Paradigm Academic Press
Frontiers in Management Science
ISSN 2788-8592
MAR. 2025 VOL.4, NO.2

Investigating the Strategic Behavior of Competitive Intelligence on Green Marketing Performance in a Strategic Industry

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doi:10.56397/FMS.2025.03.01

Abstract

Iran, as the world's second largest producer of natural gas and a key player in the Middle East energy sector, has a prominent role in the development of the oil and gas industry. However, the environmental challenges arising from the activities of this industry highlight the need for an innovative and sustainable approach. This study examines the role of Competitive Intelligence (CI) in enhancing Green Marketing (GM) in a gas refinery in Iran. This study, using a descriptive-survey method and using a questionnaire as a data collection tool, attempts to examine the importance of CI in realizing green marketing. Non-probability sampling is used, and 73 refinery experts were selected as the sample. Data analysis is conducted using SPSS and PLS software. The results show that CI has a positive and significant effect on GM and in the areas of marketing strategy, internal marketing, green products, and communications. These findings identify CI as a key tool for enhancing sustainable performance in the oil and gas industry, and refineries should implement the GM approach at strategic, semi-strategic, and tactical levels to succeed in greening. This study also faced limitations such as limited access to accurate data and sampling adjustment to a specific refinery. Finally, it is suggested that refinery managers, in addition to paying attention to CI, fully believe in the importance of GM in resource management and pollution reduction. This study, by providing new findings, contributes to a deeper understanding of how CI and GM interact in the oil and gas industry and can be used as a foundation for future studies in this area.

Keywords: marketing communication, strategy, green marketing, internal marketing, product, competitive intelligence

1. Introduction

Refinery pollution, releasing millions of tons of pollutants, poses a significant threat to health and the environment. The reliance on fossil fuels contributes to severe pollution and climate change, recognized as major global challenges (Wang et al., 2023). These activities have led to harmful changes in soil and water and unpredictable climate shifts. If global warming continues, temperatures might rise by 1.5 degrees Celsius between 2030 and 2052, resulting in extreme weather events that threaten ecosystems and human livelihoods (Majeed et al., 2022).

The growth of the oil industry and its effects on Iran's development is a critical issue that needs attention (Farzanegan et al., 2021). In a globalized economy, industries face uncertain markets driven by economic security principles. Achieving long-term equilibrium is challenging, yet this instability can foster competition and innovation. Managers must adapt to rapid market changes, as competitors may offer better products at lower prices, while regulatory shifts and currency fluctuations can impact trade and consumer preferences (LUȚAI & MIHĂIESCU, 2022). Thus, early identification of these threats and the implementation of swift countermeasures are vital (Ahmed et al., 2023). Despite the focus on Competitive Intelligence (CI) and its advantages, challenges remain in marketing non-renewable energy sectors.

CI analysts develop CI through data collection, processing, and transfer. The rise of digital markets has transitioned businesses online, generating vast amounts of data on products, customers, and competitors, which is crucial for informed decision-making. Given the abundance and diversity of this data, it's essential to create tools that assist analysts in collecting and analyzing CI. This initiative aims to enhance analysts' tasks by providing tools to explore, organize, and visualize environmental data (Silva & Bação, 2022). Organizations must adapt to these environmental changes and produce safer products using methods like Green Marketing (GM) (Bhargavi Mahadevappa, 2022).

But in a situation where pollution and environmental damage caused by people and organizations is a very worrying problem, it attracts the attention of a wide society. Therefore, it makes the organization prioritize GM in order to protect the environment. However, when the organization does not do GM properly, GM can be considered by consumers as green washing against environmental pollution (Santos et al., 2024). This shows that the influence of CI by analysts on the determination of strategies, especially the GM of industries, is ambiguous.

The Ministry of Petroleum and the management groups active in it, considering the age of the oil and gas industry and the vital position of this industry in the Iranian economy, should replace the ineffective strategies of selling more and lower prices with management approaches based on intangible capital such as human, communication and structural capital (David & Gupta, 2024). To respond to the continuous growth and developments in the business world. If the result of this process leads to the maintenance, continuation and development of the activities of the oil and gas industries and realizes the field of innovation management growth in the industry.

On the other hand, evidence shows that despite digital transformations and increased environmental problems in recent years, many gas refinery sectors still use the same market analysis and marketing strategies as they did two decades ago (Muazu, 2019; Wang et al., 2022). This issue has led to challenges such as the lack of attracting private capital for sustainable exports, transferring energy from sources to distribution centers, and developing international business relations, and as a result, facing conflicting information in the market and different views of employees. This indicates insufficient attention to moving towards progress by applying current knowledge, which will lead to a decrease in performance and productivity.

In this regard, energy, as a necessary material input base, plays a decisive role in all aspects of economic and social development (Tudor et al., 2023). But global climate changes require a rapid energy transition for less carbon emissions, from traditional fossil fuels to clean, renewable and sustainable energies. Made necessary. However, in reality, the majority of the world's energy cannot immediately switch to renewable or clean energy due to immature technological readiness, unavailability of sufficient resources, and unstable energy supply (Constante & Erazo, 2024).

In the next few decades, fossil fuels, especially oil and gas, will continue to operate as the primary energy sector (Wang et al., 2023). And the use of resources in countries with high population growth continues to increase (Majeed et al., 2022). But today, in order to provide a suitable answer to management issues, especially in the field of industrial research and development, special attention should be paid to the combination of approaches and its consequences with regard to the work field and the market. For this purpose, a number of industries have used CI and strategies such as GM in order to create a competitive advantage (de Oliveira Lima et al., 2024; Pillai, 2024).

CI has become a crucial technique for competitor analysis, aiding companies in decision-making (Kazemi & Soltani, 2024). It serves as a strategic management tool that fosters rapid growth and improvement by enhancing the quality and speed of strategic decisions, ultimately boosting organizational competitiveness (Markovich et al., 2019). Recently, CI has gained importance in management, adapting to the culture of leading firms. It enables organizations to analyze data swiftly and accurately, providing valuable insights for decision-makers. This enhances information exchange and collective decision-making effectiveness (Yin, 2018). The marketing landscape is constantly evolving due to rising competition. Until the 1970s, marketing was product-centric, but it shifted to a customer-oriented approach with the emergence of new products and a growing population. Today, organizations are increasingly aware of and value their environmental impact (Daud et al., 2019).

On the other hand, GM tries to reduce its final effects on the environment by applying the role of social-environmental responsibility in companies in order to achieve sustainable development. Therefore, in such a situation where "green" issues have become increasingly important for corporate decision-makers, companies are also facing increased public sensitivity, stricter regulations, and increasing pressure from stakeholders focused on preserving the natural environment (Nguyen-Viet, 2023). This requires analysis of consistent results as well as ongoing research. With this approach, the concept of GM has found an important place on a global scale and the recent increase of green customers has created a new market opportunity for the global economy (Majeed et al., 2022). Although some researchers believe that GM for organizations may seem expensive at first, but it will undoubtedly give results over time and will gain double importance in the organization (Ahmed et al.,

2023).

