

CHAPTER 4

DATA ANALYSIS AND RESULTS

4.1 Introduction

This chapter presents the results of data analysis. The main purpose of this chapter is to examine research variables namely, GSCM practice, innovation capabilities, competitive advantage and social performance. Firstly, the chapter describes the response rate and the demographic profile of the respondents, including their age, gender, professional qualification, job title, number of employees, sector classification, industry classification and age of the organization. This is followed by the data analysis specifically on the goodness of measures used for assessing the validity and reliability of the study variables. Next, the results of the study particularly, the relationships between the predictors and criterion variables involved are reported. Finally, the results of the hypotheses testing are presented.

4.2 Response Rates

The population of this study has been collected from ISO 14001 certified manufacturing companies in Malaysia that represent Malaysia's green companies. A total of 600 questionnaires were distributed to the manufacturing companies with ISO 14001 certification. The data collection took around four months which was carried out between May 2021 to August 2021. Therefore, out of the 600 questionnaires distributed, only 265 (44.2%) were returned. After an inspection of the 265 questionnaires, only 258 questionnaires were usable, giving a response rate of 43%.

Specifically, from the 265 questionnaires returned, seven questionnaires were excluded due to the questionnaires classified as missing data.

The sample size of this study (N=258) is considered sufficient to achieve an adequate level of statistical power in Smart-PLS since it is above the minimum requirement as suggested by Hair et al. (2017). Table 4.1 summarizes the distribution of the questionnaires in the study.

Table 4.1: Questionnaires Distribution

Response Rate	Respondents No
Questionnaires Distributed	600
Returned	265
Not returned	335
Returned and Unusable	7
Returned and Usable	258
Response Rate	44.2 %

4.3 Profiles of Respondents

To provide an overview of the data collected, the researcher summarized the respondent's information using basic descriptive statistics such as frequency and percentage. Table 4.2 shows the frequency and percentage of the respondents' demographic profile in this study. It shows that most of the respondent are male (73.6%) and the rest are females (26.4%). Regarding age groups, it comprises most of them in the age of 41 to 50 (46.9%) following by the age 31 years to 40 (30.6%).

In terms of the educational background, the majority of the respondents are educated with (55.4%) are postgraduate and (24.4%) are having bachelors. This will indicate most of the management employees at Malaysian manufacturing industry are highly educated. Furthermore, most of the respondent job position are supervisor with (31.8%) following by Engineers (19.8%) and assistant managers (15.1%). Under the

category number of employees, majority of the manufacturing firms are having more than 251 employees with (67.4%) and it consider as large company, next 51 to 250 employees with (31.8%) and it consider as medium company. Moving to sector classification, majority of the survey organization are private limited with (64.3%), multinational corporation gaining second percentage with (26.5%). This implies that the private sector which plays a key role in green supply chain practices is well represented in this study.

In terms of industry classification, respondents from electrical and electronics in scored the highest respondent (56.2%), and pharmaceutical (12.0%), following rubber and plastic recorded by (10.1%). The aspect of organization age most of the respondent companies were running their business for more than 16 years 92 (45.7%), following to companies age between 11 to 15 years scored (31.0%).

Table 4.2: Demographic variables (N = 258)

Demographic Item	Category	Frequency	%
Gender	Male	190	73.6
	Female	68	26.4
Age	20 – 30	23	8.9
	31 - 40	79	30.6
	41 - 50	121	46.9
	51 and above	35	13.6
Education	Graduate	63	24.4
	Post Graduate	143	55.4
	Doctorate	18	7.0
	Others	34	13.2
Job Title	Manager	24	9.3
	Assistant Manager	39	15.1
	Supervisor	82	31.8
	Officer	42	16.3
	Engineer	51	19.8
	Others	20	7.8
Number of Employees	Less than 50 Employees	28	10.9

	51-250 Employees	82	31.8
	More than 251 Employees	148	57.4
Sector Classification	Public Sector	5	1.9
	Private Sector	166	64.3
	Multinational Corporation	68	26.4
	Others	19	7.4
Industry Classification	Electrical and Electronics	145	56.2
	Chemical / Petroleum	12	4.7
	Food Product, Beverages	19	7.4
	Pharmaceutical	31	12.0
	Textiles and textile products	12	4.7
	Rubber & plastic	26	10.1
	Others	13	5.0
Organization Age	Less than 5 years	23	8.9
	6 - 10 years	63	24.4
	11 – 15 years	80	31.0
	More than 16 years	92	35.7

4.4 Data Screening

In this study, it is important to have accurate data and a smooth process of data analysis. For this reason, it's highly recommended to have optimal data where data screening is performed (Tabachnik & Fidell, 2012). Therefore, after completing the process of distributing and collecting the data, the researcher starts to check the raw data to ensure completeness. According to Pallant (2020), the process of data screening usually involves the identification of outliers. However, handling these two issues in data screening was to avoid the ambiguous data characteristics that might affect the results negatively, such as screening for missing data, outliers, normality, and multicollinearity. Thus, the raw data were entered manually via SPSS software for both descriptive and frequencies analysis. In addition, the use of multivariate it required that data do not have errors (Hair et al., 2010).

4.4.1 Normality Test

The normality test is an important part of the data analysis to fulfil the assumptions of the multivariate analysis, referring to the bell-shaped curve of the data distribution of a single measurement variable (Hair et al., 2010). This study was conducted to ensure that the collected data is normally distributed and it is important to verify that the data are not too far from normal as extremely non-normal data prove to be problematic in the assessment of the significance of such parameters. George and Mallery (2010), pointed out that if the Skewness value obtained is between the cut-off point of ± 2.0 , the arithmetic mean is a good description and the cut-off point for kurtosis must be less than ± 7 to be acceptable (Byrne, 2013). Table 4.4 illustrates the evaluation of the normality of the data. The table contains results of statistical tests for skewness and kurtosis based on the normality test of the latent variables of the four variables. This study performed a normality test on the main variables and the results showed that there were no violations Thus, all variables in this study are categorized as normally distributed. However, the results reach normality because all the variables shown in Table 4.3 do not have normality problems.

Table 4.3: Results of Skewness and Kurtosis for Normality Test

Constructs	Skewness		Kurtosis	
	Statistic	Std. Error	Statistic	Std. Error
Internal Environmental Management	0.156	0.152	-0.281	0.302
Green Purchasing	-0.981	0.152	0.159	0.302
Eco-Design and Packaging	-0.418	0.152	0.036	0.302
Customer Cooperation	0.022	0.152	-0.271	0.302
Investment Recovery	-0.300	0.152	-0.171	0.302
Product Innovation	0.147	0.152	-0.272	0.302
Process Innovation	-0.281	0.152	-0.460	0.302
Marketing Innovation	0.239	0.152	1.692	0.302
Organizational Innovation	0.395	0.152	-0.247	0.302

Price/cost	0.422	0.152	0.405	0.302
Quality	0.171	0.152	-0.111	0.302
Delivery	0.124	0.152	-0.562	0.302
Social Performance	-0.687	0.152	-0.094	0.302

4.4.2 Multicollinearity

The multicollinearity must be checked to guarantee that the exogenous latent constructs are not extremely correlated (Brien, 2007). Referring to Table 4.5 shows that all variance inflation factor values were less than 5 as introduced by Hair et al. (2017). This means that there is no multicollinearity among the exogenous latent constructs. Table 4.4 illustrates in detail the collinearity statistics.

