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Influence mechanism between information management technologies and green innovation: the role of sustainable firms practices in China

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ABSTRACT

Despite the proposition of sustainable development goals by the United Nations, the progress shown by the organizations is not satisfactory. It also raised the attention of the policymakers to overcome those challenges by identifying potential solutions. Hence, the current study aims to assess the role of the information and knowledge management process in attaining green innovation in sustainable practices. For this purpose, the data is collected from the 395 organizations operating in China that are ISO 14001 certified. The application of PLS-SEM shows that information and knowledge management significantly and positively enhance all three sustainable practices, which eventually play an encouraging role in green innovation. Additionally, all three types of sustainable practices also reported mediating the relationships between the information and knowledge management process and green innovation. Based on the findings, organizations are recommended to integrate and align sustainable practices, information management, and green innovation with the mission, vision, and routine activities and objectives.

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1. Introduction

Controlling adverse effects because of commercial activities and their mitigation for ecological well-being is becoming a global issue where the stakeholders pressurize organizations to have environmental protection and conservation policies (Shahzad et al., 2020). Due to these, global commercial giants like Ford, General Motors, IBM, and Toyota have urged their suppliers to have certifications that certify their contribution toward environmental pollution and degradation elimination (Tian et al., 2014). Despite the proposition of sustainable development goals by the United Nations, the progress shown by the organizations is not satisfactory, which also raised the policymakers' attention to overcome those challenges by identifying the potential

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solutions to overcome them (Awan et al., 2021). Thus, organizations must integrate sustainable practices to achieve operational excellence and market competitiveness.

Sustainable practices are operationally comprised of three kinds of practices. These include ecological, economic, and social practices (Tseng et al., 2018). For instance, to control the global calamity caused because of carbon emissions and pollution leading to adverse global warming, organizations need to have a transformation toward energy consumption that are environmentally friendly and renewable (Wang, 2020). Practices by which such a process of transformation is expedited are covered in Sustainable Environment Practices. Similarly, by reducing operational costs, organizations improve productivity and efficiency, which eventually contribute to financial benefits, and such practices are categorized as Sustainable Economic Practices (Saunila et al., 2018). On the other hand, organizations provision equal employment opportunity, avoid gender discrepancy, striving to improve the underprivileged people in society and the practices through which such initiatives are taken falls under the category of Sustainable Social Practices (Shahzad et al., 2021; Wang, 2020).

On the other hand, the rapid increase in business due to globalization has alarmed organizations to sustain their competitiveness. For this purpose, an efficient tool is reported to be the information and knowledge management process (Ooi, 2014). This process is majorly comprised of three aspects. Firstly, Knowledge Acquisition through which new, advanced and recent learning, information and/or knowledge is discovered and acquired, eventually assisting the organizations in their pursuit of operational excellence (Darroch, 2005). Secondly, Knowledge Dissemination through which new, advanced and recent learning, information and/or knowledge is disseminated and diffused among the stakeholders of the organizations, which eventually assists the organizations in their pursuit of operational excellence (Shahzad et al., 2020). Thirdly, Knowledge Application through which new, advanced and recent learning, information and/or knowledge is assimilated, embraced, and implemented within the organizations' processes, supporting the organizations in their pursuit of operational excellence (Mills & Smith, 2011).

Despite all of the initiatives, for the betterment of the ecology and environment, organizations need to have an extent of innovation through which the advancement and revolution are deployed in the existing operations (Yousaf, 2021). This enables the organization to improve productivity and assists in the transformation process for better and further environment-friendly processes, products, and services (Jun et al., 2019; Razzaq et al., 2021). However, for innovation, organizations need to have certain forces which trigger the enforcement and implementation of a green and clean philosophy (Shahzad et al., 2020). Primarily organizations need to implement sustainable practices within their operations, which must also be aligned with the process of information and knowledge management (Gupta & Barua, 2018; Khan et al., 2021; Shahzad et al., 2020).

China is a country that is still considered a developing economy, whereas, in terms of income, it is categorized as upper-middle. Moreover, as per the Global Innovation Index (2021), the country is ranked 12th, which shows the level of support by the organizations and governments towards innovation and competitiveness. Despite the significance of sustainable practices for excelling toward green innovation, the role of

information and knowledge management is either neglected or least explored. Hence, the current study aims to assess the extent of assistance the information and knowledge management process provides in attaining green innovation in the presence of sustainable practices. Therefore, the following are the research questions on which the present study is based.

RQ1: What is the role of the information and knowledge management process in enhancing sustainable practices?
RQ2: To what extent do sustainable practices (including social, ecological, and economic) contribute to green innovation?
RQ3: To what extent do sustainable practices (including social, ecological, and economic) mediate the relationships between information and knowledge management processes and green innovation?

For seeking the answers to the research questions mentioned above, the rest of the study is organized as the following section comprised of discussion related to hypotheses development, followed by research methodology, estimations, and results, whereas the last section comprised of conclusion and recommendations.