Iran has historically been a strategic region for non-renewable energy, with gas refineries playing a vital role, especially in the Middle East (Mostaghimi & Rasoulinezhad, 2022). The eastern gas refineries, among the first in the country, are crucial for supplying gas to northern provinces and have a significant global standing. However, there is a lack of strategies to attract competitor information and insufficient social activity in environmental matters within the gas industry. Given the importance of current knowledge for enhancing organizational performance, CI and GM are critical for the long-term success of energy organizations (Vilkaite-Vaitone et al., 2022; Widyastuti et al., 2024). These concepts facilitate the absorption of market information and the adoption of environmentally compatible marketing methods. Unfortunately, over the past two decades, these issues have been overlooked in refinery operations, resulting in poor performance and negative financial impacts. Thus, studying the effect of CI on GM in gas refineries is essential (Kazemi & Soltani, 2024). Based on these challenges, we formulate the research questions and hypotheses accordingly.

1.1 Research Questions and Hypotheses

RQ1: Does CI have a positive and significant effect on GM?

H 1) CI has a positive and significant effect on strategy in GM.

H 2) CI has a positive and significant effect on internal marketing in GM.

H 3) CI has a positive and significant effect on the product in GM.

H 4) CI has a positive and significant effect on marketing communication in GM.

2. Theoretical Framework

2.1 CI

The literature has not reached a precise definition of CI and different interpretations have been provided by different authors and methodologies. CI is a proactive process of gathering information about the competition in order to improve organizational performance. Companies with CI programs have a deeper understanding of markets and can formulate more proactive strategies (Tahmasebifard, 2018; Yin, 2018). CI is vital for maintaining competitiveness and influencing decision-making in various fields, leading to improvements such as increased revenue, new products, cost savings, and increased profits (Silva & Bação, 2022). Afanasyeva et al. (2024), Cekuls (2022) have defined CI as a tool for predicting the future and making strategic decisions. From the perspective of De las Heras-Rosas & Herrera (2021), CI is dynamic business knowledge to collect and analyze information in order to gain a competitive advantage. CI makes a deep distinction between information and intelligence, and managers need intelligence to make decisions. One of the key goals of CI is timely warning that helps decision makers take action to maintain their competitive advantage (Tredinnick, 2022).

2.1.1 CI and Ethics

Economic espionage has created a moral question and ambiguity in CI, and this issue itself is a failure for it and sometimes causes neglect of CI (this issue should not question the importance and effect of CI on success in business). Importantly, the principles of the Professional Association of CI are derived based on a rigid ethical framework. The purpose of CI is not to steal competitors' trade secrets or other personal assets. Rather, it collects information in a systematic, public, (legal) manner that, when arranged and analyzed, will give us a better understanding of the structure, culture, strengths and weaknesses of competitors' companies (Ojinaga, 2018).

2.1.2 CI and Strategy

Of course, small and large companies have always maintained the use of some methods in front of their competitors without knowing that this method and style is the same as CI. That's not to say that they can't do much better, and this (identifying optimal methods) is the driving force behind the CI professional association. The perception of the members of the association about CI is to make its methods professional, unlike in the past. This not only includes identifying basic information sources, collecting and analyzing information, but also includes tools and techniques to make it practical (Semerkova et al., 2017).

2.1.3 Objectives of CI System

The primary foundation of intelligence is information; but every type of information is not considered intelligence. Many researchers have emphasized the need to differentiate between information and intelligence and state that information includes numbers, statistics and isolated but real data about people, organizations and competitors. While intelligence will include filtered and analyzed information. To achieve a competitive advantage from the point of view of CI, it is considered very important to identify and define sources of CI. The field that CI is focused on to produce intelligence in its context shows the types of intelligence (Bagnoli & Watts, 2015).

2.2 GM

The American Marketing Association in 1975 referred to green or environmental marketing as "the study of the positive and negative aspects of marketing activities related to pollution, energy reduction, and non-energy resources." However, due to its focus on a limited range of environmental issues, this definition is not compatible with today's human needs and needs to be redefined and studied more comprehensively (Shamsi et al., 2022). GM is not limited to promoting products with environmental attributes. At a 1975 workshop by the American Marketing Association on environmental marketing, it was categorized into three main areas:

1) Retail definition: marketing of products deemed environmentally safe. 2) Social marketing definition: development and marketing of products aimed at reducing negative environmental impacts. 3) Environmental definition: organizations' efforts to produce, promote, package, and recycle products in an environmentally conscious manner (Garg & Sharma, 2017).

2.2.1 Wilkite-Whitten, Seskaskin and Dies-Menesses Theory

GM refers to the organization's involvement in strategic, tactical and operational marketing activities to produce, communicate and offer products with minimal environmental impact (Vilkaite-Vaitone et al., 2022). Researchers divide GM into four criteria: strategy, internal marketing, product, and marketing communications. Strategy includes stakeholder dialogue, policy statements, organizational culture, and core goals. Internal marketing addresses employee environmental initiatives and awareness of GM practices. The product focuses on innovation, recyclability and material safety. Marketing communication highlights the importance of marketing research in effectively communicating environmental issues.

3. Research Background

These studies examine the relationship between different theories and practices of GM and CI in different industries. The study (Eyadat et al., 2024) focuses on the Jordanian pharmaceutical industry and shows that GM strategies have a positive and significant relationship with competitive performance. Pacevičiūtė & Razbadauskaitė-Venskė (2023) reviewed the existing literature on GM and proposed a conceptual framework that explains the relationship between relationship marketing and sustainable competitive advantages. Research (Bahrami Gahrui & Omidi, 2023) identified the impact of CI dimensions on marketing strategies in the Sari food industry and emphasized that quality differences and price competition have a greater impact on the effectiveness of strategies. LUȚAI & MIHĂIESCU (2022) examines the importance of open-source information in achieving strategic advantages in unstable economic conditions. Also, Lai et al. (2021) emphasizes the need to integrate sustainability and risk management in the oil and gas industry to attract environmentally conscious consumers and proposes a conceptual framework to promote green growth. The study (Cavallo et al., 2021) examines the use of CI methods in different stages of the strategy formulation process, and Karimi & Eshaghi (2018) examines the relationship between cultural intelligence and CI in Iranian knowledge-based organizations and emphasizes the importance of increasing intelligence. Culture refers to strengthening competitive abilities. Together, these researches point to the importance of integrating different approaches in green management and CI in improving the performance of organizations and competition in different markets.

4. Conceptual Model

The authors have developed a conceptual model based on research objectives, questions, and gaps in previous studies. This model outlines key research components and maps the relationships within the study. It integrates essential elements such as problem statements, literature review, goal setting, and question formulation. According to standard definitions, the model should be clear and detailed, describing the necessary steps, variables, and tools to meet research objectives. It presents the relationships coherently, helping to provide clear answers to research questions. Ultimately, this model defines the research structure and rationalizes the approach to the research issues.