Table 4.4: Multicollinearity Test (Inner VIF Values) Coefficients

	Modal	VIF
Green Supply Chain Management Practices	Competitive Advantages	1.485
Innovation Capabilities		1.485
Green Supply Chain Management Practices	Innovation Capabilities	1.000
Green Supply Chain Management Practices	Social Performance	1.485
Technological Innovation		1.485

Therefore, the researcher proposed an alternative matrix between variables to help identify multicollinearity. Table 4.5 indicate that the highest correlation between any two variables was 0.702 innovation capabilities and competitive advantages. This is evidence of the non-existing multicollinearity in the data because of the correlation values of predictor variables which are estimated at less than 0.9 (Field, 2009).

Table 4.5: Test of Multicollinearity Based on Correlation Between Factors

No	1	2	3	4
1 Green Supply Chain Management	1			
2 Innovation Capabilities	0.684**	1		
3 Competitive Advantages	0.702**	0.683**	1	
4 Social performance	0.607**	0.679**	0.573**	1

** . Correlation is significant at the 0.01 level

4.5 Descriptive Analysis

The descriptive statistics of the dimensions through standard deviation, mean and variance provide a clear background and knowledge that assist to understand how the respondents of the sample respond to the questions in the survey (Sekaran & Bougie, 2016). Moreover, the descriptive analysis is used or summarize the characteristics of the collected data from the respondents' perspective on all research variables namely GSCM practice, innovation Capabilities, competitive advantage and social performance. However, the five-point Likert scale has been employed in this research to measure variables. The means and standard deviations are presented in Table 4.6.

According to Pihie, Sadeghi, and Elias (2011), the interpretation of mean scores is divided into three categories: low (1-2.33), moderate (2.34-3.67), and high (3.68-5). In this research, all of the research variables' means were in the moderate range (2.42 - 2.76) which indicate that all variables have values of mean that do not differ much from one another and the standard deviation ranged from 0.605-0.822. On top of that, in Table 4.6, social performance recorded the highest mean score of 2.76 and standard deviation of 0.882, while competitive advantages recorded the lowest value of 2.42 mean 0.576 standard deviation respectively.

Table 4.6: Descriptive Statistics for The Studied Variables

Second-order Constructs	First-Order Constructs	Mean	S.D
	Internal environmental management (IEM)	2.57	0.802
	Green purchasing (GP)	2.95	0.889
	Eco-Design and Packaging (EP)	2.84	0.815
	Customer cooperation (CC)	2.57	0.858
	Investment recovery (IR)	2.71	0.861
Green Supply Chain Management Practices (GSCM)		2.73	0.605
	Product innovation (PTI)	2.73	0.744
	Process innovation (PSI)	2.53	0.825
	Marketing innovation (MI)	2.60	0.672
	Organizational innovation (OI)	2.41	0.821
Innovation Capabilities (IC)		2.57	0.541
	Price/cost (PC)	2.37	0.794
	Quality (QY)	2.45	0.713
	Delivery (DY)	2.43	0.897
Competitive Advantages (CA)		2.42	0.576
Social Performance (SP)		2.76	0.882

4.6 Assessment of Measurement Model

This section discusses content validity, convergent validity and discriminant validity to evaluate the assessment of the measurement model.

4.6.1 Construct Reliability

This test of construct reliability for the variables in this study is the first measure to be evaluated, where Cronbach's alpha coefficients and composite reliability are the most widely used estimators of the construct reliability of a scale (Hair Jr et al., 2017). As pointed out in Table 4.7 the values of Cronbach's alpha coefficients ranged between 0.811 and 0.919, which means that values were higher than the suggested value of 0.7 (Kannan & Tan, 2005). On the other hand, the value of composite reliability (CR) should be higher than 0.7 (Gefen et al., 2011; Kline, 2016; Werts et al., 1974). In this study, the result of composite reliability ranged between 0.894 (lower composite value)

and 0.933 (higher composite value), which was more than the benchmark value of 0.7. This result indicated the error-free and adequate internal reliability of the measures used in this study.

Table 4.7: Cronbach's Alpha and Composite Reliability

Second-order Constructs	First-Order Constructs	Cronbach's alpha (> 0.7)	Composite Reliability (> 0.7)
	Internal environmental management (IEM)	0.906	0.930
	Green purchasing (GP)	0.901	0.927
	Eco-Design and Packaging (EP)	0.892	0.921
	Customer cooperation (CC)	0.910	0.933
	Investment recovery (IR)	0.884	0.919
Green Supply Chain Management Practices (GSCM)		0.922	0.931
	Product innovation (PTI)	0.811	0.910
	Process innovation (PSI)	0.897	0.921
	Marketing innovation (MI)	0.868	0.904
	Organizational innovation (OI)	0.896	0.923
Innovation Capabilities (IC)		0.900	0.914
	Price/cost (PC)	0.901	0.927
	Quality (QY)	0.852	0.894
	Delivery (DY)	0.902	0.931
Competitive Advantages (CA)		0.865	0.889
Social Performance (SP)		0.919	0.935

4.6.2 Convergent Validity

According to Hair et al. (2010), convergent validity is defined as the degree to which a set of variables converges in measuring a particular concept. The existence of convergent validity occurred when the indicators of one concept converge or share a higher proportion of variance. However, if there is any violation in the convergent validity it will affect the findings negatively. Besides, because the outer loadings of all indicators should be statistically significant (Hair et al., 2014).

In this study, the items' loading was examined and all items are statistically significant where the loading for the items in the model has fulfilled all requirements between 0.753 and 0.902 as it shows in Table 4.8 except four items that were removed (IEM5, GP1, PTI4 and PSI3) because of their low loadings were less than the critical value 0.7 as recommended by (Hair et al., 2010).

Table 4.8: Factor Loading

Second-order Constructs	First-Order Constructs	Indicators	Loading (> 0.7)	
Green Supply Chain Management Practices (GSCM)	Internal environmental management (IEM)	IEM1	0.864	Deleted
		IEM2	0.860	
		IEM3	0.835	
		IEM4	0.845	
		IEM5	0.552	
		IEM6	0.855	
	Green purchasing (GP)	GP1	0.471	Deleted
		GP2	0.893	
		GP3	0.902	
		GP4	0.772	
		GP5	0.753	
		GP6	0.902	
	Eco-Design and Packaging (EP)	EP1	0.836	
		EP2	0.840	
		EP3	0.778	
		EP4	0.843	
		EP5	0.882	
	Customer cooperation (CC)	CC1	0.841	
		CC2	0.876	
		CC3	0.857	
CC4		0.863		
CC5		0.851		
Investment recovery (IR)	IR1	0.811		
	IR2	0.898		
	IR3	0.900		
	IR4	0.828		
Innovation Capabilities (IC)	Product innovation (PTI)	PTI1	0.810	
		PTI2	0.841	
		PTI3	0.822	

		PTI4	0.521	
		PTI5	0.812	Deleted
		PTI6	0.789	
	Process innovation (PSI)	PSI1	0.824	
		PSI2	0.783	
		PSI3	0.422	Deleted
		PSI4	0.849	
		PSI5	0.876	
		PSI6	0.845	
	Marketing innovation (MI)	MI1	0.824	
		MI2	0.836	
		MI3	0.805	
		MI4	0.776	
		MI5	0.797	
	Organizational innovation (OI)	OI1	0.850	
		OI2	0.841	
		OI3	0.841	
		OI4	0.833	
		OI5	0.834	
Competitive Advantages (CA)	Price/cost (PC)	PC1	0.837	
		PC2	0.862	
		PC3	0.848	
		PC4	0.832	
		PC5	0.854	
	Quality (QY)	QY1	0.802	
		QY2	0.804	
		QY3	0.799	
		QY4	0.794	
		QY5	0.764	
	Delivery (DY)	DY1	0.875	
		DY2	0.877	
		DY3	0.876	
		DY4	0.886	
Social Performance (SP)	SP1	0.846		
	SP2	0.780		
	SP3	0.814		
	SP4	0.805		
	SP5	0.870		
	SP6	0.830		
	SP7	0.786		

• The measurement used is a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree) for GSCM, TI, CA and SP constructs.