2. Literature review

2.1. Knowledge acquisition and sustainable practices

Knowledge acquisition is the process through which new, advanced and recent learning, information and/or knowledge is discovered and acquired, which eventually assists the organizations in their pursuit of operational excellence (Darroch, 2005). Primarily, it is associated with acquiring and identifying customer needs and requirements, incorporating which the firms will be in a better position to generate economic benefits. Moreover, when there is an integration of sustainability, it opens an avenue for all stakeholders to collaborate and cooperate, and efficiently communicate regarding the latest developments and the knowledge through which the product and service offerings of the organization is improved (Shah & Soomro, 2021). Incorporating the latest development is an essential element of innovativeness and researchers have reported a positive association between knowledge acquisition and innovativeness (Cui et al., 2021; Darroch, 2005). To integrate sustainable practices, there is a need to have an environment and atmosphere within the organization through which the process of Knowledge Acquisition is completed (Shahzad et al., 2021). Recently, a few researchers have highlighted the association between Knowledge Acquisition and sustainability goals and urged to have a Knowledge Acquisition process for the integration of sustainability within the operations of the organizations (Abbas & Sağsan, 2019). Moreover, for efficient integration of sustainability practices, the process of knowledge acquisition is extremely crucial (Shahzad et al., 2020). Hence it is proposed that:

H1: Knowledge Acquisition significantly enhances the integration of Sustainable Environmental Practices.

H2: Knowledge Acquisition significantly enhances the integration of Sustainable Economic Practices.

H3: Knowledge Acquisition significantly enhances the integration of Sustainable Social Practices.

2.2. Knowledge dissemination and sustainable practices

The term Knowledge Dissemination has been explained as the process through which a new, advanced, and recent learning, information and/or knowledge is disseminated and diffused among the stakeholders of the organizations, which eventually assist the organizations in their pursuit for operational excellence (Shahzad et al., 2020). The dissemination process can be multi-facets, comprising of knowledge collection and then information sharing. This means that for efficient dissemination, firstly, there is a need to have a collection of knowledge, in which the relevant information is compiled and then such compiled and collected information is accordingly disseminated among the related stakeholders (Lee et al., 2013). This disseminated knowledge enabled the employees and organizational staff to seek potential solutions and further innovate them to improve the problem-solving and decision-making process (Awan et al., 2021). Similarly, in order to penetrate the knowledge related to sustainability, an organization should have a culture and atmosphere where information sharing, learning, and knowledge dissemination is encouraged with a common objective to improve organizational, and operational excellence (Abbas & Sağsan, 2019; Shahzad et al., 2021). Moreover, through knowledge dissemination, the sustainable corporate performance of the organization will also have favourable progression and development (Shahzad et al., 2020). Hence it is proposed that:

H4: Knowledge Dissemination significantly enhances the integration of Sustainable Environmental Practices.

H5: Knowledge Dissemination significantly enhances the integration of Sustainable Economic Practices.

H6: Knowledge Dissemination significantly enhances the integration of Sustainable Social Practices.

2.3. Knowledge application and sustainable practices

The term Knowledge Application has been explained as the process through which a new, advanced, and recent learning, information and/or knowledge is assimilated, embraced, and implemented within the processes of the organizations, which eventually provide assistance to the organizations in their pursuit for operational excellence (Mills & Smith, 2011). Moreover, according to Lee et al. (2013), Knowledge Application is a favourable response to acquired learning which is also a sort of confidence and reliance shown by the organization in the same acquired learning. The most critical and important application of the acquired knowledge is assumed the one which is integrated in the development phase of the product and service offering, which includes either in the process, in the product or could be both (Mills & Smith,

2011; Shahzad et al., 2021). To integrate the philosophy of sustainability in the product offerings, organizations need to apply the newer technologies, solutions, and advancements available in the market so that they can reap the potential benefits through their offering of sustainable products, which could also get them a sustainable competitive advantage (Abbas & Sağsan, 2019; Shahzad et al., 2020). Furthermore, when the organizations effectively apply their acquired knowledge in their processes, it will improve their transition towards having sustainable practices within their operations. Hence it is proposed that:

H7: Knowledge Application significantly enhances the integration of Sustainable Environmental Practices.

H8: Knowledge Application significantly enhances the integration of Sustainable Economic Practices.

H9: Knowledge Application significantly enhances the integration of Sustainable Social Practices.

2.4. Sustainable practices and green innovation

As already discussed, sustainable practices are comprised of three practices, which include Precisely, through the assistance of the sustainable environmental practices, the products that are being developed are advanced and more environmentally complied in terms of the material usage, manufacturing operations performed, as well as for delivering the goods to the consumer for consumption, all of these operations are made environmentally friendly, and the environmental costs are controlled and eventually diminished (Saunila et al., 2018). Moreover, since consumers are now demanding environmentally friendly products, therefore to have the integration of philosophy of sustainability, organizations need to have the acceptance and integration of such practices within their operations (Huang & Li, 2017). In addition, since the transformation towards environmentally friendly products are impossible without innovation, Sustainable Environmental Practices have been considered an integral element of green innovation (Saunila et al., 2018; Zhang et al., 2020). Hence it is proposed that:

H10: Sustainable Environmental Practices significantly enhance Green Innovation.

Similarly, the other important aspect of sustainable practices is Sustainable Economic Practices. These practices have been considered tool to improve the organization's financial position and societal well-being (Saunila et al., 2018). This is because when the organizations strive for cost-saving through enhancing the level of productivity and efficiency, reducing the level of wastage or non-value-added activities, optimize the consumption of energy and other natural resources, all of these operations are not financially contributing to the organization, but at the same time, it is also improving the societal well-being (Ardito et al., 2019; Geng et al., 2021; Tseng et al., 2018). It should also be noted that such kind of improvement in the level of productivity is possible due to the contribution of green innovation; therefore, sustainable economic practices are also a contributing factor in improving the level of green innovation (Abdul-Rashid et al., 2017; Shahzad et al., 2021). Hence it is proposed that:

H11: Sustainable Economic Practices significantly enhance Green Innovation.