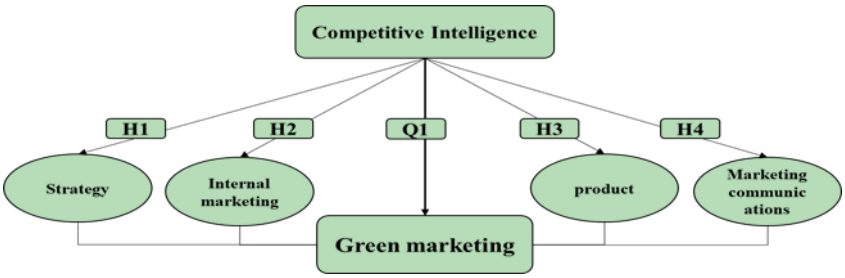

Figure 1. Conceptual model

5. Methodology

In terms of the type of research, this research is applied research, since it intends to investigate the effect of CI on GM among the employees of the Gas Refinery. The research discussed employs descriptive and correlational methods, primarily focusing on descriptive research, which aims to objectively and systematically describe conditions or phenomena without manipulating variables. This type of research is prevalent in behavioral sciences and serves to enhance understanding and aid decision-making by accurately portraying the characteristics of the subject under investigation. The researcher's goal is to present the objective results of the situation, emphasizing a clear depiction of what exists rather than exploring cause-and-effect relationships.

5.1 Society and Research Statistical Sample

5.1.1 Statistical Society

A statistical population refers to a set of elements and people that have one or more common characteristics in a specific geographic scale (whether global or regional) (Spina, 2011). In this research, the statistical population includes a group of people or objects that share the characteristics or characteristics of the study and are related to the research objectives. In this research, the studied community includes all the experts of the Gas Refinery in the number of 90 people.

5.1.2 Statistical Sample

A sample is a subset of the population (Andrade, 2020), and selecting an appropriate sample size is crucial for a study. The minimum sample size should meet the required amount without exceeding conventional limits. Sampling methods are categorized into probability and non-probability methods. This research, focused on the impact of CI on GM in the refinery, will utilize non-probability accessible sampling, where members are chosen based on availability and researcher judgment (Etikan & Bala, 2017). For structural equation modeling, which resembles multivariable regression, the sample size is determined by the formula q <= n <= 15q, with q representing the number of questionnaire items. The minimum sample size is 26 cases (Adam, 2021), and with a 26-item questionnaire, the sample size should range from 26 to 390. For a population of 90, Morgan's table suggests a sample size of 73. Thus, the researcher has set the sample size at 73.

5.2 Data Collection Tool

The methods of collecting information can be divided into two categories: library and field. In this research, field methods were used to collect information in general, and library methods such as books, treatises, and research articles were used to compile the theoretical foundations of the research. There are many tools and methods for data collection, in this research, a 26-question questionnaire was used to collect information. This questionnaire consists of two parts, the first part includes questions related to the personal information of the respondents and the second part includes questions related to the investigation of the effect of CI on GM.

5.3 Likert Scale

This scale includes a set of questions who's attitudinal or value load is considered almost equal. The respondent chooses a scale that is between two extremes, such as agree-disagree and accept-reject, according to the intensity or weakness of his attitude. To determine the attitude score of each person, the scores of each of his selected positions in all scales are added together, and then averaged, and thus the score of the individual's attitude about each concept or expression is obtained (Leonor et al., 2022). The scoring in this questionnaire was based on a 5-point Likert scale (strongly disagree = 1 to strongly agree = 5).

5.4 Questionnaire Components

1) CI: 1 to 12 of the questionnaires.

2) GM: 1 to 14 of the questionnaires.

3) Strategy: 1 to 4 of the questionnaires.

4) Internal Marketing 5 to 7 of the questionnaire.

5) Product: 8 to 11 of the questionnaires.

6) Marketing communication: 12 to 14 of the questionnaires.

Table 1. Questionnaire questions

Main component		**Number of items**	**Number of questions**
CI		12	12-11-10-9-8-7-6-5-4-3-2-1
GM	Strategy	4	16-15-14-13

	Internal marketing	3	19-18-17
	product	4	23-22-21-20
	Marketing communications	3	26-25-24
	Total	26	

5.5 Determining the Reliability — Validity of the Questionnaire

Reliability is one of the technical characteristics of measuring instruments and indicates the consistency of results in similar conditions. The reliability coefficient is variable between zero and one; The closer it is to one, the more efficient it is. To measure complex concepts with a Likert scale, Cronbach's alpha can be used to check internal consistency. Alpha above 0.7 indicates good reliability and between 0.5 and 0.7 indicates moderate reliability (Trizano-Hermosilla & Alvarado, 2016). In this research, Cronbach's alpha was calculated with SPSS software and the results are shown in the table below. The obtained values are higher than 0.7, which indicates high reliability. Validity refers to the accuracy of the measurement tool in evaluating the desired characteristic. In this study, "content validity" and "construct validity" were used to evaluate the questionnaire. Content validity verifies that all relevant dimensions and components have been considered. This research reviewed the initial framework with the feedback of professors and management experts to ensure that the questionnaire correctly measures the desired characteristic.

Table 2. Calculate the reliability of the questionnaire

Variables	**Number of items**	**Cronbach's alpha coefficient**
CI	12	0/805
Strategy	14	0/765
Internal marketing	4	0/871
product	3	0/861
Marketing communications	4	0/803
CI	3	0/856

6. Findings

6.1 Descriptive Statistics

In this section, a descriptive review of the information related to the personal characteristics of the respondents, i.e., gender, level of education, job position, age, service history, as well as the descriptive information of the variables of the CI questionnaire, including GM (strategy, product, internal marketing, and marketing communications) is discussed.

Table 3. Information about the personal characteristics of the respondents

Demographic variable		**Abundance**	**Abundance percentage**
Gender	man	45	61/6
	woman	28	38/4
Age group	20 to 30 years	12	16/4
	30 to 40 years	38	52/1
	40 to 50 years	16	21/9
	50 to 60 years	7	9/6
Education level	Bachelor's degree	20	27/4
	Master's degree	38	52/1
	Ph.D.	15	20/5
Work position	the expert	9	12/3
	In charge of affairs	25	34/2

	Head of Department	35	47/9
	general manager	4	5/5
Work history	Less than 10 years	51	69/9
	Between 10 and 20 years	14	19/2
	Between 20 and 30 years	8	11

6.2 Average Distribution of Selected Options in the Questionnaire

In this section, the average selection of the options chosen by the respondents in the questionnaire questions is discussed, these averages are presented in the following table.

Table 4. Frequency distribution of the options chosen by the respondents

Questions	Number	Minimum	Maximum	Mean	Standard Deviation
CIQ1	73	1.00	5.00	3.7123	.92014
CIQ2	73	1.00	5.00	3.3836	.84377
CIQ3	73	1.00	5.00	3.9041	.91537
CIQ4	73	1.00	5.00	3.5753	1.16569
CIQ5	73	1.00	5.00	3.6575	.91620
CIQ6	73	1.00	5.00	3.6301	.90534
CIQ7	73	1.00	5.00	3.7397	.95782
CIQ8	73	1.00	5.00	3.6712	.92878
CIQ9	73	1.00	5.00	3.3973	.99638
CIQ10	73	1.00	5.00	3.4521	1.13089
CIQ11	73	1.00	5.00	3.1644	1.14278
CIQ12	73	1.00	5.00	3.4110	1.05192
GMQ1	73	1.00	5.00	3.0822	1.10244
GMQ2	73	1.00	5.00	3.3699	1.16078
GMQ3	73	1.00	5.00	3.2466	1.06433
GMQ4	73	1.00	5.00	3.3014	1.27677
GMQ5	73	1.00	5.00	3.7671	.96495
GMQ6	73	1.00	5.00	3.3836	1.23187
GMQ7	73	1.00	5.00	3.3014	1.22117
GMQ8	73	1.00	5.00	3.5616	.92776
GMQ9	73	1.00	5.00	4.1096	.71805
GMQ10	73	1.00	5.00	3.8630	.82184
GMQ11	73	1.00	5.00	3.7808	.88579
GMQ12	73	1.00	5.00	3.6438	.94824
GMQ13	73	1.00	5.00	3.5753	1.03974
GMQ14	73	1.00	5.00	3.3973	1.17544

6.3 Descriptive Study of Variables

In the following table, the descriptive indices including the minimum, maximum, average and standard deviation for each of the research variables are specified. Based on this table, average CI, GM including (strategy, product, internal marketing, marketing communications) are mentioned in order.