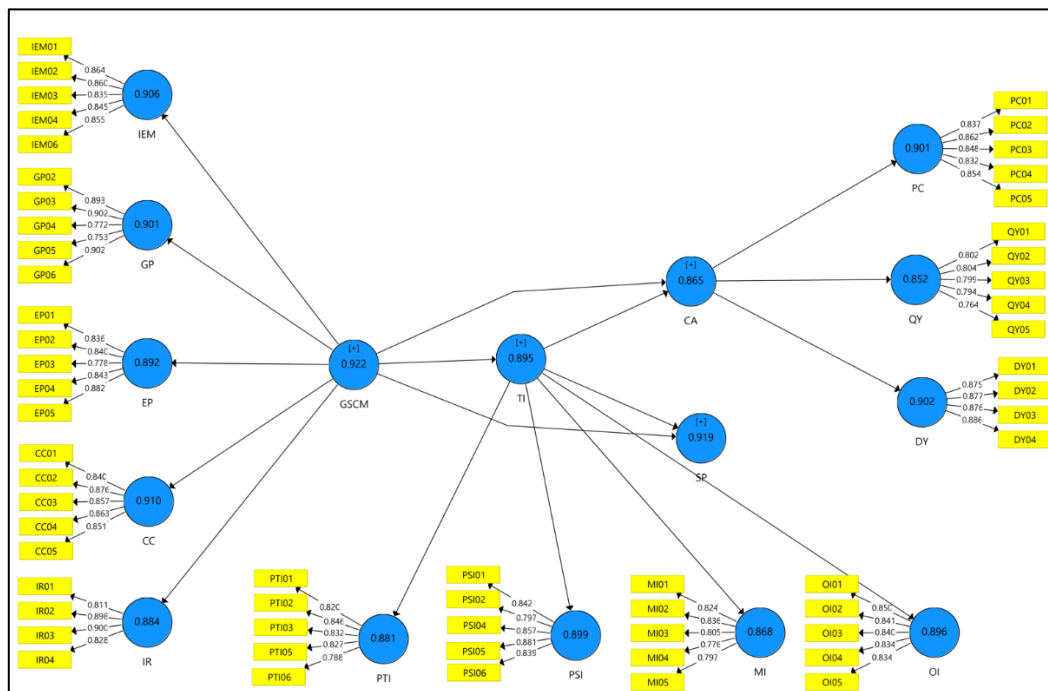
• All the factor loadings of the individual items are statistically significant except for the items IEM5, GP1, PTI4 and PSI3 which were eliminated from the scale due to low loadings.

On the other hand, the convergent validity is average variances extracted (AVE) is to examine whether the extent to which indicators of a specific construct converge a high proportion of variance in common. In this research, the AVE indicate that all the values were considered acceptable because they were having a value higher than the suggested critical value of 0.50 as suggested by (Hair et al., 2010). The AVE values in this study of the constructs were between 0.63 and 0.74. Subsequently, it established satisfactory convergent validity measurement as exhibited in Table 4.9.

Table 4.9: Convergent Validity

First Order Constructs	Second-Order Constructs	AVE (> 0.5)
Internal environmental management (IEM)		0.725
Green purchasing (GP)		0.718
Eco-Design and Packaging (EP)		0.699
Customer cooperation (CC)		0.735
Investment Recovery (IR)		0.740
	Green Supply Chain Management	0.513
Product innovation (PTI)		0.629
Process innovation (PSI)		0.662
Marketing innovation (MI)		0.653
Organizational innovation (OI)		0.705
	Innovation Capabilities	0.503
Price/cost (PC)		0.717
Quality (QY)		0.629
Delivery (DY)		0.772
	Competitive Advantages	0.519
	Social Performance	0.671

Note: AVE = Average Variance Extracted



Key: IEM: internal environmental management, GP: green purchasing, EP: eco-design and packaging, CC: customer cooperation, IR: investment recovery, PTI: product innovation, PSI: process innovation, MI: marketing innovation, OI: organization innovation, PC: price/cost, QY: quality, DY: delivery, SP: social performance

Figure 4.1: Research Model

4.6.3 Discriminant Validity

Discriminant validity is defined as the extent to which a construct is differentiated from other items by empirical criterion Hair Jr et al. (2017). In other words, it shows how many items represent only a single construct. In this study, the discriminant validity of the measures was checked by three criteria as recommended by Hair Jr et al. (2017), namely cross-loadings, Fornell-Larcker criterion, and HTMT (Heterotrait-monotrait) ratio to check and measure distinct concepts of the measurement model.

The cross-loading method is the first approach to be adopted to assess the discriminant validity of the indicators. As shown in Table 4.10 the cross-loading criteria fulfilled the requirements because of the indicators' outer loadings. Therefore, in this research, the measurement model accomplished satisfactory discriminant validity.

