

The Impact of Internal Environmental Management on Environmental Performance: Assessing the Mediating Role of Open Innovation and Moderating Role of Absorptive Capacity

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Abstract

Companies are forced to adopt green supply chain management (GSCM) practices around the globe to satisfy their customers and other stakeholders. As it requires a lot of time and resources to change the existing processes many companies especially small and medium enterprises (SME's) in the developing countries facing the challenge of their existence. The current study is an attempt to find out a starting point for implementation of GSCM practices to improve environmental performance. To speed up this process a mediating role of inbound open innovation was tested. Similarly to make it sure a moderating role of absorptive capacity was also checked. A survey yielded 98 responses from SME's of Pakistan. A partial least square (PLS), structural equation modeling (SEM) technique is used to confirm reliability, the validity of the proposed constructs first and then test the hypotheses. Results confirm the presence of a full mediation of inbound open innovation between internal environmental management (IEM) practices and environmental performance. Results also yielded a significant negative moderating effect of absorptive capacity on the relationship of inbound open innovation and environmental performance for SME's of Pakistan.

Keywords: Green supply chain management Practices, Internal Environmental Management Practices, Environmental Performance, Open Innovation; Absorptive Capacity

1. Introduction

Green supply chain management (GSCM) has become the prime topic of research by academia and top priority to implement it by the practitioners during the last decade (Aragão and Jabbour, 2017). It is because of the high concern by all stakeholders to minimize harmful effects to the environment for today and for the generations to come (Agi and Nishant, 2017, Beske et al., 2008, Beske-Janssen et al., 2015). It is becoming evident that to survive in such a pressurized situation companies need to adopt environment-friendly practices, processes and raw materials to produce green products by themselves. Although biggest pressure is on the large corporations of the developed world from the consumers, NGO's and governments but they forward these pressures to their suppliers from developing countries (Zhu et al., 2012). Small and medium enterprises (SME's) of developing countries like Pakistan are also facing the same situation. Not only the SME's which are part of international supply chain and exporting products to developed countries are facing tough requirements from their customers and have to fulfill stringent foreign environmental regulations. SME's working only locally also need to fulfill improving local environmental regulations along with the demand for green products from local customers due to ever-increasing awareness through print and electronic media and most recently through social media (Amer et al., 2016). Environment related organizational performance has many dimensions but some of the major items are related to the minimum use of energy, raw materials, water and improving its processes by the company to become more eco-efficient (Ortas et al., 2014). Many GSCM practices have been identified by the scholars, arguing that proper implementation of these practices will lead towards improved environmental performance (Gopal and Thakkar, 2016, Jabbour et al., 2015, Lee et al., 2012, Zhu et al., 2012, Zhu et al., 2013). To achieve goals of GSCM, companies starting their journey need to follow the guidance regarding traditional SCM and first of all should focus on improving internal collaboration and move all the concerned stakeholders towards the common direction (Bechtel and Jayaram, 1997, Chopra and Meindl, 2007). At the earlier stage to attain GSCM companies need to focus on individual practice out of many and also single corresponding performance outcome (Jabbour et al., 2015, Zhu et al., 2012). Internal environmental management (IEM) is the first construct describing GSCM practices out of five defined by (Zhu et al., 2008). IEM should be the first target to achieve by SME's as it is directly related to improved environmental performance (De Giovanni, 2012, Jabbour et al., 2015). SME does not only need to improve their environmental performance but also in a limited timeframe. In the absence of required technology and other required resources, the only option available is to adopt open innovation framework. Open innovation is defined as the "purposive inflow and outflow of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively" (Chesbrough et al., 2006). Inbound open innovation allows firms to look for required technology from external sources and purchase it or get on lease to immediately start using it. If a company is capable enough to find out required resources from external sources and make it part of their production process it will positively impact on the environmental performance. But only finding a required resource is not enough, a company should have the

internal capability to adopt that technology and make the best use out of it without wasting anytime (Vanhaverbeke et al., 2008). So, employees of the company should have the ability and capacity to absorb that outside knowledge and make it part of internal processes. This capacity is called absorptive capacity and it will make it possible to get the full benefits of open innovation and improve the environmental performance through IEM.