Table 5. Data description indicators for research variables (number of respondents = 73)

Variables	Minimum	Maximum	Average standard	Deviation
CI	1.20	5.00	3.7068	.69768
GM	1.00	5.00	3.6192	.77184
Strategy	1.00	5.00	3.2959	.96097
Internal marketing	1.00	5.00	3.4000	1.01871
product	1.60	5.00	3.7918	.65865
Marketing communications	1.00	5.00	3.4301	.91206

6.4 Inferential Statistics and Hypothesis Testing

This research examines one main hypothesis and four sub-hypotheses. In this section, the analysis method intended in this research is first explained, namely structural equation modeling, and then the research hypotheses are tested using this method.

6.4.1 Structural Equation Modeling Based on Partial Least Squares — Composite Reliability

The PLS method, or partial least squares, is a modern approach for developing regression equations applicable to both univariate and multivariate analyses (Esposito Vinzi & Russolillo, 2013). It establishes relationships between dependent and independent variables by generating new explanatory variables, focusing on maximizing variance rather than reproducing the empirical covariance matrix. Like other structural equation models, it includes a structural component for latent variables and a measurement component for their indicators. To assess reliability, both Cronbach's alpha and composite reliability are used, with the latter accounting for the correlations among constructs. A composite reliability above 0.7 indicates good internal stability, while below 0.6 suggests a lack of reliability. This method has been used in a mixed-method study (Kazemi et al., 2024) in its entirety and in a two-structure method.

Table 6. Measurement model reliability test values, Cronbach's alpha and composite reliability

Composite reliability	Cronbach's alpha	Variables
CI (CI)	0/948	0/939
GM (GM)	0/840	0/901
Strategy (S)	0/906	0/862
Internal Marketing (IM)	0/942	0/908
Product (P)	0/867	0/798
Marketing Communications (MC)	0/859	0/897

6.4.2 Convergent Validity- Confirmatory Factor Analysis (Checking the Validity of Questionnaire Questions)

Confirmatory factor analysis is the best method to assess construct validity, examining if selected questions yield appropriate factor structures for the research dimensions. Higher factor loadings indicate stronger relationships with latent variables, while a zero loading signifies no relationship, and a negative loading indicates a reversed effect. This study uses a 26-question questionnaire to measure CI as the independent variable and GM (including strategy, internal marketing, and product marketing communications) as the dependent variable, identified through factor analysis. Factor loads with t-statistics below -1.96 or above 1.96 are considered small and should be eliminated from the model (Cudeck & O'dell, 1994).

Table 7. The results of confirmatory factor analysis of the variables related to the hypotheses

Variables	Questionnaire questions	Factor loading	T- value
CI	CIQ1	0/830	19/89
	CIQ2	0/589	5/20
	CIQ3	0/819	16/49

	CIQ4	0/666	6/26
	CIQ5	0/843	20/11
	CIQ6	0/784	12/76
	CIQ7	0/763	13/23
	CIQ8	0/766	11/76
	CIQ9	0/681	7/54
	CIQ10	0/825	22/55
	CIQ11	0/854	25/97
	CIQ12	0/862	33/26
Strategy	GMQ1	0/797	17/21
	GMQ2	0/839	16/83
	GMQ3	0/862	22/41
	GMQ4	0/866	25/94
Internal marketing	GMQ5	0/893	29/40
	GMQ6	0/930	45/67
	GMQ7	0/934	59/64
product	GMQ8	0/883	24/71
	GMQ9	0/806	14/52
	GMQ10	0/782	16/009
	GMQ11	0/669	6/81
Marketing communications	GMQ12	0/720	7/63
	GMQ13	0/859	20/50
	GMQ14	0/871	45/55

If it can be seen from the above table that the amount of factor loading is close to one in most cases and the t statistic for all factor loadings is greater than 1.96, so it can be concluded that the selected questions have appropriate factor structures to measure the variables and dimensions of the case. They provide study in research model.

6.4.3 Average Variance Extracted Index (AVE)

The average variance extracted for convergent validity examines the correlation of each construct with its questions (indices). The AVE criterion indicates the average variance shared between each construct with its indicators, and a value of 0.4 or higher is considered sufficient.

Table 8. Average Variance Extracted (AVE) values

Variables	**AVE**
CI (CI)	0/605
Strategy (S)	0/708
Internal Marketing (IM)	0/845
Product (P)	0/623
Marketing Communications (MC)	0/672

6.4.4 Divergent Validity — Transverse Load Test (Reciprocal)

In the transverse load test, the degree of correlation between the indicators of one structure with that structure and the degree of correlation between the indicators of one structure with other structures are compared. If it is determined that the correlation between an index and another structure other than its own structure is higher than

the correlation of that index with its own structure, the validity is questioned. The rows of the mutual factor load matrix belong to the indexes and its columns belong to the constructs of the research model. The values that are in the houses of this matrix indicate the degree of correlation of indicators with structures.

Table 9. Divergent validity cross-loading test

Overt	CI	Strategy	Internal marketing	Product	Marketing communications
CIQ1	0/56	0/31	0/18	0/831	0/12
CIQ2	0/42	0/53	0/50	0/645	0/007
CIQ3	0/38	0/47	0/17	0/786	0/19
CIQ4	0/62	0/21	0/23	0/677	0/04
CIQ5	0/39	0/72	0/73	0/804	0/35
CIQ6	0/556	0/54	0/50	0/41	0/35
CIQ7	0/678	0/39	0/22	0/26	0/24
CIQ8	0/809	0/79	0/66	0/32	0/34
CIQ9	0/741	0/66	0/63	0/37	0/22
CIQ10	0/787	0/50	0/63	0/32	0/35
CIQ11	0/79	0/17	0/852	0/07	0/33
CIQ12	0/66	0/53	0/855	0/53	0/28
GMQ1	0/28	0/57	0/776	0/57	0/38
GMQ2	0/16	0/776	0/795	0/37	0/35
GMQ3	0/03	0/795	0/783	0/51	0/11
GMQ4	0/059	0/783	0/17	0/86	0/44
GMQ5	0/17	0/14	0/776	0/59	0/32
GMQ6	0/033	0/33	0/795	0/62	0/42
GMQ7	0/18	0/26	0/783	0/59	0/12
GMQ8	0/18	0/41	0/51	0/63	0/81
GMQ9	0/16	0/22	0/22	0/63	0/69
GMQ10	-0/10	0/37	0/39	0/852	0/75
GMQ11	-0/04	-0/15	-0/009	0/855	0/78
GMQ12	0/22	-0/25	-0/18	0/26	0/776
GMQ13	0/04	0/04	0/17	0/195	0/795
GMQ14	-0/32	-0/50	-0/45	0/383	0/783

6.4.5 Fornell Larcker Test

The relationship of a construct with its indicators should exceed its relationships with other constructs to ensure acceptable divergent validity. This is assessed using a matrix containing correlation coefficients and the square root of the AVE values for each construct. A latent variable must exhibit more variance among its observables than with other latent variables, with the average square root of the extracted variance being greater than its maximum correlation with other variables in the model.