Table 4.10: Results of Discriminant Validity by The Cross Loading

	IEM	GP	EP	CC	IR	PTI	PSI	MI	OI	DY	QY	PC	SP
IEM01	0.864	0.282	0.308	0.196	0.193	0.195	0.188	0.334	0.110	0.193	0.139	0.195	0.332
IEM02	0.860	0.496	0.381	0.326	0.391	0.250	0.268	0.397	0.252	0.256	0.304	0.321	0.416
IEM03	0.835	0.282	0.309	0.203	0.231	0.108	0.245	0.298	0.208	0.185	0.189	0.273	0.337
IEM04	0.845	0.285	0.249	0.265	0.191	0.156	0.191	0.326	0.156	0.101	0.186	0.170	0.288
IEM06	0.855	0.281	0.297	0.187	0.230	0.195	0.105	0.306	0.109	0.177	0.153	0.184	0.252
GP02	0.329	0.893	0.435	0.410	0.513	0.352	0.372	0.471	0.288	0.335	0.389	0.314	0.361
GP03	0.405	0.902	0.491	0.384	0.514	0.345	0.337	0.481	0.238	0.349	0.414	0.285	0.359
GP04	0.253	0.772	0.270	0.260	0.349	0.275	0.271	0.381	0.308	0.221	0.227	0.185	0.297
GP05	0.272	0.753	0.299	0.220	0.281	0.223	0.194	0.349	0.194	0.191	0.163	0.183	0.229
GP06	0.385	0.902	0.404	0.406	0.501	0.346	0.356	0.486	0.257	0.259	0.398	0.339	0.354
EP01	0.318	0.445	0.836	0.323	0.419	0.266	0.211	0.366	0.153	0.245	0.366	0.356	0.342
EP02	0.323	0.342	0.840	0.231	0.317	0.282	0.175	0.266	0.197	0.262	0.320	0.290	0.320
EP03	0.233	0.280	0.778	0.222	0.333	0.290	0.164	0.146	0.138	0.214	0.305	0.262	0.261
EP04	0.304	0.384	0.843	0.280	0.352	0.256	0.189	0.334	0.156	0.196	0.279	0.250	0.217
EP05	0.349	0.443	0.882	0.289	0.430	0.347	0.265	0.356	0.254	0.289	0.352	0.391	0.449
CC01	0.150	0.285	0.224	0.840	0.325	0.124	0.193	0.213	0.170	0.160	0.313	0.216	0.175
CC02	0.352	0.472	0.362	0.876	0.393	0.210	0.316	0.357	0.329	0.151	0.447	0.401	0.335
CC03	0.242	0.322	0.284	0.857	0.326	0.108	0.243	0.262	0.181	0.123	0.333	0.352	0.238
CC04	0.250	0.303	0.234	0.863	0.290	0.101	0.203	0.285	0.208	0.171	0.400	0.277	0.240
CC05	0.185	0.330	0.262	0.851	0.307	0.123	0.197	0.260	0.142	0.136	0.386	0.265	0.221
IR01	0.143	0.261	0.220	0.222	0.811	0.114	0.199	0.325	0.150	0.154	0.216	0.152	0.192
IR02	0.289	0.552	0.453	0.424	0.898	0.370	0.308	0.478	0.181	0.240	0.436	0.312	0.299
IR03	0.295	0.533	0.470	0.367	0.900	0.273	0.274	0.446	0.205	0.255	0.372	0.282	0.338
IR04	0.275	0.375	0.328	0.269	0.828	0.205	0.136	0.372	0.174	0.154	0.324	0.260	0.237
PTI01	0.173	0.237	0.179	0.146	0.180	0.820	0.307	0.161	0.237	0.248	0.152	0.113	0.172
PTI02	0.181	0.413	0.397	0.182	0.336	0.846	0.468	0.264	0.437	0.436	0.291	0.213	0.445
PTI03	0.191	0.280	0.278	0.134	0.224	0.832	0.354	0.258	0.301	0.280	0.192	0.210	0.348
PTI05	0.124	0.318	0.314	0.146	0.256	0.827	0.356	0.171	0.339	0.284	0.215	0.177	0.302
PTI06	0.141	0.243	0.216	0.129	0.199	0.788	0.314	0.135	0.346	0.243	0.188	0.180	0.221
PSI01	0.172	0.257	0.137	0.185	0.164	0.314	0.842	0.208	0.377	0.403	0.177	0.165	0.421
PSI02	0.149	0.251	0.155	0.166	0.214	0.340	0.797	0.181	0.275	0.369	0.220	0.167	0.335
PSI04	0.268	0.298	0.194	0.245	0.175	0.385	0.857	0.199	0.353	0.390	0.160	0.197	0.455
PSI05	0.238	0.392	0.295	0.290	0.261	0.433	0.881	0.230	0.443	0.496	0.261	0.203	0.492
PSI06	0.173	0.343	0.228	0.256	0.254	0.390	0.839	0.190	0.424	0.359	0.243	0.173	0.442
MI01	0.309	0.350	0.302	0.233	0.343	0.223	0.120	0.824	0.155	0.103	0.211	0.272	0.319
MI02	0.453	0.513	0.350	0.353	0.419	0.220	0.338	0.836	0.204	0.271	0.284	0.296	0.485
MI03	0.266	0.431	0.291	0.196	0.396	0.160	0.213	0.805	0.124	0.173	0.156	0.160	0.239
MI04	0.270	0.468	0.297	0.251	0.391	0.204	0.102	0.776	0.125	0.107	0.199	0.182	0.196
MI05	0.253	0.297	0.190	0.258	0.385	0.182	0.139	0.797	0.191	0.105	0.254	0.152	0.282
OI01	0.262	0.374	0.277	0.265	0.213	0.462	0.493	0.197	0.850	0.490	0.284	0.263	0.487
OI02	0.175	0.170	0.164	0.188	0.162	0.261	0.293	0.155	0.841	0.319	0.209	0.193	0.252
OI03	0.112	0.214	0.236	0.205	0.131	0.361	0.351	0.106	0.840	0.310	0.178	0.236	0.292
OI04	0.166	0.247	0.150	0.192	0.143	0.310	0.368	0.162	0.834	0.378	0.161	0.221	0.319
OI05	0.115	0.225	0.149	0.173	0.199	0.288	0.340	0.108	0.834	0.310	0.206	0.197	0.325
PC01	0.344	0.381	0.474	0.411	0.364	0.265	0.225	0.294	0.314	0.837	0.244	0.429	0.399
PC02	0.153	0.225	0.230	0.259	0.235	0.146	0.124	0.140	0.186	0.862	0.171	0.284	0.235
PC03	0.265	0.236	0.275	0.250	0.231	0.202	0.150	0.233	0.207	0.848	0.147	0.273	0.241
PC04	0.212	0.257	0.306	0.290	0.218	0.148	0.155	0.254	0.217	0.832	0.209	0.225	0.314
PC05	0.178	0.225	0.277	0.296	0.217	0.160	0.163	0.208	0.195	0.854	0.168	0.339	0.171
DY01	0.128	0.245	0.240	0.177	0.195	0.306	0.371	0.165	0.353	0.215	0.875	0.169	0.281
DY02	0.253	0.380	0.331	0.115	0.230	0.423	0.478	0.222	0.455	0.205	0.877	0.256	0.448
DY03	0.165	0.267	0.265	0.192	0.200	0.285	0.408	0.147	0.361	0.154	0.876	0.180	0.323
DY04	0.170	0.251	0.180	0.191	0.147	0.280	0.426	0.158	0.366	0.208	0.886	0.210	0.310
QY01	0.260	0.333	0.310	0.357	0.254	0.226	0.213	0.288	0.244	0.369	0.202	0.802	0.284
QY02	0.151	0.260	0.328	0.377	0.360	0.228	0.192	0.111	0.237	0.301	0.197	0.804	0.162
QY03	0.235	0.302	0.282	0.343	0.358	0.201	0.199	0.195	0.163	0.328	0.160	0.799	0.191
QY04	0.160	0.294	0.302	0.349	0.311	0.208	0.248	0.194	0.217	0.189	0.196	0.794	0.236

QY05	0.120	0.361	0.321	0.326	0.329	0.153	0.150	0.309	0.127	0.269	0.171	0.764	0.168
SP01	0.314	0.235	0.304	0.178	0.330	0.266	0.408	0.382	0.276	0.256	0.266	0.218	0.846
SP02	0.258	0.194	0.212	0.134	0.240	0.194	0.334	0.285	0.269	0.192	0.239	0.177	0.780
SP03	0.329	0.410	0.346	0.279	0.226	0.370	0.443	0.312	0.417	0.300	0.372	0.229	0.814
SP04	0.354	0.402	0.321	0.330	0.242	0.370	0.464	0.322	0.427	0.304	0.380	0.220	0.805
SP05	0.340	0.388	0.396	0.306	0.335	0.378	0.480	0.333	0.361	0.307	0.354	0.278	0.870
SP06	0.351	0.261	0.316	0.218	0.256	0.264	0.385	0.322	0.243	0.272	0.315	0.254	0.830
SP07	0.254	0.220	0.267	0.133	0.185	0.225	0.378	0.273	0.295	0.184	0.260	0.103	0.787

Key: IME: internal environmental management, GP: green purchasing, EP: eco-design and packaging, CC: customer cooperation, IR: investment recovery, PTI: product innovation, PSI: process innovation, MI: marketing innovation, OI: organization innovation, PC: price/cost, QY: quality, DY: delivery, SP: social performance

The second method used to assess discriminant validity is the Fornell-Larcker measure. This criterion compares the square root of AVE values with the main variable correlations (Hair et al., 2017). In similar, the square root of each AVE's construct must be higher than its highest correlation with any other construct. Referring to the results in Table 4.11 reveals that the values of all average variance extracted were greater than the other elements of the row and column in which they are located, this confirms the discriminant validity of the outer mode. However, having established the construct validity of the outer model, it can be assumed that the giving results of the hypotheses testing should be reliable and be valid which also indicate in this study appropriate discriminant validity (Chin, 1998; Fornell & Larcker, 1981).

Table 4.11: Results of discriminant validity by Fornell-Larcker Criterion

	<i>Factors</i>	1	2	3	4
		CA	GSCM	SP	IC
1	CA	0.715			
2	GSCM	0.605	0.728		
3	SP	0.449	0.493	0.819	
4	IC	0.551	0.564	0.584	0.786

Key: GSCM: green supply chain management, IC: innovation capabilities, CA: competitive advantages, SP: social performance.