On the other hand, Sustainable Social Practices are comprised of operations through which there is a growth in the human capital, provision of employment and improvement in the society's overall well-being (Saunila et al., 2018). There is no doubt that through the internal capabilities of the organizations where knowledge is created and developed, such knowledge creation leads to an advancement in the level of green innovation (Lim et al., 2017). However, there are certain practices through which the organization and society are interlinked. For instance, by providing training to the employees regarding environment preservation and resource optimization, those employees are also part of the society and will accordingly disseminate such knowledge to the other societal members (Awan et al., 2021). Similarly, through such kind of initiatives, there will be a collaborative approach between the organization and other societal members towards attaining green innovation, which not just improves the level of sustainability of the organization but the overall society as well (Nidumolu et al., 2013; Song & Yu, 2018). Hence it is proposed that:

H12: Sustainable Social Practices significantly enhance Green Innovation.

2.5. Sustainable practices as mediators

Experts in different fields and research areas regularly highlight the importance of sustainable practices. In addition to this, numerous researchers have reported its association with innovation, who consider it to be a contributing factor to innovative performance (Darroch, 2005) and an integral element for sustainable and green innovation (Nidumolu et al., 2013). However, to achieve a better outcome, sustainable practices must be integrated within the business and organizational strategy, whereas it requires support from not just the top management but also the other employees (Shahzad et al., 2021). Once the internal stakeholders are committed to these practices, it will play a triggering role in attaining green innovation (Abbas & Sağsan, 2019; Davenport et al., 2019; Ooi, 2014). Hence, in addition to the direct association between the knowledge management practices with sustainable practices, and sustainable practices in bringing green innovation, it is assumed that once sustainable practices become an essential element of the organizational strategy and operating policies, it will enhance the assurance of the organization towards green innovation (Shahzad et al., 2021). Hence it is proposed that:

H13: Sustainable Practices significantly mediate the association between Information Management Practices and Green Innovation.

Lastly, Figure 1 presents the direct and indirect (mediating) relationship between model variables.

3. Methodology

Before conducting any research, a researcher can choose various alternatives available in the research purpose and design context. Majorly, research can either be quantitative, qualitative, or mixed (integration of both quantitative and qualitative). Hence

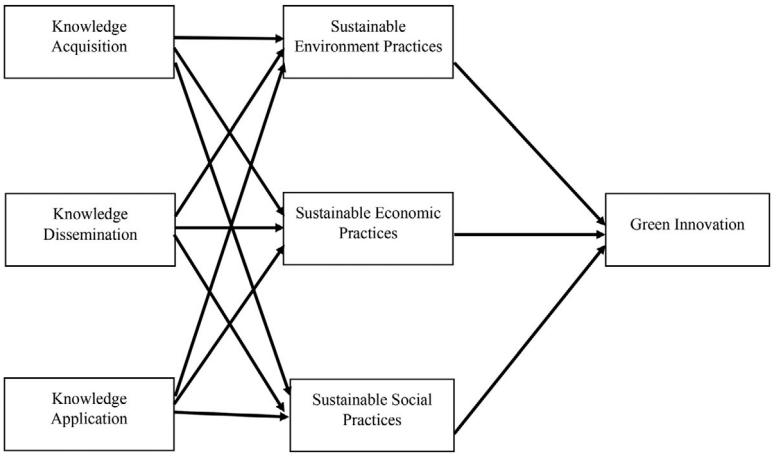

Figure 1. Framework of the study.
Source: Authors drawing.

the selection of a particular research approach should be made in terms of the objectives and research questions which provide a direction about the possible solutions for seeking solutions to a highlighted research problem. Therefore following the proposed research questions and objectives, the current research falls within the domain of the quantitative research approach, in which the precise research design is the survey methodology. Through the survey research design, the researcher is enabled to collect the data, which is quantitative, with the assistance of a research survey form which itself is an extremely crucial element in any survey design. Moreover, this survey form collects data from the potential respondents who qualify for the target populace.

There are several potential benefits associated with survey research design. These include outcome generalization, where the data is collected from the potential sample (relatively smaller in size) and then the outcome can be generalized to the populace sharing similar attributes and features. In addition to this, this research design is more cost-effective when compared with the other research methodologies, whereas it is also resource-efficient in terms of time, energy, and so on (Cooper et al., 2006). In addition to the potential benefits associated with the survey research design, it is also prone to absorbing unwanted operational and methodological variance, which can inflate the outcome generated through this methodology and hence require careful consideration (Hulland et al., 2018). This unwanted variance is also termed 'Common Method Variance' (CMV) (Podsakoff et al., 2003), which is discussed later in this section.

3.1. Development of questionnaire

In survey methodology, data collection is made through a survey questionnaire. Since the connection between the researcher and the potential respondent regarding the study is made possible through a survey questionnaire, its development phase is crucial. Firstly, the measurement of the studied variables should be reliable and robust

Table 1. Source of measures.

Constructs	Number of Items	Sources
Knowledge Acquisition	6	Darroch Darroch (2005) and Shahzad et al. (2020)
Knowledge Dissemination	5	Darroch Darroch (2005) and Shahzad et al. (2020)
Knowledge Application	5	Darroch Darroch (2005) and Shahzad et al. (2020)
Sustainable environmental practices	5	Saunila et al. (2018)
Sustainable economic practices	4	Saunila et al. (2018)
Sustainable social practices	4	Saunila et al. (2018)
Green Innovation	6	Song and Yu (2018)

enough to collect reliable responses that could further lead to robust outcomes. Secondly, the questionnaire outline should have user-friendly navigation to provide the respondent with an experience of ease and comfort. Focusing on the first requirement, the questionnaire of the current study is comprised of the measurements adapted from the existing literature.

