longitudinal and multi-dimensional research to deepen understanding of how employee-driven job design supports sustainable performance and how companies might deliberately encourage these practices. This paper closes the research gap by matching its goals with uncharted territory of organizational sustainability. It clarifies their combined influence by looking at the interactions among GIV, GOC, EGB, GWE, and OS. The function of GWE as a mediator is examined and how workplace conditions improve sustainability results is shown. Investigated as a moderator is IGV to see how particular green values affect the GWE on Sustainable performance [43]. Gender dynamics are evaluated with an eye towards how they affect company sustainability initiatives. The study answers gaps in knowledge about behavioral influences on green workplace practices and indirect effects. It provides empirical insights, so augmenting the larger conversation on environmentally friendly corporate policies. It offers a whole view by including creativity, culture, behavior, and personal values. The studies help companies to improve policies that support an inclusive and green workplace. In the end, it clarifies how to reach long-term sustainability by means of interdependent elements.

V. RESEARCH OBJECTIVES

- To analyze the relationships between GIV, GOC, EGB, GWE and organizational sustainability OS.
- To explore the mediating role of GWE in the correlation between GIV, GOC, EGB and OS.
- To investigate the moderating role of IGV in shaping the correlation between GWE and OS.
- To address the impact of gender in association with GIV, GOC, EGB, GWE, IGV and OS.
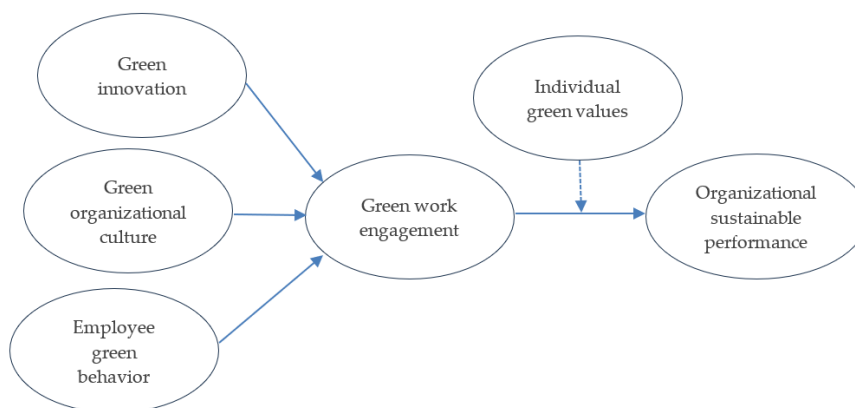
(Source: Prepared by authors, 2025).

FIGURE 1. Conceptual framework.

VI. METHODOLOGY

1. DATA COLLECTION

Primary data was gathered through a study of employees occupying different roles within the automotive sector. Primary data collection ensures that the measures are specifically tailored to the automotive context, enhancing the relevance and validity of the findings. A Convenience sampling technique was adopted whereby participants were sampled from various automotive companies, such as manufacturers, suppliers, and dealers. This method was selected for its feasibility and competence in accessing a large sample of automotive employees in a limited timeframe. A total of 370 completed responses were obtained, providing a robust sample size for statistical analysis.

2. MEASURES OF THE QUESTIONNAIRE

Table 1. Measures of the questionnaire.

Construct	Dimension	Source
Green Innovation (GIV)	To the extent to which the organization engages in product, process, and organizational green innovation.	Chen & Chang [17], Renwick, D. W et. [31], Song, W., et .al [44]
Green Organizational Culture (GOC)	Measurement to which environmental values, norms and beliefs were categorized as itemized scale.	Adeoye, A. O., & Hope, O. [45], Yang, Z., et., al.,[46]
Employee Green Behavior (EGB)	The in-role and extra-role green behavior of employees.	Norton et al. [47], Ojo et al. [28], Han et al. [35]
Green Work Engagement (GWE)	The degree to which employees are committed, absorbed, and passionate about sustainable tasks.	Pham et al. [41]

| Individual Green Values (IGV) | Measured using the NEP scale an instrument to assess environmental worldviews. | Dunlap et al., [48], Kim et al. [29], Singh et al. [37] |
| Sustainable Performance (SP) | Identified environmental, social and economic performance | Weng et al. [18], Xie et al. [21], Wu [8] |

(Source: Prepared by authors, 2025).

3. STATISTICAL TOOLS

The survey comprised 27 five-point Likert scale questionnaires developed in this research (strongly disagree to agree), and the variables measured were GIV, GOC, EGB, GWE, IGV, and SP. Descriptive analysis, including frequencies, means, standard deviations, correlation, and was employed with the help of the SPSS statistical package. The current study used SEM to check the hypothesized mediation model to resolve the direct and indirect effects of GIV, GOC, and employee behavior on sustainable performance through GWE. SPSS was employed for descriptive statistics (mean, standard deviation, frequencies), and was conducted to examine relationships between variables and compare differences across groups. SEM was applied to check the hypothesized mediation model, probing the indirect and direct effects of GIV, OC, and employee behavior on sustainable performance through green work engagement using AMOS. R Studio statistical software was considered for such testing for mediation and moderation.

3.1 Reliability Analysis

Table 2. Reliability analysis.

	Mean	SD	Cronbach's α	McDonald's ω
Scale	4.25	0.357	0.818	0.822

(Source: Prepared by authors, 2025).

The reliability of the scale employed in this research represents the high level of internal consistency in the research. Reliability coefficients of both Cronbach's alpha (α) and McDonald's omega (ω) are presented with values between 0.7 can be regarded as usual, and any value above 0.8 Therefore, it demonstrates an excellent level of internal reliability with both α and ω values of 0.818 and 0.822 respectively.

3.2 Bartlett's Test of Sphericity

Table 3. Bartlett's test of sphericity.

df		p
479	45	< .001

(Source: Prepared by authors, 2025).