Table 10. Divergent Validity Assessment Matrix with Fornell-Larker Method

Variables	CI	Internal Marketing	Marketing Communications	Product	Strategy
CI	0/778				
Internal Marketing	0/814	0/919			
Marketing	0/833	0/806	0/820		

Communications					
Product	0/803	0/702	0/726	0/789	
Strategy	0/825	0/845	0/818	0/647	0/841

According to the above matrix, since the root value of AVE related to each structure (substantive variables) in the present study, which are located in the houses in the main diameter of the matrix, is higher than the correlation value between them, which are located in the lower and right houses of the main diameter; Therefore, it can be said that in the current research, the model structures interact more with their indicators than with other structures. In other words, the divergent validity of the model is adequate.

6.4.6 Examining the Fit of the Research Model — Significant Values of T — Coefficient of Determination — Effect Size Criterion ($f2$)

In the PLS method, after fitting measurement models, the structural model's fit is assessed by analyzing relationships between latent variables. Key criteria include significant t-values, R2, effect size ($f2$), Stone-Geary criterion (Q2), redundancy, and overall GOF. Significant t-values exceeding ±1.96 indicate valid relationships and confirm hypotheses at a 95% confidence level. R2 measures the explained variance in dependent variables influenced by independent ones, with values for endogenous constructs only. Higher R2 indicates a better model fit, categorized as weak (0.19), medium (0.33), and strong (0.67). The effect size ($f2$) assesses relationship intensity with values of 0.02, 0.15, and 0.35 indicating small, medium, and large effects, respectively. To compute $f2$, run the model, note R2, remove the independent variable of interest, and rerun the model for new calculations.

Table 11. Effect Size in the Main Paths of the Model

The effect of variable A on B	**Effect size**
CI--> Internal Marketing	1/95
CI--> Marketing Communications	2/27
CI--> Product	1/81
CI--> Strategy	2/12

6.4.7 Stone-Geisser Criterion (Q^2) — Redundancy Index

This criterion assesses the model's predictive power, where models with acceptable structural fit should predict indicators related to endogenous structures. Accurate definitions of relationships allow structures to influence each other's indicators, thus verifying hypotheses (Henseler et al., 2015). They identified predictive power levels at 0.02 (weak), 0.15 (medium), and 0.35 (strong). A Q2 value of zero or less indicates poor explanation of relationships for that construct. In this research, Q2 values of 0.53, 0.43, 0.37, and 0.47 show average predictive power. The redundancy index, the fifth structural model fit index, reflects the variability of an endogenous structure's indices affected by exogenous structures, calculated from the product of common R2 values. This index serves as a general measure of structural model quality for all endogenous structures.

Table 12. The values of determination and sharing coefficient and the redundancy index of the research variables

Current variables	**R^2 values**	**Common values**	**Index Q^2**	**redundancy index**
CI	-	0/25	-	-
Internal Marketing	0/657	0/63	0/53	0/409
Marketing Communications	0/690	0/72	0/43	0/496
Product	0/640	0/42	0/37	0/268
Strategy	0/676	0/39	0/47	0/263
Average	0/665	0/482	-	-

6.4.8 GOF Index

The primary fit index in partial least squares (PLS) is the GOF index, introduced by Tenenhaus (2004) and

calculated by equation 2. Wetzels et al. (2009) defined GOF values of 0.01, 0.25, and 0.36 as weak, medium, and strong, respectively. This index is derived from the geometric mean of R2 and the average redundancy indices, serving a similar purpose to fit indices in covariance-based methods and assessing PLS model quality. The GOF ranges from 0 to 1, with values close to 1 indicating good model quality. For this research, the average shared values of the latent variables are 0.25, 0.63, 0.72, 0.42, 0.39, and 0.45, resulting in an average of 0.482. The average R2 for the four endogenous variables with values of 0.657, 0.690, 0.640, and 0.676 is 0.665.

Table 13. Appropriateness indicators of the research model

Indicators	**R^2**	**Common values**	**GOF**
Values	0/665	0/482	0/566
Acceptable amount	Above 0.1	positive	Above 0.3

As can be seen in the above tables, the fit indices have reported excellent fit of the model. As a result, the structural equation model in PLS can be confidently used to confirm and reject the research hypotheses.

6.5 Examining Research Hypotheses

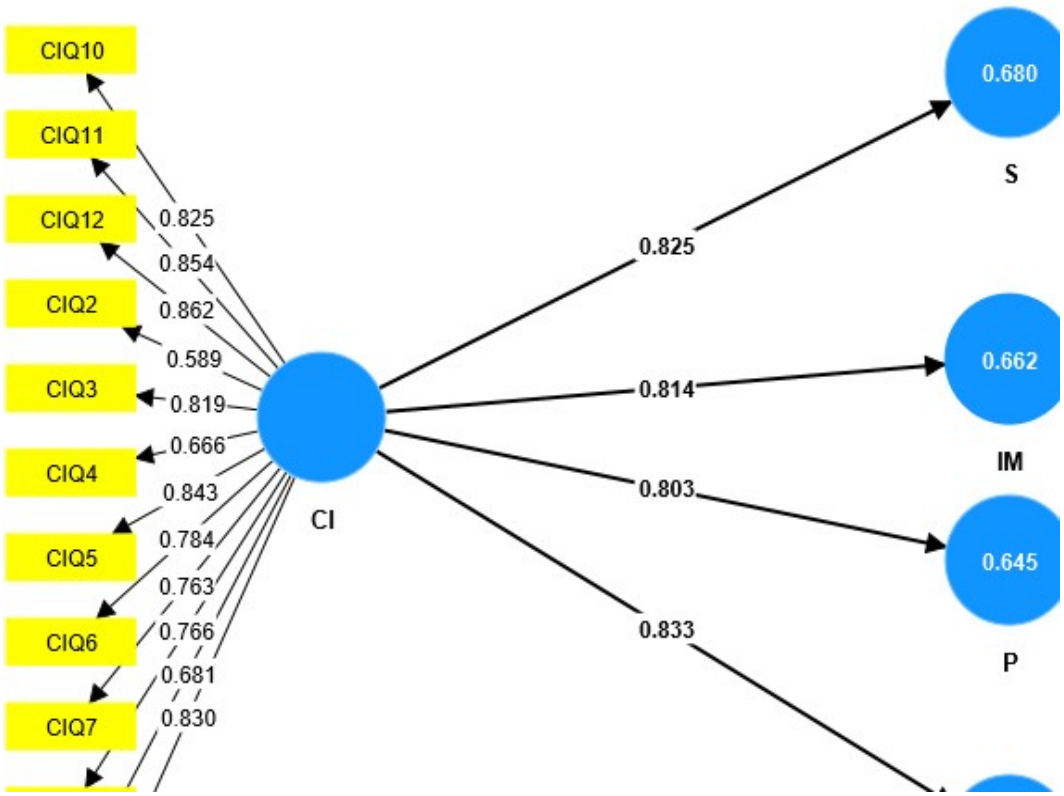

Figure 2. Graph of path coefficients between competitive intelligence and green marketing components

The current research includes one main hypothesis and four sub-hypotheses, which were used to test the hypotheses, path analysis. In this section, using path analysis in structural equation modeling, the research parameters will be analyzed and estimated, and the research hypotheses will be tested.