Moreover, these questions were asked on the Likert Scale of 5 points where '1 represents Strongly Disagree', '2 represents Disagree', '3 represents neither Disagree nor Agree', '4 represents Agree', and '5 represents Strongly Agree'. Secondly, for the navigation, the placement of the questions was made to reduce the possibility of the respondents' mental distress while responding to the questionnaire. The details from the measurements that were adapted are listed in Table 1.

3.2. Collection of data and data screening

Following the context of the present study, the target populace for the current study were the manufacturing organizations operating in China. Moreover, among these manufacturing organizations, only those firms were approached that are internationally certified for integrating green philosophy, like ISO 14000. These certifications were considered criteria for delimitation for the manufacturing organizations as only the certified firms understand the essentiality and importance of green philosophy within their operations. Furthermore, there was a circulation of 1000 questionnaires to different firms from where 439 were returned, leading to a response rate of 43.9%. Among those returned questionnaires, following the recommendations of Hair et al. (2010) regarding data screening, there was a discard of 44 responses because of being the property of an outlier that could affect the overall flow and behaviour of the data. The demographic profiles of the collected sample are mentioned in Table 2.

3.3. Controlling for unwanted variances

As discussed earlier, the unwanted variances tend to inflate the generated outcome analyzed through the collected data; therefore, it's handling and controlling is also integral. For CMV, which is an unwanted methodological variance, several remedies are further categorized as operational and statistical remedies (Podsakoff et al., 2012). From the category of operational remedies, the solutions implemented in the current study include the provision of a temporal gap where the navigation of the questionnaire plays an important role and improving the language of the measurement scales, which need to be simple and easy to comprehend. For the language, the

Table 2. Descriptive statistics.

		Frequency	Percent
Gender	Female	164	42%
	Male	231	58%
	Total	395	100%
Age	30 or less years	99	25%
	31–40 years	182	46%
	41–50 years	69	17%
	51 and above	45	11%
	Total	395	100%
Size (Number of Employees)	Less than 100	92	23%
	101–250	139	35%
	251–450	94	24%
	More than 450	70	18%
	Total	395	100%
Industry	Automobile	107	27%
	Electronics	112	28%
	Chemical	76	19%
	Pharmaceutical	84	21%
	Others	16	4%
	Total	395	100%

Source: Authors estimation.

questionnaire, despite being based on the adapted scales, was ensured to pass the face and content validity requirements. This validity was assessed by a panel of 5 experts, including three from linguistics and two from the relevant subject and research area. From the statistical remedies, Harman's (1976) test was used to assess the level of CMV as discussed by Najmi and Ahmed (2018) which is found to be acceptable in the current study. Additionally, as Kock (2015) discussed, full collinearity analysis was used, the outcome of which also declared the data free from CMV.

In addition to CMV, there was an assessment of Social Desirability Bias (SDB). For this, as Bhutto et al. (2020) discussed, the respondents were fully aware of their identification's anonymity and confidentiality. Additionally, the current study also collected the data from the self-administered questionnaire. It means that the researchers have zero or minimal administration, and the respondents have complete liberty regarding their responses to the questions asked. Hence, the possibility of SDB is also controlled accordingly. Lastly, Non-response bias was also assessed, in which a mean comparison was made between the early and late respondents to evaluate the Non-response bias. The outcome revealed the absence of any significant difference during the comparisons; hence the possibility of Non-response bias is also controlled respectively.

4. Estimations and results

In order to statistically assess the proposed hypotheses that are graphically shown in Figure 1, the application of the second generation prediction technique was used, a linear-based estimation technique. Within this category, the selection of Ordinary Least Squares (OLS) based 'Partial Least Square-Structural Equation Modelling' (PLS-SEM) was made because of its effectiveness in explaining higher variance from the

model while comparing with the conventional co-variance-based estimation techniques (Hair et al., 2019). In addition, the application of PLS-SEM is made through the assistance of SmartPLS software developed and designed by Ringle et al. (2015). Moreover, for the legitimate application of PLS-SEM, Hair et al. (2016) have discussed thorough guidelines, following which the generated outcome is said to be more legitimate and robust. These guidelines are summarized in assessing the PLS-SEM at two levels: the outer and inner models.

4.1. Assessment of outer model

At the outer model, the level of associations that the measuring items of a construct possess with the latent variable is assessed. Theoretically and statistically, all measuring items should be loaded and reflected to their respective latent variables; hence, this loading and reflection are evaluated in the outer model of a PLS-SEM. Two different criteria assess the outer model. One criterion evaluates the level of convergence that the measuring items of a latent variable must possess, enabling them to make that particular latent construct statistically. This assessment is called Convergent Validity (Mehmood & Najmi, 2017). In this criterion, there are three further parameters through which the possession of Convergent Validity is ensured. These include Factor Loadings, Internal Consistency and 'Average Variance Extracted' (AVE). For Factor Loadings, which represents the explanation of the variation of a measuring item, the suggested acceptable value by Hair et al. (2016) is any value exceeding 0.7. For Internal Consistency which is further assessed by two types of reliability which are Cronbach's Alpha and Composite Reliability, the suggested acceptable value by Hair et al. (2016) is also any value exceeding 0.7. For AVE, the recommended acceptable value by Hair et al. (2016) is any value exceeding 0.5. The outcome summarized in Table 3 clearly shows the meeting of these parameters for assessing the convergent validity.