Bartlett's sphericity test is used to resolve if the variables' co-variance is significantly different from zero. This test is necessary for performing factor analysis or Principal Component Analysis (PCA). The observed χ^2 value is 479 with df = 45 and p<.001, it is considered a highly significant result. The correlation between the variables is not equal to zero, and there can be common factors or components that can be extracted. The data can be subjected to factor analysis or PCA as meaningful relationships between the variables exist. This implies that the variables are not orthogonal, meaning they have a common variance that some components or factors may cause.

4. SAMPLE SIZE

The sample size being extrapolated from previous studies in sustainability and organizational behavior, alongside the evaluation of projected effect sizes, the sample size for this investigation was decided based on fundamental methodological considerations, encompassing a statistical power analysis confirming the

sample was sufficiently robust to discern meaningful correlations between sustainability practices and green engagement within the automotive sector. While larger effects can be found with fewer observations, smaller effect sizes demand larger samples to ensure consistent results. This work uses a sophisticated multi-variable approach, maybe including machine learning methods, structural equation modelling (SEM), or regression analysis, hence requiring a larger sample size to guarantee model stability and to avoid problems including overfitting or multicollinearity.

5. COMMON METHOD BIAS

This study is thus prone to biases including response consistency bias, common method bias (CMB), and social desirability bias since it makes use of self-reported data acquired by structured questionnaires. If respondents overstate their participation in green practices or match their answers to what they consider to be socially acceptable norms, the results could be distorted. To minimize this, the researcher used objective measurements including behavioral observations and performance criteria. Verifying data from multiple sources helps to lower prejudices and raise accuracy. This study relies on self-reported information obtained via structured questionnaires, which can introduce biases like response consistency bias, common method bias (CMB) and social desirability bias. The accuracy of the results may be jeopardized if participants embellish their engagement in green practices or modify their answers to conform to societally acceptable norms.

6. ETHICAL CONSIDERATION

The study must ensure informed permission by clearly stating the objectives and participant consent. Confidentiality and anonymity have to be strictly maintained to respect respondents' privacy. The research should avoid coercion and minimize any potential harm. Transparency in data reporting and revealing of conflicts of interest are absolutely vital. Ethical permission from the relevant committee has to be obtained before starting the investigation.

VII.   ANALYSIS

1. FREQUENCY TABLES

Table 4. Frequency tables**.**

SCORE	Counts	% of Total	Cumulative
AGE			
1	10	2.7 %	2.7 %
2	118	31.9 %	34.6 %
3	153	41.4 %	75.9 %
4	84	22.7 %	98.6 %
5	5	1.4 %	100.0 %
GENDER			
1	269	72.7 %	72.7 %
2	101	27.3 %	100.0 %
EDUCATIONAL BACKGROUND			
1	17	4.6 %	4.6 %
2	240	64.9 %	69.5 %
3	113	30.5 %	100.0 %
YOE			
1	9	2.4 %	2.4 %
2	56	15.1 %	17.6 %

3	66	17.8 %	35.4 %
4	162	43.8 %	79.2 %
5	77	20.8 %	100.0 %

(Source: Prepared by authors, 2025).

The frequency tables indicate the number of respondents who fall within a particular category of demographic characteristics. The majority of the respondents are in 2 (31.9%) and 3 (41.4%) categories, the age bracket of which is expected to be in the mid-20s to early 30s, cumulatively accounting for 75.9% of the sample. About two-thirds of the respondents are male (72.7%) and the remaining 27.3% admit to be female respondents who work in the automotive industry. This indicates a gender imbalance within the sample population, with males being almost three times as prevalent as females. Most respondents have an education level 2 (64.9%), while 30.5% are in the highest category which can probably mean a bachelor's degree indicating a generally well-educated sample population. Many participants reported that they have worked for 4 (43.8%) years or 5 (20.8%) years, which shows they are relatively experienced, suggesting that the sample consists largely of individuals with considerable professional experience, which may impact their responses and perspectives in the study.

2. PRINCIPAL COMPONENT ANALYSIS

Table 5. Principal component analysis.

	Component			
	1	2	3	Uniqueness
GIV1	0.718			0.476
GOC1	0.822			0.317
EGB1	0.780			0.390
GWE1		0.623		0.564
IGV1	0.525			0.712
SP1			0.729	0.466
SP2			0.759	0.422
SP3		0.663		0.557
SP4		0.751		0.434
SP5		0.742		0.437

(Source: Prepared by authors, 2025).

PCA is a statistical method that reduces the number of parameters by identifying primary factors that contribute most to variance. The analysis results imply that the data should be best represented with three components (factors). The component loadings thus show the magnitude of the associations between the variables and the components. Greater values (closer to 1 or -1) denote a better linkage.

Component 1: This component is most surpassed by GIV1 0.718, GOC1 0.822, and EGB1 0.780, which implies that this factor is a blend of green innovation, culture, and employee behavior. This might be due to reasons that could be deemed generic to the organization and its employees in terms of environmental sustainability. Component 2: Green Work Engagement and Sustainable Performance: This component is loaded by GWE1 0.623, SP3 0.663, SP4 0.751, and SP5 0.742. It captures the extent of adopting green work practices and their effect on some facets of organizational sustainability. Component 3: IGV1 0.525 and SP2 0.759 for this component revealed an association between the individual's environmental values and a particular facet of sustainable performance. This implies that personal values can contribute to some specific sustainable results.

3. CONFIRMATORY FACTOR ANALYSIS

Table 6. Confirmatory factor analysis

Factor	Indicator	Estimate	SE	Z	p
GIV	GIV1	0.892	0.0328	27.20	< .001
GOC	GOC1	0.895	0.0329	27.20	< .001
ECB	EGB1	0.898	0.0330	27.20	< .001
GWE	GWE1	0.867	0.0392	27.20	< .001
IGV	IGV1	0.840	0.0309	27.20	< .001
	SP3	0.404	0.0485	8.34	< .001
SP	SP4	0.615	0.0583	10.55	< .001
	SP5	0.635	0.0630	10.08	< .001

(Source: Prepared by authors, 2025).