6.5.1 The Visual Representation of Path Coefficient Plots that Illustrates the Relationship Between CI and GM Strategies

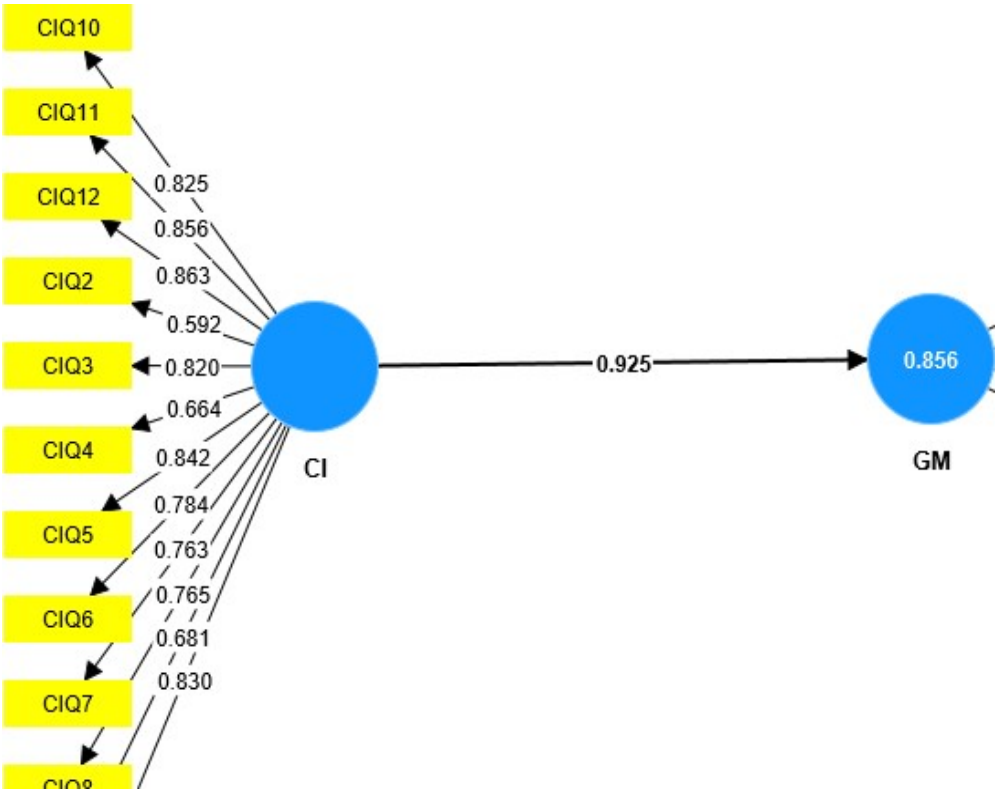

Figure 3. Path coefficient plots between CI and GM

6.5.2 The Statistical Values That Pertain to the Various Components of CI as Well as Those Related to the Elements of GM

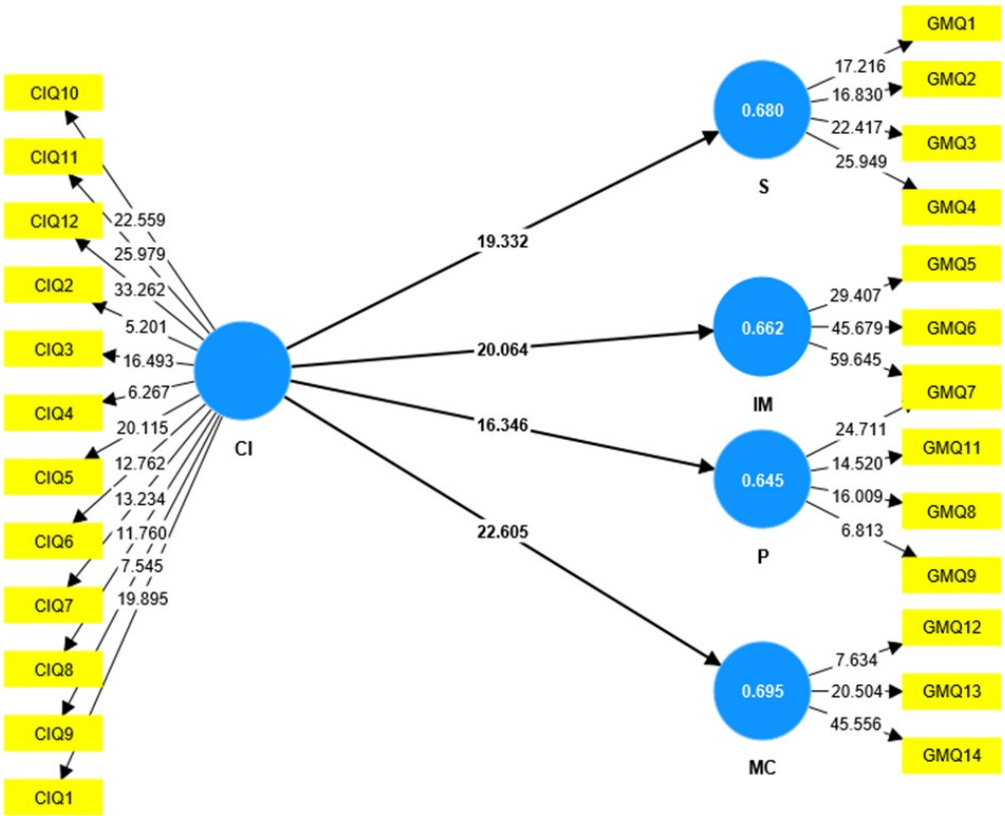

Figure 4. Statistical values of CI and GM components

6.5.3 The Statistical Values That Are Associated with CI and the Principles of GM in Their Various Forms

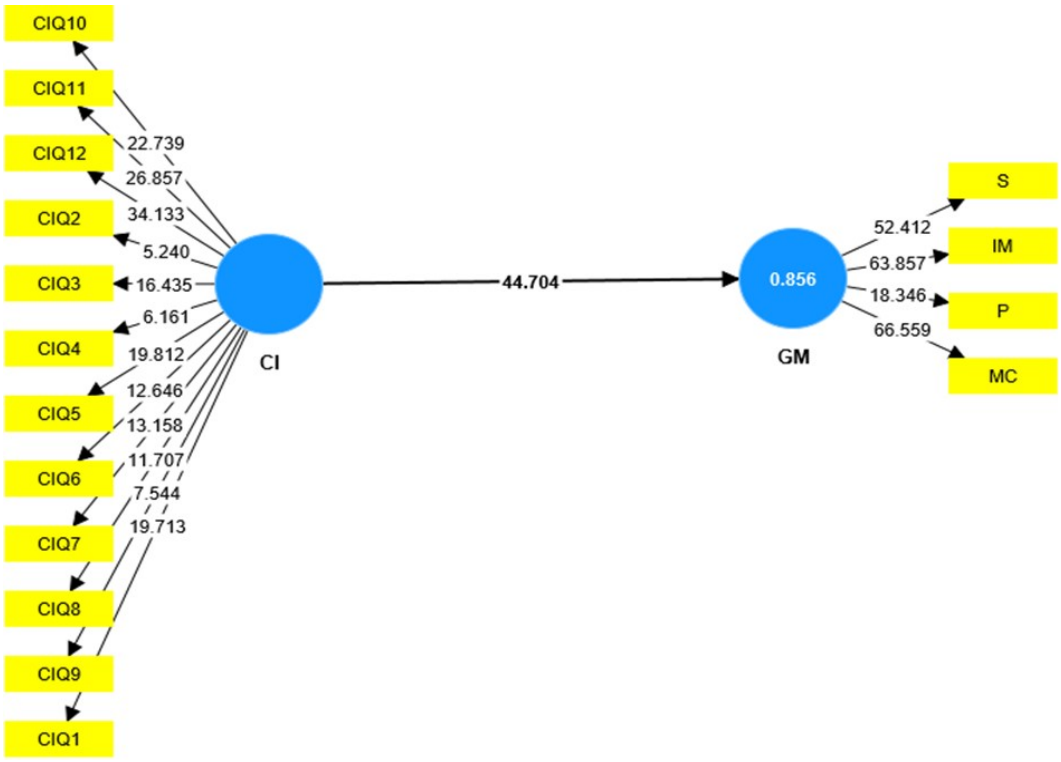

Figure 5. Statistical values of CI and GM

6.5.4 Examining the Main Question: CI Has a Positive and Significant Effect on GM

In this hypothesis, according to the path coefficient between CI and GM is equal to 0.925, which is a positive value, and the t-statistic is equal to 44.70, which is more than 1.96, so with 95% confidence, we can conclude found that this path coefficient is significant at the error level of 0.05 and the presence of a significant and positive relationship between CI on GM is confirmed and it can be said that CI has a significant effect on GM.

Table 14. Regression coefficient and significance of the effect of CI on GM

	Straight Path	P-Value	T-Value	Result
RQ1	0/925	0/000	44/70	Accept

6.5.5 Examining the First Hypothesis: CI Has a Positive and Significant Effect on Strategy in GM

In this hypothesis, according to the path coefficient between CI and strategy in GM is equal to 0.825, which is a positive value, and the t-statistic is equal to 19.33, which is more than 1.96, so it can be concluded with 95% confidence that this path coefficient is significant at the error level of 0.05 and the existence of a significant and positive relationship between CI over strategy in GM is confirmed and it can be said that CI over strategy in GM has a positive and significant effect.

Table 15. Regression coefficient and significance of the effect of CI on strategy in GM

	Straight Path	P-Value	T-Value	Result
H 1	0/825	0/000	19/33	Accept

6.5.6 Examination of the Second Hypothesis: CI Has a Positive and Significant Effect on Internal Marketing in GM

In this hypothesis, according to the path coefficient between CI and internal marketing in GM is equal to 0.814, which is a positive value, and the t-statistic is equal to 20.064. Which is more than 1.96, so it can be concluded with 95% confidence that this path coefficient is significant at the error level of 0.05 and the existence of a significant and positive relationship between CI and internal marketing in GM is confirmed. And it can be said that CI has a positive and significant effect on internal marketing in GM.

Table 16. Regression coefficient and significance of the effect of CI on internal marketing in GM

	Straight Path	P-Value	T-Value	Result
H 2	0/814	0/000	20/064	Accept

6.5.7 Examination of the Third Sub-Hypothesis: CI Has a Positive and Significant Effect on the Product in GM

In this hypothesis, according to the path coefficient between CI and product in GM is equal to 0.803, which is a positive value, and the t-statistic is equal to 16.346, which is more than 1.96. Therefore, with 95% confidence, we can conclude that this path coefficient is significant at the error level of 0.05, and the presence of a significant and positive relationship between CI on the product in GM is confirmed, and it can be said that CI has a significant effect on the product in GM.

Table 17. Regression coefficient and significance of the effect of CI on the product in GM

	Straight Path	P-Value	T-Value	Result
H 3	0/803	0/000	16/346	Accept