The other criterion that is assessed at the level of the outer model is the level of divergence that the measuring items of a construct possess from the measuring items of other constructs. This property enables them to make different latent variables and is known as Discriminant Validity (Mehmood & Najmi, 2017). In this criterion, there are three further parameters through which the possession of Discriminant Validity is ensured. These include: Cross Loadings, Fornell and Larcker (1981) criterion and the 'Heterotrait-Monotrait ratio of correlations'. For Cross Loadings which is the reflection of the association of a measuring item of a construct with the other construct, it should be highly loaded within their own respective construct, whereas the loading in the other construct loadings must be far lesser whereas the acceptable difference is any value exceeding 0.1 (Gefen & Straub, 2005). The outcome summarized in Table 4 clearly shows the meeting of the parameter of Cross Loadings for assessing the Discriminant validity.

The second parameter for assessing Discriminant Validity is the Fornell and Larcker (1981) criterion. As per this parameter, the square root of the AVE of a construct must be larger than the value of the inter-construct correlations value of this particular construct with the other construct. The outcome summarized in Table 5

Table 3. Measurement model results.

Variables	Items	Factor Loadings	Cronbach's Alpha	Composite Reliability	AVE
Knowledge Acquisition	ACQ1	0.795	0.728	0.761	0.578
	ACQ2	0.773			
	ACQ3	0.738			
	ACQ4	0.850			
	ACQ5	0.821			
	ACQ6	0.831			
Knowledge Dissemination	DIS1	0.811	0.792	0.746	0.533
	DIS2	0.725			
	DIS3	0.741			
	DIS4	0.835			
	DIS5	0.833			
Knowledge Application	APP1	0.788	0.808	0.754	0.583
	APP2	0.759			
	APP3	0.762			
	APP4	0.814			
	APP5	0.816			
Sustainable environmental practices	SEN1	0.739	0.780	0.786	0.621
	SEN2	0.813			
	SEN3	0.779			
	SEN4	0.782			
	SEN5	0.756			
Sustainable economic practices	SEC1	0.745	0.779	0.728	0.554
	SEC2	0.788			
	SEC3	0.829			
	SEC4	0.773			
Sustainable social practices	SSO1	0.743	0.804	0.800	0.676
	SSO2	0.813			
	SSO3	0.727			
	SSO4	0.800			
Green Innovation	GIN1	0.811	0.713	0.757	0.648
	GIN2	0.801			
	GIN3	0.845			
	GIN4	0.730			
	GIN5	0.752			
	GIN6	0.751			

Source: Authors estimation.

clearly shows the meeting of the parameter of Fornell and Larcker (1981) criterion for assessing the Discriminant validity.

The last parameter, which is the most recent among the other available alternatives for assessing the discriminant validity, is the value of the 'Heterotrait-Monotrait ratio of correlations' (HTMT) which is proposed by Henseler et al. (2015). According to this parameter, the discriminant validity exists when the generated ratio of correlations is less than 0.85. The outcome summarized in Table 6 clearly shows the meeting of the parameter of HTMT criterion for assessing the Discriminant validity.

4.2. Assessment of the inner model

At this level of the PLS-SEM, the variation explained by the model and its quality is estimated. There are two parameters through which the assessment of inner model is made. These are 'coefficient of determination' that is represented by R-Square and 'Cross-Validated Redundancy' that Q-Square represents. For R-Square, there are three further levels in terms of the quality of predictability. According to Cohen (1988), the value is said to be substantial if it is greater than 0.26 and is considered weak if it is

Table 4. Results of loadings and cross loadings.

Variable	ACQ	DIS	APP	SEN	SEC	SSO	GIN
Knowledge	**0.795**	0.241	0.226	0.211	0.271	0.247	0.322
Acquisition	**0.773**	0.316	0.220	0.345	0.193	0.302	0.288
	0.738	0.235	0.276	0.314	0.273	0.228	0.276
	0.850	0.322	0.225	0.240	0.304	0.208	0.199
	0.821	0.221	0.204	0.314	0.297	0.291	0.191
	0.831	0.316	0.275	0.295	0.308	0.204	0.257
Knowledge	0.283	**0.811**	0.237	0.190	0.306	0.320	0.191
Dissemination	0.283	**0.725**	0.309	0.320	0.260	0.350	0.208
	0.205	**0.741**	0.284	0.297	0.217	0.317	0.209
	0.328	**0.835**	0.259	0.322	0.345	0.238	0.292
	0.237	**0.833**	0.264	0.286	0.191	0.286	0.246
Knowledge	0.299	0.210	**0.788**	0.339	0.195	0.301	0.251
Application	0.241	0.260	**0.759**	0.343	0.296	0.190	0.330
	0.338	0.306	**0.762**	0.297	0.348	0.256	0.308
	0.276	0.217	**0.814**	0.243	0.285	0.310	0.276
	0.335	0.250	**0.816**	0.283	0.293	0.247	0.219
Sustainable	0.291	0.226	0.231	**0.739**	0.200	0.269	0.243
Environmental	0.269	0.331	0.276	**0.813**	0.274	0.299	0.198
Practices	0.310	0.278	0.315	**0.779**	0.347	0.310	0.284
	0.302	0.210	0.207	**0.782**	0.204	0.349	0.341
	0.341	0.236	0.224	**0.756**	0.309	0.282	0.290
Sustainable	0.220	0.220	0.307	0.290	**0.745**	0.276	0.225
Economic	0.314	0.316	0.329	0.254	**0.788**	0.301	0.266
Practices	0.313	0.252	0.206	0.322	**0.829**	0.298	0.332
	0.253	0.219	0.247	0.192	**0.773**	0.244	0.233
Sustainable	0.200	0.278	0.280	0.263	0.215	**0.743**	0.289
Social Practices	0.284	0.213	0.318	0.237	0.217	**0.813**	0.320
	0.219	0.199	0.224	0.311	0.284	**0.727**	0.219
	0.234	0.262	0.232	0.347	0.223	**0.800**	0.258
Green Innovation	0.328	0.327	0.343	0.205	0.256	0.322	**0.811**
	0.214	0.341	0.343	0.233	0.263	0.325	**0.801**
	0.305	0.196	0.290	0.248	0.222	0.290	**0.845**
	0.196	0.278	0.239	0.300	0.207	0.270	**0.730**
	0.293	0.219	0.258	0.229	0.221	0.226	**0.752**
	0.195	0.264	0.336	0.324	0.193	0.274	**0.751**