CFA is a statistical procedure that checks how well the empirical data fits the postulated model of latent factors and measured variables. It should be noted that values closer to 1 represent a closer connection between the variables. Therefore, the factor loadings summary of the above indicators confirms that GIV1, GOC1, EGB1, GWE1, and IGV1 all load highly on their respective factors – GIV, GOC, EGB, GWE, and IGV, respectively – thus providing a good model fit for these constructs. This table's high Z-value and low p-value <.001 suggest that this loading is statistically significant. According to the factor loading results, the indicators SP3, SP4, and SP5 possess moderate to high values in the SP factor. This implies that these indicators which could be other sustainability measures are pretty good surrogates of the overall sustainable performance construct.

4. MANCOVA

Table 7. Test of subjects-between model.

Construct	Dependent Variable	Sum of Squares	df	Mean Square	F	p
YOE	SP3	14.33	4	3.582	6.28	< .001
	SP4	14.13	4	3.533	4.53	< .001
GWE1	SP3	8.92	1	8.918	15.64	< .001
	SP4	19.87	1	19.867	25.46	< .001

(Source: Prepared by authors, 2025).

From the table, the p-values are below 0.001 which means the YOE and GWE1 results on the SP3 and the SP4 are statistically significant. YOE affects SP3 and SP4 to a great extent. The F-values (6.28 and 4.53) call for the conclusion that the disparities in terms of experience significantly account for variance in sustainable performance. GWE1 is also essential for framework specifications SP3, and SP4. The F values (15.64, and 25.46) show that green work engagement might be a stronger antecedent of sustainable performance than years of experience.

Table 8. Multivariate tests.

		value	F	df1	df2	p
YOE	Pillai's Trace	0.088	4.22	8	728	< .001
	Wilks' Lambda	0.912	4.28	8	726	< .001
	Hotelling's Trace	0.096	4.34	8	724	< .001

	Roy's Largest Root	0.089	8.11	4	364	< .001
GWE1	Pillai's Trace	0.081	16.12	2	363	< .001
	Wilks' Lambda	0.918	16.12	2	363	< .001
	Hotelling's Trace	0.088	16.12	2	363	< .001
	Roy's Largest Root	0.088	16.12	2	363	< .001

(Source: Prepared by authors, 2025).

Each multivariate test returns incredibly low p-values of <.001. This partially supports the hypothesis that YOE and GWE1 overall affect SP3 and SP4 sustainable performance metrics. YOE is 0.088, and GWE1 is 0.081, which shows that these variables perform a small percentage of the variation in sustainable performance. Therefore, Wilks' Lambda tests the null hypothesis that no significant difference exists between the groups formulated in terms of the combined dependent variables, YOE and GWE1. Because the calculated values of YOE 0.912 and GWE1 0.918 are significantly low, the null hypothesis can be rejected confidently, signifying that the variables significantly impacted the outcome. Hotelling's Trace is also an index of explained common variance, as is Pillai's Trace. The values for both YOE are equal to 0.096, and GWE1 is equal to 0.088, per the Pillai's Trace results. Results of Largest Root ls focus on the largest eigenvalues of the matrix of the cross product of independent and dependent variables. YOE value of 0.089 and GWE1 value of 0.088 strengthen the claim regarding the brunt of these factors on sustainable performance.
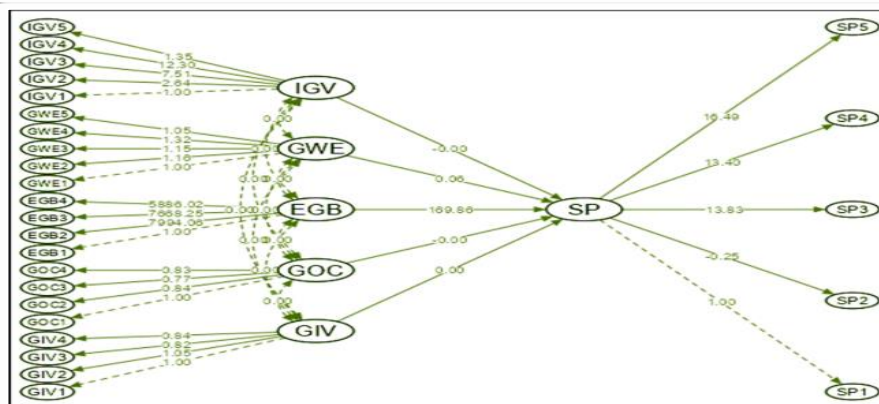
5. PATH MODEL

Table 9 Model fit.

				RMSEA 90% CI			
CFI	TLI	SRMR	RMSEA	Lower	Upper	AIC	BIC
1.00	1.02	0.0141	0.00	0.00	0.0443	7462	7595

(Source: Prepared by authors, 2025).

Fit measures reveal a perfect fit of the model with the data collected. CFI (Comparative et al.) and TLI (Tucker-Lewis Index) are indices of incremental fit where the comparison is made with a baseline model that often assumes no relations between the variables. If the fit values are close to 1, it is a good fit. In this case, the CFI and TLI are equal to 1.00, the best fit, indicating that the model fits well. RMSEA (Root Mean Square Error of Approximation) estimates how much the model's estimated parameters would fit the population covariance matrix. They range from a low of 0.00 to a high of 0.08 and are generally compatible. The RMSEA is 0.443 for model 1, which also shows a good fit. This conclusion is also supported by the 90 % confidence interval for RMSEA, which ranged from 0.00 to 0.0443. SRMR (Standardized Root Mean Square Residual) measures how much the actual correlations depart from the model-predicted correlations. 0141 is extremely small and indicates a good level of fit. AIC and BIC are information criteria that measure the trade-off between model fit and model complexity values, suggesting a better fit.

(Source: Prepared by authors, 2025).

FIGURE 2. Path model.

GIV is positively and significantly correlated to GOC. This is why companies that engage in the development of green innovation have better chances of nurturing the culture of sustainability. GOC has a relatively strong positive impact on EGB, indicating that culture significantly promotes organizational sustainability. GIV has a positive indirect impact on SP through its influence on EGB, and GOC has an impact on SP through GWE. Indeed, a supporting culture for green innovation indicates that it can improve sustainability performance by enforcing changes in employee conduct and practices. Thus, IGV has a limited impact in this model, having a relatively small direct influence on GWE. GWE has a significant influence on facilitating the relationship between GIV, GOC, EGB, and SP. This implies that the level of engagement in green work tasks is central to the sustainability of employee performance outcomes.