The last method used to assess the discriminant validity is HTMT (Heterotrait-monotrait) ratio. HTMT ratio is defined by Hair et al. (2017), as the mean value of the indicator correlation across constructs such as (heterotrait-heteromethod correlations) relative to the (geometric) mean of the average correlations of the indicators measuring the same construct. Henseler et al. (2014) indicated that HTMT values will have a problem if their values are higher than 0.90. As a result, in Table 4.12 all values were lower than the benchmark value of 0.90. This fulfilled the recommended HTMT criterion

Table 4.12: Results of Discriminant Validity by HTMT

	<i>Factors</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
		CA	GSCM	SP	IC
1	CA				
2	GSCM	0.665			
3	SP	0.488	0.521		
4	IC	0.619	0.618	0.415	

Key: GSCM: green supply chain management, IC: innovation capabilities, CA: competitive advantages, SP: social performance.

4.7 The Goodness of Fit (GoF) of the Model

According to Ramayah et al. (2018), goodness of fit (GoF) is a choice through PLS-SEM and it is not compulsory to be applied since this approach is still at the very early stage. Moreover, Henseler et al. (2014), considered the goodness of fit measure for PLS-SEM is as a standardised root mean square residual (SRMR) since this approach (GoF) is used to evaluate the overall fit of the model and to judge the model's quality in PLS-SEM, researchers should rely on measures indicating model's predictive capabilities. However, the researcher assessed the Goodness of Fit to support the model (Henseler et al., 2014).

The goodness of fit is defined for the PLS path modelling as the geometric mean of the average communality (outer measurement model) and average R² value for the endogenous constructs (Tenenhaus et al., 2004). The measure of GoF can be used to evaluate the overall fit of the model. To support the validity of the PLS model, the GoF value was estimated according to the guidelines set up by Wetzels et al. (2009), they proposed a closer value to GoF which is 1, $GoF=(0<GoF>1)$. Specifically, the GoF value for the model was calculated using the following formula:

$$Gof = \sqrt{(R^2 \times AVE)}$$

According to Wetzels et al. (2009), they identified the criteria of Gof as follows small 0.1, medium 0.25, and large 0.36. In this study, the obtained GoF value was 0.546 (average R² was 0.472, average AVE was 0.632). Therefore, the result provided evidence of an adequate global PLS model validity and was considered a good fit (Henseler, Hubona, & Ray, 2016). Moreover, the standardized root mean square residual (SRMR) of the model fit should be from 0.0 to 1.0. to indicate a good fit, where SRMR is defined as the root mean square discrepancy between the observed correlations and the model-implied correlations (Henseler et al., 2014). According to Anderson and Gerbing (1984), SRMR is enhanced (lowered) when the measurement model is clean (high factor loadings) an adequate cut-off value for PLS path models is (0.08) Henseler et al. (2016), Hu and Bentler (1999). Hence, the standardized root mean square residual (SRMR) criterion of the reflective measurement model for this research was 0.076. This was considered a valid model and a good fit.

4.8 Structural Model Assessment

After analysing the measurement model using PLS-SEM which is reliable and valid that allows moving to the next step to analyse the structural model that analyses the inner model which helps to examine the quality of the structural model and test the hypothesis (Hair Jr et al., 2017). Moreover, (R²) value, effect size (f²) as well as predictive relevance (Q²) were reported in this chapter.

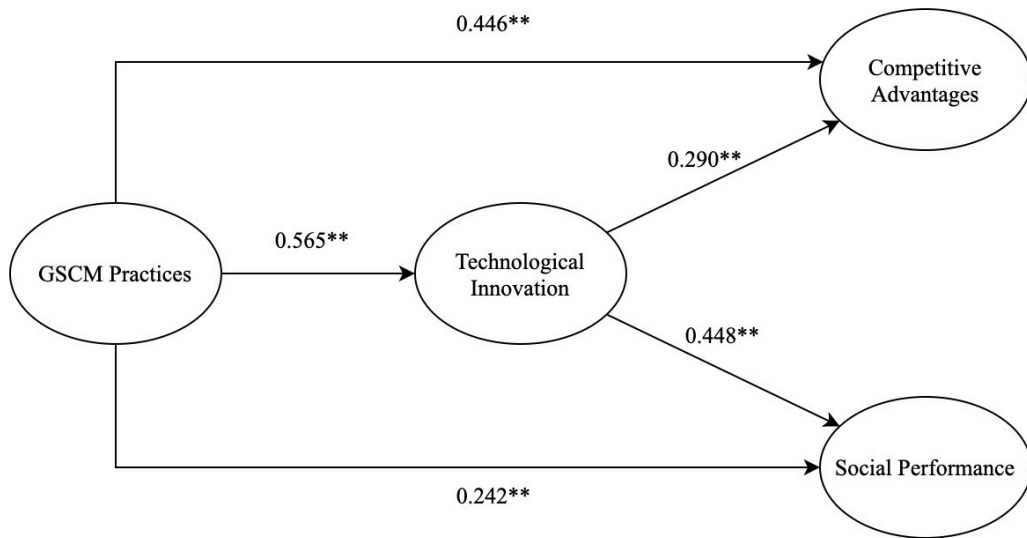
4.8.1 Direct Effect

After ensuring that there was no violation in the measurement model analysis, the structural model estimate was performed to test the developed hypothesis relationships. Hair et al. (2017), explained that direct effect has been introduced as a direct relationship between the independent variable and dependent variable in the PLS path model. However, the path coefficients and R² values in the structural assessment were examined first. Following that, the bootstrap analysis was performed to assess the statistical significance of the path coefficients. Thus, Hair et al. (2014), recommended that when the standardised values of path coefficients are closed to +1, this means a strong, positive, and meaningful relationship. The path coefficients of this research are displayed in Table 4.13 and Figure 4.2.

Table 4.13: Summary of The Direct Effect

	Relationship	Std Beta	Mean (M)	Std Error	T-value	P-values	Decision
H1	GSCM→CA	0.446	0.445	0.050	8.991	0.000	Supported
H2	GSCM→SP	0.225	0.226	0.066	3.395	0.001	Supported
H3	GSCM→IC	0.565	0.564	0.065	8.685	0.000	Supported
H4	IC→CA	0.296	0.297	0.058	5.089	0.000	Supported
H5	IC→SP	0.470	0.472	0.076	6.327	0.000	Supported

Key: GSCM: green supply chain management, IC: innovation capabilities, CA: competitive advantages, SP: social performance.



Note: * = $p < 0.05$, ** = $p < 0.01$

Figure 4.2: Structural Model

Referring to Hair et al. (2014) explained the R^2 which is also known as the coefficient of determination as an important criterion for assessing the structural model in PLS-SEM. However, the R^2 indicates that the variance in the endogenous variable (also referred to as dependent variable) is explained by the exogenous variables (also referred to as independent variables) and the main target constructs level of R^2 should be high. The minimum acceptable level of R^2 value proposed by Falk and Miller (1992), is 0.19. Meanwhile, Chin (1998), proposed that R^2 values of 0.67, 0.33, and 0.19 can be considered as substantial, moderate, and weak, respectively.

In this research, the results shown in Figure 4.2 and Table 4.14 indicates the hypothesis tests, with five direct hypotheses. H1's GSCM had a positive effect on competitive advantages, supported with ($\beta=0.445$, $t=8.991$, $p>0.000$). Likewise, GSCM significantly predicts social performance ($\beta=0.242$, $t=3.617$, $p>0.000$). Hence, H2 is supported. Moreover, there was a positive and significant effect between GSCM and

innovation capabilities at ($\beta=0.565$, $t=8.685$, $p>0.000$). This means that H3 was supported. These are similar to innovation capabilities which was found to significantly influence competitive advantages at ($\beta=0.290$, $t=4.959$, $p>0.000$). Hence, H4 is supported. Finally, the last hypothesis of this research was supported, since innovation capabilities predicted a positive, and significant effect on social performance at ($\beta=0.448$, $t=5.889$, $p>0.001$) respectively. Hence, H1, H2, H3, H4, and H5 were supported.