Source: Authors estimation.

Table 5. Discriminant validity Fornell-Larcker criterion.

	ACQ	DIS	APP	SEN	SEC	SSO	GIN
ACQ	**0.760**						
DIS	0.589	**0.730**					
APP	0.406	0.499	**0.764**				
SEN	0.580	0.559	0.400	**0.788**			
SEC	0.453	0.348	0.337	0.346	**0.744**		
SSO	0.410	0.413	0.391	0.466	0.379	**0.822**	
GIN	0.323	0.356	0.338	0.581	0.350	0.416	**0.805**

Source: Authors estimation.

Table 6. Results of HTMT ratio of correlations.

	ACQ	DIS	APP	SEN	SEC	SSO	GIN
ACQ							
DIS	0.515						
APP	0.647	0.742					
SEN	0.468	0.694	0.482				
SEC	0.660	0.663	0.630	0.623			
SSO	0.604	0.486	0.417	0.607	0.634		
GIN	0.442	0.425	0.448	0.534	0.598	0.623	

Source: Authors Estimation.

Table 7. Predictive power of construct.

	R-Square	Q-Square
SEN	0.127	0.090
SEC	0.214	0.098
SSO	0.259	0.100
GIN	0.174	0.103

Source: Authors Estimation.

less than 0.02 whereas any value in-between is considered moderate. On the other hand, for Q-Square, the acceptable value as proposed by Hair et al. (2016) is any value exceeding 0. The outcome summarized in Table 7 shows the assessment of the inner model of the PLS-SEM.

4.3. Hypotheses testing

This section discusses the statistical significance and the generated relationship of the proposed hypotheses through PLS-SEM application. Moreover, for ascertaining the statistical significance, the PLS-SEM follow the bootstrapping methodology. In this methodology, there is a generation of multiple sub-samples, and then the significance is computed. The recommended sample for bootstrapping following the proposition by Hair et al. (2016) is 5,000 subsamples.

Firstly, the relationship of Knowledge Acquisition with sustainable practices is assessed. The relationship is positive and significant at a 5% significance level for all three sustainable practices categories. Precisely, the relationship of Knowledge Acquisition with sustainable environmental practices is found to be incremental as Knowledge Acquisition is reported to improve sustainable environmental practices. In terms of strength, the improvement in sustainable environmental practices by Knowledge Acquisition is reported to be 32.3% $(\beta = 0.323,\ p < 0.05)$. It means that when an organization possesses a favourable internal culture and atmosphere regarding learning new things and knowledge, it will also favor environment protection and preservation practices. Similarly, the relationship of Knowledge Acquisition with sustainable economic practices is also found to be incremental as Knowledge Acquisition is reported to improve sustainable economic practices. In terms of strength, the improvement in sustainable economic practices by Knowledge Acquisition is reported to be 28.6% $(\beta = 0.286,\ p < 0.05)$. It means that when an organization possesses a favourable internal culture and atmosphere regarding learning new things and knowledge, it will also have a favourable impact on improving its financial position and practices regarding financial well-being of the organizations. Likewise, the relationship of Knowledge Acquisition with sustainable social practices is also found to be incremental as Knowledge Acquisition is reported to improve sustainable social practices. In terms of strength, the improvement in sustainable social practices by Knowledge Acquisition is reported to be 19.9% $(\beta = 0.199,\ p < 0.05)$. It means that when an organization possesses a favourable internal culture and atmosphere regarding learning new things and knowledge, it will also have a favourable impact on improving social practices regarding welfare, prosperity, and well-being of the employees, general public, and society.

Secondly, the relationship of Knowledge Dissemination with sustainable practices is assessed. The relationship is found to be positive and significant at 5% level of significance for all of the three categories of sustainable practices. Precisely, the association of Knowledge Dissemination with sustainable environmental practices is found to be incremental as Knowledge Dissemination is reported to improve sustainable environmental practices. In terms of strength, the improvement in sustainable environmental practices by Knowledge Dissemination is reported to be 25.4% ($\beta = 0.254,\ p < 0.05$). It means that when an organization holds a favourable internal culture and atmosphere regarding information sharing and disseminating new learning and knowledge, it will also have a favourable impact on environmental protection and preservation practices. Similarly, the relationship of Knowledge Dissemination with sustainable economic practices is also found to be incremental as Knowledge Dissemination is reported to improve sustainable economic practices. In terms of strength, the improvement in sustainable economic practices by Knowledge Dissemination is reported to be 19.0% ($\beta = 0.190,\ p < 0.05$). It means that when an organization possesses a favourable internal culture and atmosphere regarding information sharing and disseminating new learning and knowledge, it will also have a favourable impact on improving financial position and practices regarding financial well-being of the organization. Likewise, the relationship of Knowledge Dissemination with sustainable social practices is also found to be incremental as Knowledge Dissemination is reported to improve sustainable social practices. In terms of strength, the improvement in sustainable social practices by Knowledge Dissemination is reported to be 29.3% ($\beta = 0.293,\ p < 0.05$). It means that when an organization possesses a favourable internal culture and atmosphere regarding information sharing and disseminating new learning and knowledge, it will also have a favourable impact on improving social practices regarding welfare, prosperity and well-being of the employees, general public, and society.