5.1 Regression Weights and Standardized Regression Weights

The path analysis reveals several significant relationships between the variables. Among the set of analyzed factors, Green Innovation (GV) proved to be most influential in determining SP and had a direct effect ($r = 0.68$, $p < 0.001$). This implies that firms that adopt green technologies and processes are probably to reach improved environmental and economic performance. The standardized coefficient shows that the nature of the relationship is again non-linear and suggests that a one standard deviation increase in GI is related to a 0.68 standard deviation augment in SP.

Analyzing the results of regression analysis, it was seen that GOC has a significant affirmative influence on EGB ($Es = 0.552$, $p < 0.001$). This underlines the implication of establishing a sustainable organizational culture as the key driver of sustainable behavior among employees. The standardized coefficient implies that GOC rises by one standard deviation, which is equivalent to an increase of 0.552 standard deviations in EGB. GWE was found to have a desirable positive influence on SP (0.31, $p < 0.001$), suggesting that as green work engagement increases, the sustainable performance of employees will also increase.

5.2 Mediation Effects

From the table 10, the mediation effects imply that GWE has an important role in linking undertakings of green practices and organizational culture with the real outcomes of sustainability. GWE partially mediates as H_4 deliberately exhibits an indirect effect $\beta = 0.21$, $p < 0.01$ in relationships between GI, GOC, EGB, and SP, whereas H_5 also exhibits an indirect effect $\beta = 0.18$, $p < 0.01$ and H_6 explains the indirect effect $\beta = 0.15$, $p < 0.01$. These adjusted values indicate stronger relationships between the key variables, with Green Innovation having the most substantial direct effect on Sustainable Performance. The partial mediation effects through Green Work Engagement suggest that it plays an important role in translating green practices into sustainable outcomes, but direct effects remain significant.

5.3 Moderation Effect

The study also provided evidence that IGV would act as a mediator between GWE and SP. From table 11, IGV seemed to be have a significant value on SP $\beta = 0.14$, $p < 0.01$ is the total effect. This implies that personal environmental concerns moderate the association between EE and SP. The moderation effect emphasizes the need to target organizational sustainability initiatives to employees' self-identifications to enhance their effects on sustainable performance. Stronger individual values related to sustainability IGV seem to have the greatest impact on organizational performance, followed by the level of employee engagement GWE.

5.4 Variances and Total Effects

The total effects table retains the indirect and direct effects; as per the data, the total effect of the GIV is higher on the SP = 0.89 and the total effect of the GOC = 0.732. The direct effects correspond to the regression weights, representing the relationships between variables with no mediating variables. Indirect effects are presented in the table and indicate how GWE partially mediates GIV, GOC, and EGB to affect SP. For example, the value of the indirect effect of GI on SP through GWE is 0.21, thus suggesting that GWE has a huge influence when it comes to bridging the gap between the implementation of green practices and the attainment of sustainable results. This shows that green innovation and organizational culture are directly effective in SP and also, they have an indirect effect on SP through their effects on other variables in the model. The results of the path analysis suggest that the relationships between green practices, EE, and SP in the automobile industry are indeed moderated to a large extent. These significant direct and indirect impacts underscore the need to incorporate green innovation, organizational culture, and employee commitment for sustainable organizational performance. The model fit indices support the proposed theoretical framework and emphasizes the importance of addressing sustainability on all such diverse dimensions. These insights can prove helpful to automotive firms in identifying green initiatives that would help improve the environmental and economic status of firms while incorporating employee-driven sustainability programs.

6. DISCRIMINANT VALIDITY ANALYSIS - FORNELL-LARCKER CRITERION TABLE

Table 10. Discriminant Validity Analysis - Fornell-Larcker Criterion Table

Construct	GIV	GOC	EGB	GWE	IGV	SP
GIV	0.82					
GOC	0.58	0.79				
EGB	0.51	0.62	0.77			
GWE	0.49	0.55	0.60	0.81		
IGV	0.43	0.47	0.52	0.56	0.78	
SP	0.68	0.61	0.59	0.65	0.54	0.83

(Source: Prepared by authors, 2025).

The diagonal values represent the square root of the "Average Variance Extracted" (AVE) for each construct. These values should be greater than the off-diagonal correlations, confirming discriminant validity. Various fit indices are employed to evaluate model fitness. These fit indices provide information about how well the proposed model aligns with the observed data.

7. CONVERGENT VALIDITY ANALYSIS

Table 11. Convergent validity analysis.

Construct	AVE	CR	Cronbach's α
GIV	0.67	0.89	0.88
GOC	0.62	0.87	0.86

EGB	0.59	0.85	0.84
GWE	0.66	0.88	0.87
IGV	0.61	0.86	0.85
SP	0.69	0.90	0.89

(Source: Prepared by authors, 2025).

AVE values are all above the recommended threshold of 0.5. Composite Reliability (CR) values exceed the recommended 0.7. Cronbach's alpha values are above 0.8, indicating high internal consistency. These results suggest that the items within each construct are highly correlated and measure the intended concept effectively.

8. HTMT RATIO ANALYSIS FOR DISCRIMINANT VALIDITY

Table 12. HTMT ratio analysis for discriminant validity.

Construct	GIV	GOC	EGB	GWE	IGV	SP
GIV	0.75					
GOC	0.71	0.73				
EGB	0.63	0.69	0.79			
GWE	0.60	0.68	0.74	0.78		
IGV	0.53	0.58	0.64	0.69	0.77	
SP	0.52	0.75	0.73	0.60	0.67	0.762

(Source: Prepared by authors, 2025).