In terms of strengthening the relationship between exogenous and endogenous constructs which was indicated by the standardized path coefficient, the direct effect of GSCM on both competitive advantages and social performance seemed much stronger than a direct effect of innovation capabilities on competitive advantages and social performance.

Furthermore, the value of R^2 was achieved through the recommendation of Cohen (1988) who stated R^2 s value of 0.26 and above is considered substantial. On the other hand, Chin (1998), proposed that R^2 values of 0.67, is considered as substantial 0.32 as moderate, and 0.19 as weak for the endogenous latent variables in the inner path model. However, the result indicates model fit that could be considered as moderate. In response to that, the R^2 value of estimated model fits of data was acceptable since the result of this research showed exogenous variables of GSCM and CA 38% of the variance in SP. TE also explained 43 % of the variance in CA. GSCM explained 32 % of the variance in TI (see Figure 4.3 and Table 4.14).

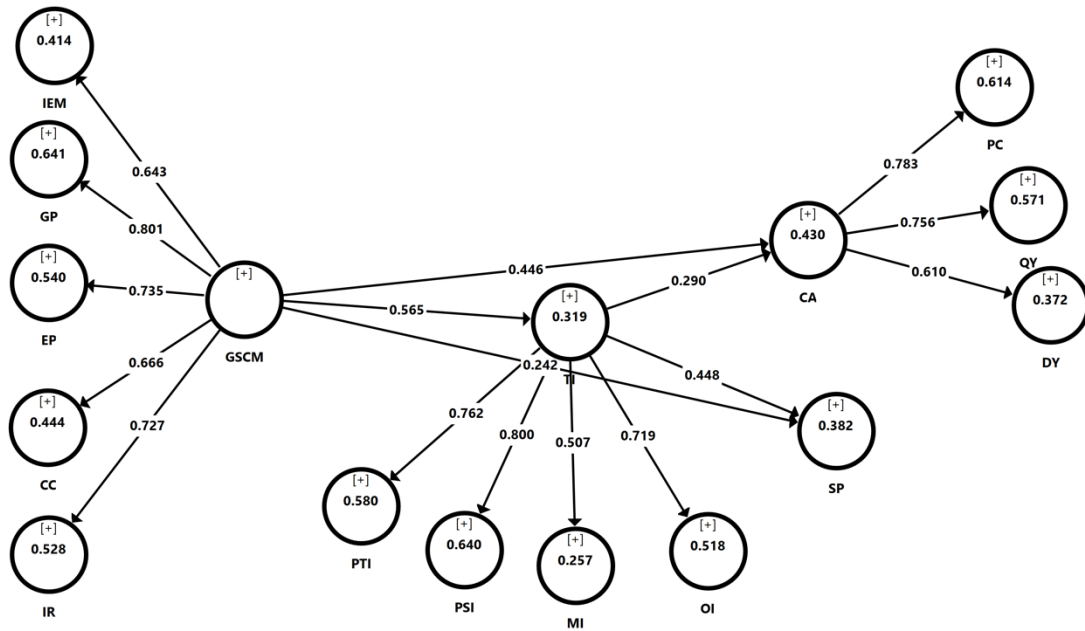


Figure 4.3: PLS Algorithm Results

Key: IME: internal environmental management, GP: green purchasing, EP: eco-design and packaging, CC: customer cooperation, IR: investment recovery, PTI: product innovation, PSI: process innovation, MI: marketing innovation, OI: organization innovation, PC: price/cost, QY: quality, DY: delivery, SP: social performance

Table 4.14: R² of Endogenous Latent Variables

Construct	R ²	Result	
		Cohen (1988)	Chin (1998)
Competitive Advantages	0.430	Substantial	Moderate
Social Performance	0.382	Substantial	Moderate
Innovation Capabilities	0.319	Substantial	Moderate

4.8.2 Effect Size

The effect size (F^2) is required in Smart-PLS (SEM). This research also assessed the effect size (F^2) to determine the change in R² to recognise whether the impact of an exogenous latent variable on an endogenous latent variable has a substantive, moderate, or weak impact on a given endogenous latent construct impact. Cohen (1988), proposed effect size values of F^2 : 0.35 (large), 0.15 (medium), and 0.02 (small). Table 4.15 reveals that the F^2 results indicated that there was a medium effect size on the relationship between GSCM and CA ($F^2=0.238$), while the relationship between GSCM

and SP had a small effect size with ($F^2=0.065$). On the other hand, the relationship between GSCM and IC has a large effect size ($F^2=0.468$), and IC and CA ($F^2=0.101$). Finally, a medium effect size was found on the relationship between IC and SP ($F^2=0.220$).

Table 4.15: The Effect Size of The Model

Relationship	F^2	Result
GSCM→CA	0.238	Medium
GSCM→SP	0.065	Small
GSCM→IC	0.468	Large
IC→CA	0.101	Small
IC→SP	0.220	Medium

Key: GSCM: green supply chain management, IC: innovation capabilities, CA: competitive advantages, SP: social performance.

4.8.3 Mediation Effect Analysis

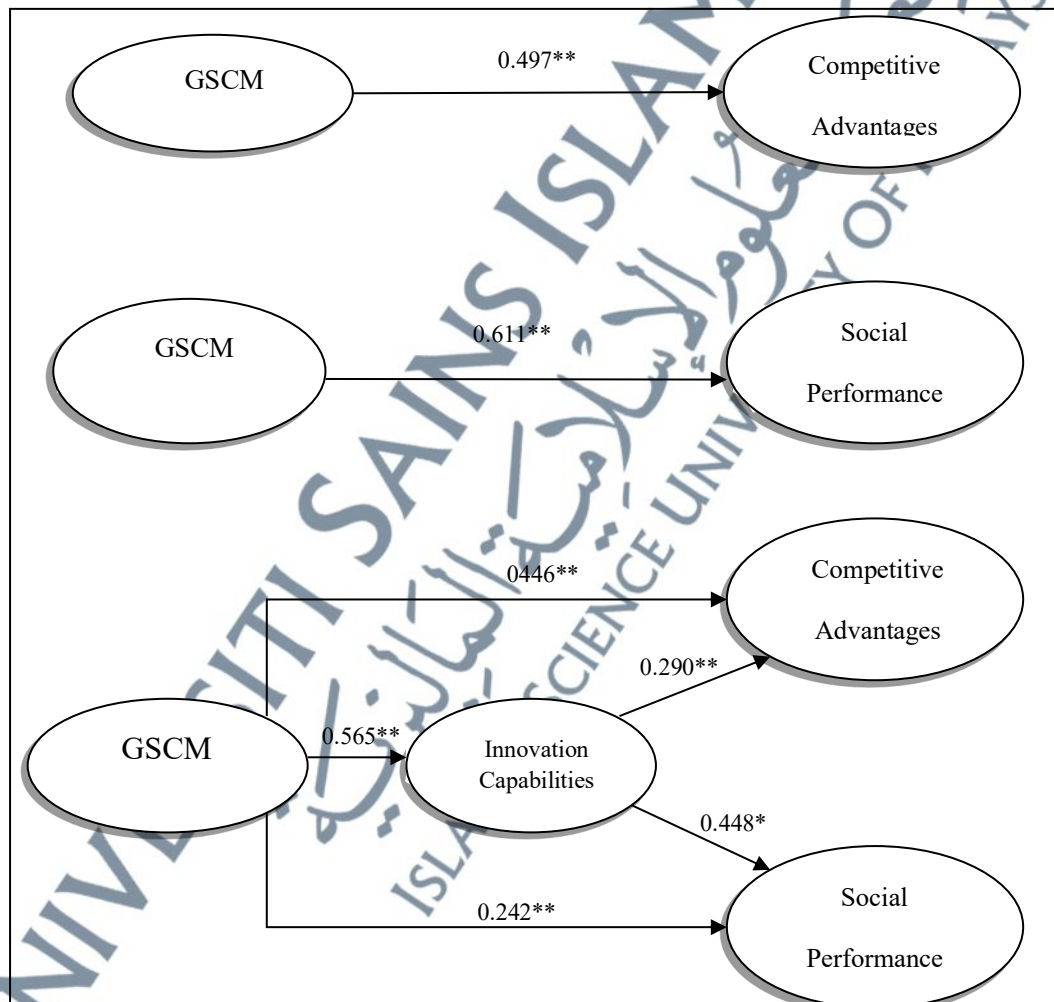
In this research, innovation capability has been chosen as the mediator variable between conjectured relationships in this study, and this involves green supply chain management practices as the independent variable and competitive advantages and social performance as dependent variables. The mediator occurs when a third variable intervenes between two other related constructs. Specifically, a change in exogenous (an independent latent variable) to its endogenous (dependent latent variable) in the PLS path model (Hair et al., 2017). Moreover, Hays (2018), introduced the mediation analysis used as a statistical method which is used to answer the question of how X transmits its effect on Y. According to Baron and Kenny (1986), they defined the mediator as a variable that accounts for all or part of the relationship between a predictor and outcome. The purpose of the mediation test is to ascertain whether a mediator construct can significantly carry the impact of an exogenous construct to an endogenous construct Ramayah et al. (2018), to understand the mechanism through which the causal