Thirdly, the relationship of Knowledge Application with sustainable practices is assessed. The relationship is found to be positive and significant at a 5% level of significance for all of the three categories of sustainable practices. The relationship of Knowledge Application with sustainable environmental practices is relatively incremental as Knowledge Application is reported to improve sustainable environmental practices. In terms of strength, the improvement in sustainable environmental practices by Knowledge Application is reported to be 12.5% ($\beta = 0.125,\ p < 0.05$). It means that when an organization possesses a favorable internal culture and atmosphere where the application of any acquired information, learning and knowledge is encouraged, it will also have a favourable impact on environment protection and preservation practices. Similarly, the relationship of Knowledge Application with sustainable economic practices is also found to be incremental as Knowledge Application is reported to improve sustainable economic practices. In terms of strength, the improvement in sustainable economic practices by Knowledge Application is reported to be 25.2% ($\beta = 0.252,\ p < 0.05$). It means that when an organization possesses a favourable internal culture and atmosphere where the application of any acquired information, learning and knowledge is encouraged, it will also have a favourable impact on improving financial position and practices regarding financial well-being

of the organization. Likewise, the relationship of Knowledge Application with sustainable social practices is also found to be incremental as Knowledge Application is reported to improve sustainable social practices. In terms of strength, the improvement in sustainable social practices by Knowledge Application is reported to be 27.8% ($\beta = 0.278,\ p < 0.05$). It means that when an organization possesses a favourable internal culture and atmosphere where the application of any acquired information, learning and knowledge is encouraged, it will also have a favourable impact on improving social practices regarding welfare, prosperity, and well-being of the employees, general public, and society.

Fourthly, the relationship between sustainable practices with green innovation is assessed. The relationship of all of the three categories of sustainable practices with green innovation is found to be positive and significant at a 5% level of significance. Precisely, the relationship of sustainable environmental practices with green innovation is incremental as sustainable environmental practices are reported to improve green innovation. In terms of strength, the improvement in green innovation by sustainable environmental practices is reported to be 34.1% ($\beta = 0.341,\ p < 0.05$). It means that when an organization possesses a favourable internal culture and atmosphere towards environment protection and preservation practices, this will improve the organization's pathway towards achieving green innovation, which will eventually be reflected in the processes operated and products designed by the organization, respectively. Similarly, the relationship of sustainable economic practices with green innovation is also found to be incremental as sustainable economic practices is reported to improve green innovation. In terms of strength, the improvement in green innovation by sustainable economic practices is reported to be 11.0% ($\beta = 0.110,\ p < 0.05$). It means that when an organization possesses a favourable internal culture and atmosphere in terms of improving financial position and practices regarding financial well-being of the organization, this will enhance the organization's pathway towards achieving green innovation, which will eventually be reflected in the processes operated and product designed by the organizations respectively. Likewise, the relationship of sustainable social practices with green innovation is also found to be incremental as sustainable social practices is reported to improve green innovation. In terms of strength, the improvement in green innovation by sustainable social practices is reported to be 27.9% ($\beta = 0.279,\ p < 0.05$). It means that when an organization possesses a favourable internal culture and atmosphere in terms of improving social practices regarding welfare, prosperity and well-being of the employees, general public and society, this will improve the organization's pathway towards achieving green innovation, which will eventually be reflected in the processes operated and product designed by the organizations respectively. The generated outcome of the direct relationships is summarized in Table 8 and graphically shown in Figure 2.

Lastly, the mediating effects of sustainable practices were assessed between information management practices and green innovation. SmartPLS enables the researcher to have specific indirect effects from a predictor to a criterion variable via a particular mediator variable. This feature is highly helpful as the researchers are better positioned to extract the specific indirect effects with precise strength and significance.

Table 8. Results of path coefficients (direct effects).

Hypothesized Path	Path Coefficient	C.R	P-Value	Remarks
ACQ → SEN	0.323	13.597	0.000	Supported
ACQ → SEC	0.286	12.024	0.000	Supported
ACQ → SSO	0.199	9.137	0.000	Supported
DIS → SEN	0.254	10.468	0.000	Supported
DIS → SEC	0.190	10.494	0.000	Supported
DIS → SSO	0.293	9.210	0.000	Supported
APP → SEN	0.125	6.095	0.000	Supported
APP → SEC	0.252	6.209	0.000	Supported
APP → SSO	0.278	9.892	0.000	Supported
SEN → GIN	0.341	10.714	0.000	Supported
SEC → GIN	0.110	13.398	0.000	Supported
SSO → GIN	0.279	11.316	0.000	Supported

Note: Level of Significance (5% i.e. 0.050).
Source: Authors' estimation.