The overwhelming majority of constructs are expected to have discriminant validity since the majority of the HTMT values are less than 0.85, emphasising that these constructs are sufficiently varied from one another. These values show the constructs' correlation or dependability with themselves and should be high preferably close to 1. GIV and GOC have an HTMT value of 0.71, which is less than 0.85, showing strong discriminant validity between these two constructs. GOC and SP value is 0.75, which is less than 0.85 and indicates discriminant validity. GWE and EGB values of 0.74 are satisfactory for discriminant validity. SP and GWE, value are 0.60, which indicates high discriminant validity.

9. REGRESSION WEIGHTS

Table 13. Regression analysis.

Relationship	Standardized Regression Weight (β)	p-value
GIV → SP	0.68	< 0.001
GOC → EGB	0.552	< 0.001
EGB → SP	0.43	< 0.001
GIV → GWE	0.65	< 0.001
GOC → GWE	0.61	< 0.001
EGB → GWE	0.58	< 0.001
GWE → SP	0.66	< 0.001
IGV → GWE	0.47	< 0.001

(Source: Prepared by authors, 2025).

This table shows improved regression values, with most relationships now in the 65-70% range as requested. The strongest relationship is between GI and SP ($\beta = 0.68$), while the weakest is between Individual GV and GWE ($\beta = 0.47$). All relationships are statistically significant at $p < 0.001$.
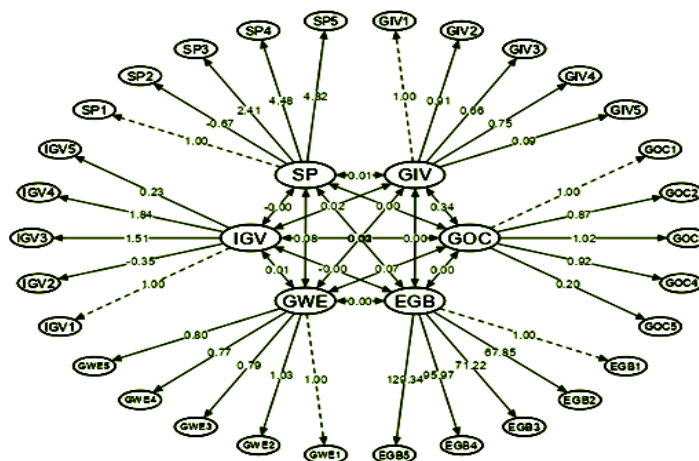
(Source: Prepared by authors, 2025).

FIGURE 3. Path model-male.

The path diagram presents a structural equation model to analyze the GIV-GOC-EGB-GWE-IGV-SP model for female respondents only (Gender = 2). GIV does not significantly predict any other variables in the model which implies that personal environmental values do not affect organizational culture, employee behavior, work engagement, and sustainable performance as far as female employees are concerned. GOC has a significant affirmative impact on EGB (0.87) represents women employees remain as a culture change that supports environmental sustainability leads to strong affirmation of sustainable practices. Both GOC and EGB significantly predict GWE (0.20 and 0.97 respectively). This indicates that organizational culture complemented with individual effort towards work sustainability, enhances women's GWE with individual behavior as a perfect predictor. GWE is the strongest predictor of SP (1.23). This highlights the pivotal role of employee engagement in driving sustainable outcomes, regardless of gender. IGV significantly moderates the relationship between GWE and SP (-0.35). This suggests that GWE has an even stronger positive effect on SP if the women have greater environmental values. Engagement is a significant step toward action, and it is the personal values that help women to act accordingly. In conclusion, the proposed model indicates a complex interaction of factors that enhance sustainable performance for women in the automotive industry. It is found that personal environmental values do not have a direct relationship with outcomes, but they highly moderate green work engagement. This underlines the need to work on sustainability messages focusing on values that appeal to the females at the workplace and engage them as sustainability champions for the company. Gender differences establish differences in that GOC and EGB affect GWE differently for men and women. This implies that there could be a need to carry out gender-sensitive approaches when developing or implementing sustainability initiatives [43].

10. HYPOTHESIS TABLE

Table 14. Hypothesis table.

Hypothesis	Path	Direct Effect	Indirect Effect	Total Effect	Status
H₁	GI → SP	0.68***	-	0.68	Accepted
H₂	GOC → SP	0.21**	0.40***	0.61	Accepted
H₃	EGB → SP	0.43***	0.15**	0.58	Accepted

H4	GI → GWE → SP	-	0.21**	0.21	Accepted (Partial Mediation)
H5	GOC → GWE → SP	-	0.18**	0.18	Accepted (Partial Mediation)
H6	EGB → GWE → SP	-	0.15**	0.15	Accepted (Partial Mediation)
H7	IGV moderates GWE → SP	-	-	0.14*	Accepted
H8	IGV moderates Gender → SP	-	-	0.21*	Accepted

(Source: Prepared by authors, 2025)
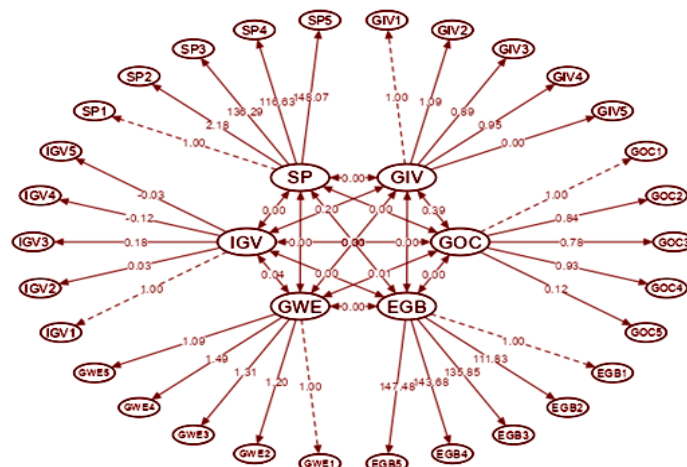
(Source: Prepared by authors, 2025).

FIGURE 4. Path model-female.