variable affects the outcome (Baron and Kenny, 1986). A mediating effect is developed when there is an intervention of a third variable or construct with two other related constructs (Hair et al., 2017).

According to Hayes and Preacher (2010), there are three different techniques of test mediation in a multivariate analysis some of these techniques include: Baron and Kenny (1986), causal step approach, Sobel test (Sobel, 1982); and contemporary approaches with fewer unrealistic statistical assumptions. These include a re-sampling approach known as PLS bootstrapping (Bollen & Stine, 1990; Preacher & Hayes, 2004). However, the researchers applied the method of Baron and Kenny (1986), to examine the mediation effect. The casual steps approach developed by Baron and Kenny (1986), which considered the most approach used to test simple mediation (Hayes, 2009). Based on the results provided in Figure 4.4 and Table 4.16, the first step of Baron and Kenny (1986), to test the effect of the independent variable (X) on the dependent variable (y) without the existence of the mediator variable. Therefore, proving that GSCM is significantly related to CA without the present of the MV (IC) ($\beta=0.611$, $p<0.000$), and it is also significantly related to SP ($\beta = 0.497$, $p < 0.000$), which indicates that Step 1 was fulfilled.

The second step of Baron and Kenny (1986) method is to test the effect of the independent variable (X) on the mediator variable (M) which must be statistically significant. Hence, Table 4.16 and Figure 4.4 illustrate that the GSCM is significantly related to IC ($\beta = 0.565$, $p < 0.000$). This means that step 2 of Baron and Kenny (1986), was fulfilled. Next in step 3, the results imply that the MV (IC) is significantly related to CA ($\beta=0.448$, $p<0.000$), and to SP ($\beta = 0.290$, $p < 0.000$), which indicates that Step 3 was fulfilled. Next, the last step as suggested by Baron and Kenny (1986), and Judd and Kenny (1981), is to test the effect of the independent variable (X) on the dependent

variable (Y) with the existence of mediator variable and to ascertain whether full mediation has occurred or partial mediation has occurred. The results showed that there a significant effect between GSCM and CA ($\beta = 0.446$, $P = 0.000$), Baron and Kenny (1986), approach determined that partial mediation takes place if the effect of independent variables on dependent variables with the existence of mediating. On the other hand, the result showed that there is a significant effect between GSCM and SP ($\beta = 0.241$, $p < 0.000$), which implies that a partial mediation took place between GSCM and SP.



Note: * = $p < 0.05$, ** = $p < 0.01$

Figure 4.4: Testing the Mediation Effect Using Baron and Kenny (1986) Approach

Table 4.16: Mediation Analysis

Relationship	C (IV → DV)		Path a		Path b		Direct effect C' Within Model		Indirect Effect			Confidence Interval		Type of mediation	
	Path coeff.	t- value	Path coeff.	t- value	Path coeff.	t- value	Path coeff.	t- value	Path coeff.	SE	t- value	95% LL	95% UL		
H6	GSCM-IC-CA	.0611**	11.886	0.565**	8.685	0.290**	4.959	0.446**	8.991	0.164	0.051	3.213	0.064	0.264	Partial mediation
H7	GSCM-IC-SP	.0497**	8.337	0.565**	8.685	0.448**	5.889	0.242**	3.617	0.253	0.060	4.219	0.136	0.371	Partial mediation

Key: GSCM: green supply chain management, IC: innovation capabilities, CA: competitive advantages, SP: social performance.

Note: * = p < 0.05, ** = p < 0.01

The bootstrapping approach has been used in the present study to confirm the mediating effect (Preacher & Hayes 2008). This mediation approach suggests two steps to be tested with the mediating effect using the bootstrapping method. The first step is bootstrapping the indirect effect (total effect), where the relationship between IV and DV via mediator should be significant ($p\text{-value} < 0.05$). The second step is bootstrapped confidence interval lower level (LL) and upper level (UL).

This study used the bootstrapping method with 2000 bootstrap re-sampling and bias-corrected confidence intervals were used for testing the significance level of each mediating effect (Preacher & Hayes, 2008). Bootstrap samples are generated by repeated estimation of the coefficients with a minimum of 2000 bootstrap samples method to test the significance level of each mediating effect. The indirect effect of bootstrapping (total effect) which the relationship between IV and DV via mediator must be significant with $p\text{-value} (< 0.05)$, and confidence interval CI (lower and upper level) should be conducted to analyze the mediating effect. Two mediating hypotheses were as follows:

H6: There is a mediating effect of innovation capabilities in the relationship between GSCM practices and competitive advantages.

H7: There is a mediating effect of innovation capabilities in the relationship between GSCM practices and social performance.

Referring to Table 4.16 shows the results of the bootstrapping analysis which indicate that the indirect effect of the relationship between GSCM and CA ($\beta = 0.164$) was significant with a $t\text{-value}$ of 3.213. Furthermore, Preacher and Hayes (2008), indicated that the 0.164, 95 percent boot CI: (LL = 0.064, UL = 0.264) does not straddle a 0 in between, thus indicating that there is a mediation. Thus, this study can conclude that the mediation effect of the TI variable is statistically significant. However, the

direct effect between GSCM (IV) and CA (DV) is also statistically significant ($\beta=0.446$, T-value = 0.8367, P-value = 0.000). Accordingly, TI partially mediates the relationship between GSCM and CA and therefore H6 is supported.

Moreover, Table 4.16 shows the results of the bootstrapping analysis which suggest that the indirect effect of the relationship between GSCM and SP ($\beta = 0.253$) was significant with a t-value of 4.219. Moreover, Preacher and Hayes (2008), imply that the 0.253, 95 percent boot CI: (LL = 0.136, UL = 0.371) does not straddle a 0 in between, which underlies the existence of mediation. Thus, this study can conclude that the mediation effect of the TI variable is statistically significant. On the other hand, the direct effect between GSCM (IV) and SP a significant ($\beta=0.225$, T-value = 3.395, P-value = 0.001). Accordingly, TI partially mediates the relationship between GSCM and SP, thus indicating that H7 was also supported.