6.5.8 Examining the Fourth Hypothesis: CI Has a Positive and Significant Effect on Marketing Communications in GM

In this hypothesis, according to the coefficient of the path between CI on marketing communications in GM is equal to 0.020, which is a positive value, and the t-statistic is equal to 0.364, which is more than 1.96. Therefore, with 95% confidence, we can conclude that this path coefficient is significant at the error level of 0.05. And the presence of a significant and positive relationship between CI on marketing communication in GM is confirmed. And it can be said that CI has a significant impact on marketing communication in GM.

Table 18. Regression coefficient and significance of the effect of CI on marketing communications in GM

	Straight Path	P-Value	T-Value	Result
H 4	0/833	0/000	22/60	Accept

7. Discussion and Conclusion

7.1 RQ 1: CI Has a Positive and Significant Effect on GM

The findings of the research clearly show a significant path coefficient of 0.925 that exists between CI and GM strategies. This path coefficient is accompanied by a notably high t-statistic of 44.70, which greatly surpasses the critical threshold value of 1.96. As a result, we can confidently assert, with a robust 95% level of confidence, that this path coefficient is indeed significant at the 0.05 error level. This statistical evidence confirms that there is a substantial positive relationship between CI and GM initiatives. Furthermore, the influence coefficient indicates that CI exerts a strong impact on GM efforts, thus affirming the principal hypothesis of this study at the 0.05 error level.

It is also noteworthy that these results align well with the findings put forth by several researchers, including Bahrami Gahrui & Omidi (2023), Ncube & Ndlovu (2022), Hanif et al. (2022), Al-dmour et al. (2023). Additionally, the support from studies conducted by Buswari et al. (2021), Silva (2021), Giantari & Sukaatmadja (2021), Tahmasebifard (2018) reinforces the conclusions drawn in this research. Importantly, an extensive review of the literature revealed no research contradicting the hypothesis posited in this study, further solidifying the credibility of these findings. Overall, the results present compelling evidence for the positive influence CI has on the advancement of GM practices.

7.2 H1: CI Has a Positive and Significant Effect on Strategy in GM

The research findings indicated that the path coefficient established between CI and the strategy utilized in GM is equivalent to 0.825. This value is clearly positive, which reflects an important and beneficial role in delineating the relationship between CI and the strategic approaches taken in GM. Furthermore, the T-statistic has been calculated to be 19.33, a figure that clearly exceeds the critical threshold of 1.96. Therefore, it can be confidently confirmed that, with a 95% level of confidence, there is a significant and positive relationship in place between CI and the strategy adopted in GM initiatives. This is encouraging and highlights the relevance of CI in formulating effective GM strategies. Based on this evidence, we can assert that the first sub-hypothesis of the research is confirmed at the 0.05 error level, signifying that the results obtained are not only valid but also possess a high degree of accuracy. These findings reinforce the notion that leveraging CI is crucial for the development and implementation of successful GM strategies. Overall, the evidence strongly supports the idea that CI plays a vital role in enhancing strategic decision-making within the context of GM, contributing to the overall effectiveness of marketing efforts aimed at sustainability.