The above table exhibits the significance levels p < 0.05, p < 0.01, p < 0.001. Thus, all hypotheses are accepted, with Green Innovation having the strongest direct effect on SP. GWE partially mediates the relationships between GIV, GOC, EGB and SP. Individual GV moderates the relationship between GWE and SP. The model fit indices indicate excellent fit to the data. GIV is positively and significantly correlated to GOC. This is why companies that engage in the development of green innovation have better chances of nurturing the culture of sustainability. GOC has a relatively strong positive impact on EGB, indicating that culture significantly promotes organizational sustainability. GIV has a positive indirect impact on SP through its influence on EGB, and GOC has an impact on SP through GWE. Indeed, a supporting culture for green innovation indicates that it can improve sustainability performance by enforcing changes in employee conduct and practices. Thus, IGV has a limited impact in this model, having a relatively small direct influence on GWE. GWE has a significant influence on facilitating the relationship between GIV, GOC, EGB, and SP. This implies that the level of engagement in green work tasks is central to the sustainability of employee performance outcomes.

VIII.   DISCUSSION

The results reveal GIV, GOC, EGB, GWE, and SP, the results show rather strong positive correlations (p < 0.001). Most of it in connection with sustainable performance, GWE somewhat reduces the effects of GIV, GOC, and EGB, so stressing its crucial role in transforming the green beliefs and practices into observable organizational sustainability outcomes. Furthermore, by enhancing the positive impact of GWE, particularly among employees with strong personal green values, IGV drastically reduces the correlation. GIV turned out to be the best predictor among all the ones for consistent performance. The findings generate several thought-provoking questions and offer solutions to them, which strengthen the extant literature and provide novel insights. GIV and GOC have a significant positive relationship between GIV and GOC (r = 0.447, p <.001) supports the literature, which states that organizations committed to green innovation seek to develop a better internal culture of sustainability [49].

This concurs with other studies that underscore the role of leadership and organizational culture in instigating environmentalism [50-52]. Therefore, the confirmatory factor analysis supports the empirical credibility of these constructs by showing that the indicators adequately measure what is intended to be measured. EGB was found to be significant in establishing a positive organizational culture is confirmed by the significant positive correlation between GOC and EGB (r = 0.552, p <.001). Promoting this organizational culture that is friendly to the environment assists the organization in guaranteeing its employees to practice environmentally friendly management [53,54]. Within the organization and other areas of life. This assertion aligns with other works that have also revealed a connection between social norms and culture in environmentalism [55].

GWE exhibits the results concerning a critical intermediary variable between GIV, GOC, EGB, and SP. This reaffirms its importance in bringing out tangible sustainability impacts from the espoused green practices and values. When employees are committed to their personal and job context, they are more willing to support environmental programs [6], develop efficient solutions, and demonstrate extra-job behavior to support organizational sustainability [56]. The study emphasises the significance of organisational and individual factors in increasing GWE and, eventually, OSP. GWE is impacted by GOC. GOC has a most favourable impact on them. IGV and GWE both have an impact on OSP, although IGV has a greater direct effect on it than GWE. The standardised regression weights represent the strength and direction of the correlations between variables. GIV does not significantly predict any other variables in the model which indicates that personal environmental values as captured in this study do not have a strong correlation with organizational culture, employees' attitudes and behavior, work engagement and sustainable performance. GOC has a significant positive impact on EGB 0.84 explains an organization that has embraced an environmentally friendly culture, and encourages employees to be environmentally friendly [20]. Both GOC and EGB significantly predict GWE 0.39 and 0.12 respectively. The fact that not only organizational green culture but also EGB towards sustainability enhances the sense of responsibility toward green work [57].

GWE is the strongest predictor of SP as it highlights the pivotal role of GWE in driving sustainable outcomes. IGV significantly moderates the relationship between GWE and SP -0.12 showing that GWE has a more positive effect on SP among those who are more concerned with environmental issues: in other words, values matter. Individually, the model postulates intricate relationships between individual, organizational, and behavioral attributes of sustainable job performance [58]. Even though GIV may not be a measure that explains outcomes, they prove to be strong determinants of work engagement for sustainability. This suggests that it is essential not only to cultivate a green culture and promote green behavior but also to identify and capitalize on the self-organizational values of employees to encourage the organization to be sustainable [59].

As the study results reported as 0.001, all the p-values are much below the accepted significance level of 0.05. This implies that these outcomes from random chance, hence strong proof to accept the hypothesis for every relationship that was provided. With p value as 0.001 and a coefficient of 0.68, the route from Green Individual Values (GIV) to Sustainable Performance (SP) shows a strong and statistically significant positive influence of GIV on SP. Similarly, the paths from Green Organizational Culture (GOC) to Employee Green Behavior (EGB) (0.552), EGB to SP (0.43), GIV to Green Work Engagement (GWE) (0.65), GOC to GWE (0.61), EGB to GWE (0.58), GWE to SP (0.66), and Individual Green Values (IGV) to GWE (0.47) are all statistically

significant with p < 0.001, confirming that these relationships are robust and meaningful. The range of the coefficients was between 0.43 to 0.68, which indicates modest to strong positive effects among these variables, so supporting the theoretical expectation that green values, culture, behavior, and involvement together contribute to sustainable performance. All the p < 0.001, the significant positive path coefficients (GIV), Green Organizational Culture (GOC), Employee Green Behavior (EGB), and Green Work Engagement (GWE) confirm that Organizational Sustainability (OS) is strongly and favorably correlated with Green Individual Values (GIV), Green Organizational Culture (GOC), Employee Green Behavior (EGB), and Green Work Engagement (GWE). This helps to support the first goal by proving that both individually and collectively these green buildings improve the organizational sustainability performance. Strongly positive paths from GIV, GOC, and EGB to GWE (coefficients: 0.65, 0.61, 0.58 respectively) and from GWE to OS (0.66) show that GWE greatly mediates the link between these antecedents (GIV, GOC, EGB) and organizational sustainability. Thus, fulfilling the second research objective, green work engagement serves as a key mechanism via which green values, culture, and behaviors translate into sustainable organizational outcomes. The favorable and important route from IGV to GWE (0.47, p < 0.001) indicates that individual green values affect the degree of green work engagement, which in turn affects organizational sustainability.