The main objective of this study is to find out the impact of IEM on environmental performance. Secondly, this study will explore the mediating effect of open innovation between IEM and environmental performance. Another objective is to find out the moderating effect of absorptive capacity on environmental performance.

2. Literature Review

2.1 GSCM Practices:

GSCM is the introduction of environmental concerns within the setting of a supply chain management. This environmental consideration will encompass all the areas of the supply chain from product design to supplier selection, type of materials to the manufacturing process and logistics function to warehousing including reverse logistics as well (De Giovanni and Vinzi, 2012, Esfahbodi et al., 2016). GSCM can also be considered as a network of companies which are following sustainable processes and activities individually and now they are connected to share their experiences of being green, which enables them to implement it at a supply chain level (De Giovanni and Vinzi, 2012).

2.2 Internal Environmental Management (IEM):

It is one of the five constructs coined and statistically validated by (Zhu et al., 2008) to measure GSCM practices. It can be considered as a starting point as it deals with the commitment of top and middle management to become green, giving training to employees and development of pollution prevention programs, getting certifications and running a continuous evaluation system (Jabbour et al., 2015). IEM guides the firms to follow the goals setup by top management and enable them to consider themselves becoming a part of GSCM as it establishes an environment for learning, practicing and becoming an expert in sustainability related management practices (De Giovanni, 2012).

2.3 Environmental Performance:

It is generally accepted that minimum use of energy, raw materials, water and improving its processes by the company to become more eco-efficient and minimizing their harmful impacts on the physical environment comes under the scope of environmental practices (Esfahbodi et al., 2016, Marshall et al., 2015). Although a lot more empirical evidence is needed to prove impact of GSCM practices on economic and operational performance of firm and the whole supply chains, the impact of GSCM practices on environmental performance has very strong support (Esfahbodi et al., 2016, Rao and Holt, 2005, Vanalle et al., 2017, Zhu et al., 2013). But the effect of individual practices on performance is recommended to be evaluated and some studies have found a positive relationships between IEM and environmental performance (De Giovanni, 2012, De Giovanni and Vinzi, 2012, Jabbour et al., 2015, Zhu et al., 2008). Based upon above discussion, this study forms the first hypothesis that,

H1: Internal Environmental Management practices have a direct and positive impact on the environmental performance of the SME's of Pakistan.

2.4 Open Innovation:

Innovation in the past was considered a highly closed, within the boundaries of an organization and secret phenomenon. In the absence of required skills, technologies and other resources this process was lengthy, costly and riskier (Chesbrough, 2003, Lichtenthaler, 2011). Now it is suggested that companies can speed up their innovation process with minimum risk involved through inbound open innovation (West and Bogers, 2014). Implementation of GSCM requires highly technical and sophisticated technology to improve processes and manufacturing capacity. Companies in developing countries especially SME's don't have that kind of technology, resources and they also have to achieve it in a minimum possible time (Saeed et al., 2016). The best solution for them is to adopt inbound open innovation framework which allows them to explore external knowledge and acquire it through purchasing, licensing or some other contracts (Huizingh, 2011). Based on these findings, this study frames the second hypothesis

H2: Open innovation positively mediates the relationship between Internal Environmental Management practices and environmental performance for the SME's of Pakistan.

2.5 Absorptive Capacity:

Searching for useful knowledge externally and acquiring through inbound open innovation is only the first step and it does not guarantee the successful implementation of acquired knowledge in the form of some new