The current conclusion drawn regarding this particular hypothesis is clearly understandable and well-supported based on the findings from the research conducted by various scholars in the field. These findings show a strong consistency with the research outputs from notable researchers, including Wu et al. (2023), Ncube & Ndlovu (2022), as well as Hanif et al. (2022). Additionally, the work of Al-dmour et al. (2023), Silva (2021), Giantari & Sukaatmadja (2021), and also the studies conducted by Kazemi & Soltani (2024) further align with these findings. Furthermore, the research contributions of Solanki & Lakhera (2023), along with those of Papadas et al. (2019) demonstrate a notable coherence and consonance with the hypothesis in question. For this reason, it can confidently be said that, to date, there has been no research that outright rejects or contradicts this hypothesis. Instead, the available body of evidence overwhelmingly supports the confirmation and reconfirmation of the significant relationship between CI and strategic approaches within GM. The positive influence highlighted in these findings underscores the critical importance of giving attention to CI during the process of formulating effective GM strategies. Such focus can lead to enhanced success and greater efficiency of these strategies, ultimately assisting organizations in advancing their strategic goals and objectives. This proactive consideration of CI can be a determining factor in achieving a sustainable competitive advantage in the marketplace.

7.3 H2 CI Has a Positive and Significant Effect on Internal Marketing in GM

The research findings have clearly demonstrated that the path coefficient linking CI and internal marketing within the context of GM is quantified at 0.814. This value is, notably, a positive one, indicating a relationship that is both significant and beneficial. In addition to this, the calculated t-statistic stands at 20.064, a figure which exceeds the critical threshold of 1.96. As a result of these statistical outcomes, we can confidently conclude, with a solid 95% level of confidence, that there exists a significant and positively correlated relationship between CI and internal marketing practices in the realm of GM. Thus, we can assert that the second sub-hypothesis of this research has been confirmed at the traditional error level of 0.05, which further emphasizes the reliability of the findings. Additionally, the results of this hypothesis are consistent with the research outcomes presented by Hanif et al. (2022), as well as Silva (2021), and the study conducted by Baah et al. (2024). Furthermore, it is essential to note that a thorough review of the relevant literature has not uncovered any research that contradicts or rejects this particular hypothesis. This points to a growing consensus within the academic community regarding the critical role CI plays in enhancing internal marketing strategies related to GM initiatives. The corroboration of these findings further underscores the import of integrating CI into marketing strategies aimed at promoting sustainability.

7.4 H3 CI Has a Positive and Significant Effect on the Product in GM

The research findings showed that the path coefficient between CI and product in GM is equal to 0.803, which is a positive value, and the t-statistic is equal to 16.346, which is more than 1.96, so it can be concluded with 95% confidence that the existence of a relationship between significant and positive relationship between CI and product in GM is confirmed. Therefore, the third sub-hypothesis of the research is confirmed at the error level of 0.05. The result of the present hypothesis with the findings of the researches of Al-dmour et al. (2023), Buswari et al. (2021), Kazemi & Soltani (2024), Tahmasebifard (2018) are in line and no research was found to reject this hypothesis.

7.5 H4 CI Has a Positive and Significant Effect on Marketing Communication in GM

The research findings showed that the path coefficient between CI and marketing communication in GM is equal to 0.020, which is a positive value, and the t-statistic is equal to 0.364, which is more than 1.96. Therefore, it can be concluded with 95% certainty that the existence of a significant and positive relationship between CI and marketing communication in GM is confirmed. Therefore, the fourth sub-hypothesis of the research is confirmed at the error level of 0.05 with 95% confidence. Now that we know that CI has an effect on GM in Khangiran Refinery, it is concluded that gathering information about competitors, market trends and customer preferences,

the gas refinery can increase its understanding of environmental concerns. In addition, the development of environmentally friendly products or services and the discovery of green initiatives in the refinery can be effectively communicated to customers. In other words, implementing a strategic CI process can act as a catalyst for the gas refinery's success in GM. In general, the result of the present research is in line with the findings of Wu et al. (2023), Al-dmour et al. (2023), Giantari & Sukaatmadja (2021) are in line and no research was found that rejects this hypothesis.

Therefore, it can be boldly stated that although the managers of this complex invest in their CI, strategy, internal marketing, product and marketing communications have an effective role in the performance of the refinery market and should be paid attention to. Without having and dealing with strategy, internal marketing, product and marketing communications, it cannot remain in the field of tight competition in this industry or gain a competitive advantage.

Refinery officials who have a long history of trying to become an attractive destination for knowledge-based companies and academic centers should carefully study the science of GM and have a proper understanding of their situation regarding environmental issues as well as GM. This can also help to reduce the destruction of the environment and reduce the excessive exploitation of resources in our country.

8. Research Limitations and Outlook

The study of CI's impact on GM in gas plants has several limitations. A significant issue is the lack of prior research, particularly in the oil industry, leading to insufficient information and a clear framework. Consequently, the researcher relied on related studies and the consultant's opinion. Data collection faced challenges; the intention was to include all employees, but refinery managers' authority restricted access, necessitating a specific sampling method. Additionally, focusing on CI and GM limited the study to one refinery to control for external factors. While CI influences GM, it cannot be assumed that CI weaknesses directly cause GM issues. Geographical constraints also limit the applicability of findings to other refineries. Finally, due to the inability to conduct qualitative research, a quantitative approach using questionnaires was employed.

Based on Menon & Menon (1997) point of view, it is suggested that GM actions be carried out at three strategic levels, quasi-strategic level and tactical level in the company. These measures show the level of commitment to various environmental activities. According to Polonsky & Rosenberger III (2001), GM measures can be implemented at a strategic level by making fundamental changes in the company's philosophy. This often requires a change in the company's mentality and behavior and tactics. Also, by making changes in the company's procedures, being green can be achieved at a quasi-strategic level. In addition to that, according to Comino et al. (2007), tactical greenness can be experienced by applying changes in operational activities such as changes in promotions and advertisements.

To achieve these essential goals, forming a dedicated team to collect and analyze data on green strategies is crucial. This team would monitor competitors' approaches and assess best practices while remaining informed about legal changes. Collaboration with other refineries and research organizations can facilitate the exchange of innovative ideas, fostering further advancements in the industry. Sustained investment in green technologies and regular communication of green strategies to stakeholders are vital. These efforts not only reinforce the refinery's commitment to sustainability but also enhance its reputation and competitive advantage, ultimately benefiting all stakeholders.

Funding

We, the authors of this research, have not received any financial support from any organization or institution.

CRediT Authorship Contribution Statement

Farzad Kazemi: Conceptualization, Software, Writing original draft, Formal analysis, Methodology, Review & editing, Resources.

Declaration of Competing Interest

The authors declare they have no conflict of interest.

Ethical Approval

The article does not involve any studies with human participants or animals conducted by the authors.

Acknowledgment

I sincerely thank and appreciate all the managers and experts who participated in this research and shared their valuable opinions with us.

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