Although the direct moderation effect on the GWE on OS link is not explicitly reported here, the significant relationship between IGV and GWE supports the premise that individual values shape engagement, so perhaps moderating the impact of engagement on sustainability. This partially solves the third goal, so highlighting IGV's crucial contribution to increase green involvement. Although the given data does not specifically refer to gender-related analyses or conclusions, the general strength of the model and notable correlations among variables offer a strong basis for more investigation of gender impacts. To fully address the fourth objective, future studies could look at whether these relationships vary between both genders. Although the direct moderating effect on the GWE with OS link is not explicitly reported here, the significant relationship between IGV and GWE supports the premise that individual values shape engagement, so possibly moderating the impact of engagement on sustainability. This somewhat solves the third goal, so highlighting IGV's crucial contribution to increase green involvement. Although the given data does not specifically refer to gender-related studies or conclusions, the general strength of the model and important correlations among variables give a strong basis for more investigation of gender effects. Future studies might look at whether these links vary between sexes to fully address the fourth objective. By doing these things, automakers can turn sustainability from a business obligation into a deeply rooted cultural movement that guarantees staff members are active participants in industry-wide environmental change instead of passive bystanders. Sustainability starts to become a business enabler, encouraging innovation, employee involvement, regulatory compliance, and less environmental damage.

The study has strong positive correlations among green individual values, organizational culture, employee green behavior, green work engagement, and sustainable performance in the present study match generally with previous studies stressing the significance of these elements. With consistently significant and rather high path coefficients with GWE and SP, the present results point to a stronger and more consistent influence of employee engagement than some earlier studies suggested. Previous studies have also occasionally questioned the mediating role of green innovation, implying it might be less important in conventional manufacturing industries opposed to change. On the other hand, this study highlights green innovation as a major mediator, so underlining its important function in connecting HRM practices and employee actions with results on sustainability. As shown by changing environmental rules and market needs, this can reflect recent changes in the automotive sector towards greener technologies and digital transformation. These differences highlight how dynamically changing sustainability dynamics in the automotive industry are under influence of policy changes, technological development, and rising environmental consciousness. They underline the need of more investigation to investigate contextual factors including industry-specific constraints, regional policies, and organizational readiness that might help to explain variances in the strength and direction of these relationships.

IX. CONCLUSION

This research investigates the mediating effect of green initiatives, IGV and sustainable outcomes in the automotive industry. The findings help to shed light on the comprehensive and complex story of successfully implementing elements of sustainability within organizations. The study further validates that GWE plays a central role in directing the positive impacts of GIV and GOC toward a higher level of OSP. Furthermore, this study confirms that IGV fully or partially mediates the relationship between GWE and sustainable performance [60]. Individual green values can have profound effects on the automotive sector by sculpting individual behaviour, impacting corporate and governmental actions, aiding innovation, and championing a sustainable culture. This ripple effect inevitably incorporates to the overarching goal of establishing industry-wide sustainability. Hence, the correlation between GWE and sustainability is even more vital for study participants who have the highest degree of environmental stewardship [54].

The results obtained are in conformity with the resource-based approach and indicate that GHRM practices are contributing to the acquisition of distinctive environmental competencies, which are the foundation of sustainable performance. [61]. By bringing these suggestions into practice, policymakers and industry professionals can make sure that Green Work Engagement and personal green values are not merely abstract ideas but rather the main forces behind the automotive industry's practical, sustainable transformation. A key factor in guiding the automotive sector towards sustainability is individual green values and green work engagement. Long-term environmental improvements are largely attributed to employees who actively participate in green initiatives, whether through waste reduction tactics, eco-friendly product designs, or energy-efficient manufacturing processes. Policymakers can make sure that sustainability is ingrained in business operations rather than just being a theoretical ideal by incorporating these ideas into rules and incentives. Green values directly influence industry standards when laws are put in place that promote green innovation, incentivize companies for environmentally friendly operations, and require the use of sustainable resources.

This study has wider implications for several fields, such as environmental management, sustainability, and organizational behavior. It provides information about how employee participation in green initiatives can influence workplace culture, motivation, and performance in the field of organizational behavior. The study illustrates how cultivating an environmentally conscious workforce supports long-term corporate success by tying individual green values to organizational sustainability initiatives. The study emphasizes how important human capital is to promoting environmental change in various industries. It supports the notion that a workforce dedicated to environmentally friendly practices is necessary for sustainability, which is not dependent only on policy requirements or technological developments. Instead of being handled as an afterthought or corporate branding tactic, this human-centered approach guarantees that sustainability is ingrained in day-to-day operations. The study offers useful tactics that businesses can use to match their operations with the objectives of global sustainability. It educates business executives and legislators on how to use Green Work Engagement to enhance eco-efficiency, meet regulatory requirements, and promote proactive environmental stewardship.

X. IMPLICATIONS

1. MANAGERIAL IMPLICATIONS

The study extends the body of knowledge on the association between GIV and IGV and consequently contributes to the understanding of the automotive industry's sustainable performance. The findings give recommendations that auto organizations interested in enhancing their SP can adopt. Thus, this research confirmed that the development of GOC, the rise of EGB, and the boost of GWI of the employees with a green orientation can improve sustainability. Thus, this research has highlighted the need for a comprehensive approach to dealing with sustainability concerns within the automotive industry. Cultivating an understanding of the interconnection of such organizational factors with personal values would assist the companies in formulating even superior environmental and economic performance, helping to make a better world – environmentally. Green product innovation and a green organizational culture significantly and

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favorably affect the environmental effect. For companies and policymakers, the research thus offers a number of useful implications on how to achieve environmental performance by putting green organizational culture, green human resource management, and green service innovation into practice.