4.9 Predication Relevance of The Model

In this section, the predictive relevance Q2 was employed to calculate the power of the proposed research model regarding predictive relevance. The predictive relevance proposes that the model must be capable enough to predict each endogenous latent construct's indicator. However, to evaluate the criterion of predictive accuracy, Stone-Geisser's Q2 value was utilized (Hair Jr et al., 2017). The blindfolding procedure was performed to obtain the value of Q2. Henseler, Ringle, and Sinkovics (2009), stated that the research model is considered as having predicting relevant; the Q2 value is higher than "0" for a specific reflective endogenous latent variable.

Next, the results shown in Table 4.17 illustrated that the values of Q2 of innovation capabilities, competitive advantages and social performance obtained greater than "0" ranging from 0.105 for innovation capabilities, 0.152 competitive

advantages to 0.251 for social performance. This indicates that there was an adequate predictive relevance for the proposed model.

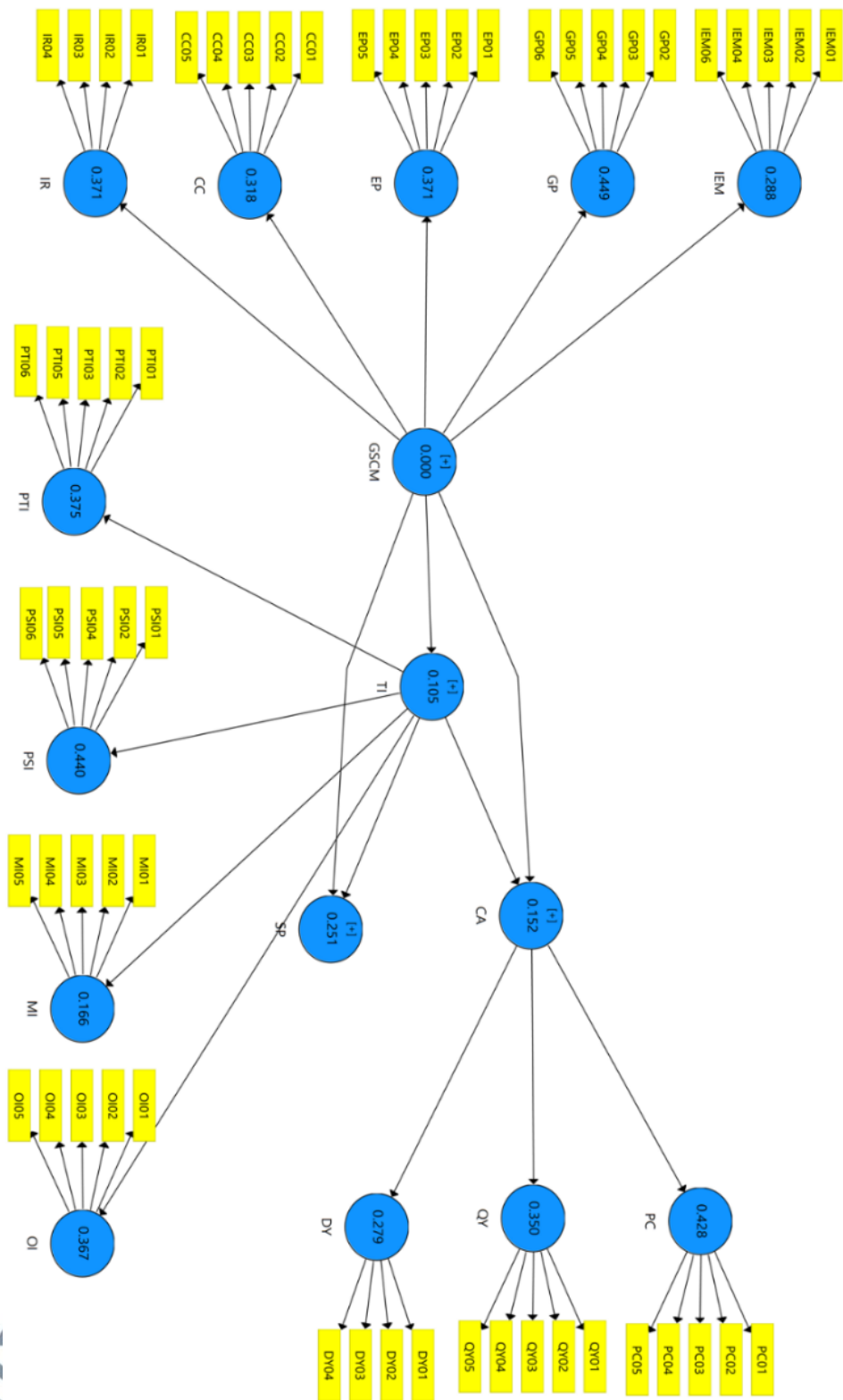
Table 4.17: Prediction Relevance of The Model

Variable	SSO	SSE	Q ² (=1-SSE/SSO)	Result of Predictive Relevance
Innovation Capabilities	5,160.00	4,619.56	0.105	Yes
Competitive Advantages	3,612.00	3,062.62	0.152	Yes
Social Performance	1,806.00	1,352.88	0.251	Yes

Key: SSO: sum of the squared observations, SSE: sum of the squared prediction errors

4.10 Summary of Research Hypotheses

This research has seven hypotheses: five of them were the direct effect hypotheses and two of them were the indirect effect hypotheses. In total, seven hypotheses were supported. Table 4.18 summarizes the results of research hypothesis testing.



Key: IEM: internal environmental management, GP: green purchasing, EP: eco-design and packaging, CC: customer cooperation, IR: investment recovery, PTI: product innovation, PSI: process innovation, MI: marketing innovation, OI: organization innovation, PC: price/cost, QY: quality, DY: delivery, SP: social performance

Figure 4.5: The Predictive Relevance of The Endogenous Latent Variables (Q2)

The table below summaries the findings of the current study.

Table 4.18: Summary of Hypotheses Testing

Hypotheses	Direct Relationships	Result
	There is a positive effect of green supply chain management practices on a firm's competitive advantages.	Supported
	There is a positive effect of green supply chain management practices on a firm's social performance.	Supported
	There is a positive effect of green supply chain management practices on a firm's innovation capabilities.	Supported
	There is a positive effect of innovation capabilities on a firm's competitive advantages.	Supported
	There is a positive effect of innovation capabilities on a firm's social performance.	Supported
Mediating Variable		
	There is a mediating effect of innovation capabilities in the relationship between GSCM practice and competitive advantage.	Supported
	There is a mediating effect of innovation capabilities in the relationship between GSCM practice and social performance.	Supported

4.11 Summary

In conclusion, this chapter reports the findings of the data analysis obtained from the targeted population in 258 manufacturing companies certified with ISO14001 in Malaysia. The initial data screenings were carried out using the SPSS version 25.0 focused on frequencies and percentages to describe the profile of the respondents. Moreover, the software also we used to conduct the descriptive analysis to test the data distribution on main constructs such as green supply chain management practices, innovation capabilities, competitive advantages and social performance. In addition, this study used SPSS to analyse assumptions (i.e., outliers, and multicollinearity).

This study also used PLS-SEM used to test the measurement and structural model. In assessing the structural model, the value for path coefficient (β), variance explained (R^2), and effect size (f^2) for each path in the model were determined. Then, the predictive relevance (Q^2) was conducted. Bootstrapping was also performed and the PLS generated a t-value for each path for hypotheses testing. However, seven hypotheses of this research were tested and it was found that all seven hypotheses were supported. Furthermore, the impact of the mediator variable namely innovation capabilities was tested and affirmed. Finally, the last chapter discuss the findings of this research, research implications, limitations, and suggestions for future research.