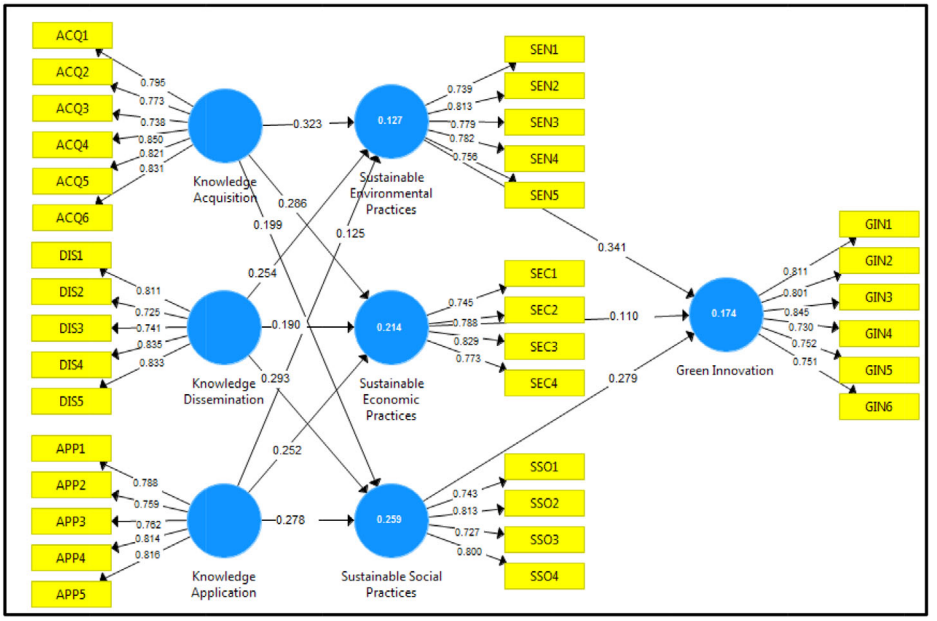

Figure 2. PLS output.
Source: Authors drawing.

The generated outcome revealed a mediating role of all three categories of sustainable practices, which mediates precisely between information management practices and green innovation. It means that for all of the information management practices, whether related to Knowledge Acquisition, Knowledge Dissemination, Knowledge Application, or all three, for an improvement in the execution of green innovation, the presence of sustainable practices is integral. In other words, these findings validate the idea that despite the organizational culture and atmosphere where Acquisition, Dissemination, and Application of any recent or advanced learning, knowledge, and information are encouraged, to have them transformed to improve green innovation, an organization that is having integration of sustainable practices including all of three dimensions which are social, financial and ecological, can easily have such

Table 9. Results of path coefficients (indirect effects).

Hypothesized Path	Path Coefficient	C.R	P-Value	Remarks
ACQ → SEN → GIN	0.118	7.841	0.000	Supported
ACQ → SEC → GIN	0.160	9.851	0.000	Supported
ACQ → SSO → GIN	0.119	6.238	0.000	Supported
DIS → SEN → GIN	0.189	11.783	0.000	Supported
DIS → SEC → GIN	0.121	7.302	0.000	Supported
DIS → SSO → GIN	0.149	7.760	0.000	Supported
APP → SEN → GIN	0.242	9.698	0.000	Supported
APP → SEC → GIN	0.237	6.182	0.000	Supported
APP → SSO → GIN	0.170	11.575	0.000	Supported

Note: Level of Significance (5% i.e. 0.050)
Source: Authors' estimation.

transformation. This transformation will be a reflection of the organization to pursue the path of green innovation. The generated outcome of the indirect relationships is summarized in Table 9.

5. Conclusion and recommendations

Despite the proposition of sustainable development goals by the United Nations, the organizations' progress is not satisfactory. It also raised the attention of the policy-makers to overcome those challenges by identifying the potential solutions to overcome them. Controlling adverse effects of commercial activities and their mitigation for ecological well-being is becoming a global issue where stakeholders pressurize organizations to have environmental protection and conservation policies. Thus, organizations must integrate sustainable practices within their operations to achieve operational excellence and market competitiveness. Hence, the current study aims to assess the extent of assistance the information and knowledge management process provides in attaining green innovation in the presence of sustainable practices. For this purpose, the data is collected from the organizations operating in China that are ISO 14001 certified, and then the application of PLS-SEM has reported a significant association among the studied phenomena as proposed in the hypotheses. In other words, information and knowledge management significantly and positively enhance all three kinds of sustainable practices, which eventually play an encouraging role in green innovation. Additionally, all three kinds of sustainable practices also reported mediating the relationships between the information and knowledge management process and green innovation.

Based on the findings, organizations are recommended to encourage a culture of knowledge and information acquisition, dissemination, and application, which will eventually improve the operations of the organizations. Additionally, sustainable practices need to be integrated and aligned with the organization's mission, vision and objectives, which will eventually be transferred to routine activities and procedures. Moreover, organizations also need to provide internal support to employees and other stakeholders in promoting green innovation. For that, there is a need to have additional channelization of financial resources towards research and development, training of the human capital, and investing in the technologies which will improve the productivity of the organizations. Lastly, future researchers are recommended to

explore the organizational factors through which the internal culture and atmosphere of the organizations are improved to acknowledge acceptance of innovation and advance learning. This includes exploring the role of top management support, employee commitment, development of human capital, and so on. The present study is geographically based on the organizations from China, whereas other developing countries could lead to more insightful results. There is also a need to explore the association among the studied phenomena through the technique which can explain the non-linear association, as the PLS-SEM applied in the current study can only describe the linear relationships.

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