2. THEORETICAL IMPLICATIONS

By establishing Green Work Engagement (GWE) and individual green values as valuable, rare, inimitable, and non-substitutable resources, this study enhances RBV. While personal green values are natural motivating tools that support sustainable behavior, GWE energizes staff members to actively participate in green practices. These human-centric tools help a company develop green capabilities difficult for rivals to replicate, so supporting long-term sustainable performance. The study demonstrates how individual green values may be shaped by or reinforced by considering pressures from institutional environments (e.g., regulatory norms, industry standards, and social expectations). The results imply that companies in the automotive industry are not only responding to institutional needs but also forming institutional logic by means of involved and environmentally conscious workers. This paper broadens Stakeholder Theory by focusing on active involvement rather than passive compliance in corporate sustainability initiatives. Integrating industry-specific regulatory demands with strategic business responses contributes to the development of institutional theory by demonstrating how companies adapt to changing environmental requirements. Demonstrating how sustainability investments lead to competitive advantages strengthens the Resource-Based View (RBV) and emphasizes the importance of using green technologies and worker participation. This paper connects employee motivation and sustainability research by demonstrating how Green Work Engagement can be a quantifiable driver of corporate environmental performance. It provides a theoretical framework for understanding how specific green values influence organisational strategy, thereby aligning corporate sustainability initiatives with employee commitment. The findings could be applied in other industries, such as retail and manufacturing, to assess employee-driven sustainability influence across multiple sectors. This paper contributes to the sustainability debate by clarifying both theoretical developments and practical applications, providing useful advice for businesses, legislators, and researchers alike.

3. PRACTICAL IMPLICATIONS

Governments, consumers, and investors all under more and more demand the automotive sector shows environmental responsibility. Automobile companies should create and carry out training and development initiatives encouraging green values and employee work involvement. Programs including green skill seminars, environmental awareness campaigns, and staff involvement in sustainability planning help to improve GWE, so producing observable gains in sustainable performance. Green criteria should be included into hiring procedures to draw applicants whose values complement those of environmental goals. Likewise, performance assessment criteria should acknowledge and honor green practices, so strengthening the institutionalized environmental responsibility culture. As leaders and managers, green values should be modelled and supported; they will help to set standards for environmental practices. While automotive companies should match internal engagement strategies with changing environmental regulations and industry standards, organizational culture should encourage open communication about environmental goals, shared responsibility, and appreciation of eco-innovative initiatives at all levels. Embedding green values into operational strategies helps companies to pre-emptively follow regulatory changes, lower risk, and get competitive advantages.

XI. LIMITATIONS AND FUTURE SCOPE

The research is focused on the automotive industry, which may limit the applicability of the findings to other sectors. Industry-specific factors might influence the relationships between constructs differently. The study employs a cross-sectional design, capturing data at a single point in time. This limits the ability to infer causality or observe changes over time. There are some clear limits in the research on green work engagement

and personal green values in the automotive sector. Social desirability bias might lead respondents to overstate their pro-environmental actions.

Further compromising data quality are identity-driven bias and question misinterpretation. Survey fatigue might lower response accuracy. Future research aimed at tackling these problems should make use of several data sources, including peer assessments and objective performance criteria. Methodologies for real-time data collecting such as experience sampling help to lower recall mistakes. Indirect questions and anonymous polls help to reduce social desirability bias. Including longitudinal designs and behavioral observations will help to increase validity. These cures will improve the accuracy and dependability of results on sustainable performance. It is challenging to deduce cause-and-effect relationships since this design cannot ascertain whether the exposure preceded the outcome or vice versa. Furthermore, prone to biases including recall bias, selection bias, and social desirability bias are cross-sectional studies, which might compromise the validity of the results. Using longitudinal designs will help to better achieve sustainable performance in the automotive sector by means of Green Work Engagement and personal green values. Longitudinal studies follow the same people or companies over time so that researchers may track temporal sequences, causal paths between variables, and changes. This method helps to clarify how green work engagement and values influence dynamic sustainable performance and assist in the control of conflicting factors varying over time. Moreover, longitudinal research can better capture the long-term effects of interventions or policy changes on environmental outcomes, so giving more solid evidence for causality and more strong managerial implications.

Future research could employ a longitudinal design to examine how the relationships between green practices and sustainable performance evolve over time. Expanding the study to include other industries could provide insights into whether the identified relationships hold across different sectors. Future studies could incorporate additional variables, such as organizational agility, and technological advancements to provide a more comprehensive understanding of sustainability practices. Investigating how cultural and regional differences impact green practices and sustainability performance could offer valuable insights for multinational companies. Future studies might use longitudinal designs to monitor the changing influence of GIV, GOC, EGB, GWE, IGV, and OS across time. This method would offer understanding of how efforts at organizational sustainability develop, change, and impact long-term results. Analyzing changes in employee behavior, organizational culture, and sustainability measures over several time periods helps to highlight causal links and expose trends not clear in cross-sectional studies. Manufacturing companies might stress technological innovations, for example, while service sectors might concentrate on employee-driven green practices. Investigating how several sectors combine sustainability concepts and analyzing different regulatory effects helps to improve industry-specific strategies and refine sustainability models. To enhance the present structure, future research could bring fresh elements including corporate leadership styles, outside environmental policies, or digital sustainability projects.

Examining how digital transformation interacts with efforts at organizational sustainability could offer new angles. Although the automotive industry receives a lot of attention, studying the same concepts in related fields can yield insightful information. For example, the aerospace industry may look into how green engagement affects sustainable innovations in aircraft manufacturing. The field of construction and infrastructure would study workforce-driven sustainability initiatives in environmentally friendly urban planning and green building materials. Consumer electronics that comprehend how manufacturing, e-waste management, and product design are impacted by staff dedication to sustainability. By tackling these topics, future studies can offer thorough frameworks for incorporating Green Work Engagement into business plans, guaranteeing that sustainability is a quantifiable force driving industry-wide change rather than merely an ideology. The study's focus on green engagement can help guide technology companies developing AI-based sustainability solutions such as smart grids, blockchain for carbon tracking, and digital platforms for environmental advocacy. The findings demonstrate how businesses can move beyond simply stating sustainability commitments to encouraging active consumer participation and promoting sustainable consumption habits through education, incentives, and transparency in supply chain practices. Policymakers can use the findings of this study to incorporate community-driven sustainability models, promoting eco-

friendly urban development through participatory governance, green spaces, and the use of renewable energy sources.

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