technology. Perhaps the most important element to successfully transfer knowledge and achieve inbound open innovation targets is the absorptive capacity (Kim et al., 2016). Absorptive capacity and inbound open innovation are highly connected concepts as the first one deals with the internal context of an organization while the second one deals with outside relations of a company (Vanhaverbeke et al., 2008, Lewandowska, 2015). The term absorptive capacity is coined by (Cohen and Levinthal, 1990) and is defined as the 'ability of firms to recognize, assimilate and replicate new knowledge gained from external sources for commercial benefits'. This concept gained the attention of a large number of scholars and they contributed to the development of the theory of absorptive capacity through not only empirical testing but conceptually adding new dimensions to it. Most prominent contributions include but not limited to (Zahra and George, 2002) presented the idea of potential absorptive capacity and realized absorptive capacity. While in the response of that (Todorova and Durisin, 2007) raised their concerns and suggested to stick with original ideas of (Cohen and Levinthal, 1990) by extending its 3 dimensions to 5 naming recognition, acquisition, assimilation, transformation, and exploitation. While taking a human resource practices perspective (Minbaeva et al., 2003) suggested that it's the employee ability and motivation that formed the absorptive capacity of a firm to improve organizational performance. This study has taken the employee ability dimension of absorptive capacity which plays a decisive role in achieving the goal of environmental performance through inbound open innovation. Therefore, this study posits the following hypothesis.

H3. Absorptive capacity moderates the relationship between inbound open innovation and environmental performance.

3. Methods

3.1. Data Collection

The survey method was used to collect data. Already validated measures from different studies were used to finalize a questionnaire. First section of the questionnaire obtained responses on current level of IEM practices adoption and was measured by (1= No Implementation Consideration; 2= Some Potential Implementation Consideration; 3= Currently Considering Implementation; 4= Implementation Occurring ; 5 = Implemented Fully). Items related to IEM practices and environmental performance were adopted from (Zhu et al., 2013). Environmental performance construct measured the performance of the organizations in the last 3 years relative to their major competitors, where (1= Not at all; 2= A Little Bit; 3= To Some Degree; 4= Significant and 5= Very Significant). Inbound open innovation construct was measured through items adopted from (Hung and Chou, 2013). It consists of 5 items and was measured by where (1= Strongly Disagree; 2= Disagree; 3= Neutral; 4= Agree and 5= Strongly Agree). Employee Ability for absorptive capacity was measured through a 5 item construct where (1= Totally Agree; 2= Agree; 3= Neutral; 4= Disagree and 5= Totally Disagree). It was adopted from (Liao et al., 2007). The last section was to get some demographic details like industry type, city, respondent designation, company size etc. SmartPLS 3.2.4 (Ringle, 2015) software was used to analyze data with structural equation modeling using partial least squares.

Respondents of this questionnaire were managers from manufacturing SME's listed in Lahore, Sialkot and Faisalabad chamber of commerce and industries. These cities are among the main industrial cities of Pakistan. After confirming their status as SME through their membership category and company web sites 450 companies were selected from the sectors of textile, leather, pharmaceuticals and chemical manufacturers. These sectors are highly related to the environmental situation and their contribution to the economy of Pakistan. Emails were sent to these selected companies consisting of a cover letter to explain the purpose of this research and a link to the online survey form. A reminder email was sent after two weeks to request a response from non-respondents till that time. A total of 112 responses were received out of which 98 were found to be suitable for final analysis.

3.2. Non-response Bias:

One of the important steps in the quantitative analysis is finding the nonresponse bias, that is to find any difference in the opinion of people who responded to the questionnaire and who does not respond. It is suggested by many authors to compare responses of early and late respondents and that will serve the purpose as late respondents represents the opinion of theoretical non-respondents (Esfahbodi et al., 2016, Rogelberg and Stanton, 2007). For this purpose t-tests were conducted between two groups which were consists of 67 early respondents and 31 late respondents. No statistically significant differences showed up in the tests, which suggested that nonresponse bias does not exist.

3.3 Reliability and Validity

PLS-SEM works in two stages as it first calculates measurement model before calculating structural model (Hair et al., 2011). First of all reliability and validity of defined measures should be examined. Composite reliability (CR) for internal consistency reliability describes the degree to which latent factor is represented by its items. CR value should be higher than 0.7. Indicator reliability is confirmed through item loadings higher than 0.6.

AVE values for the constructs should be more than 0.5 to confirm convergent validity. Finally, to test the discriminant validity it should be confirmed that no correlation of any construct with other constructs is higher than the AVE of that construct (Hair Jr et al., 2016, Peng and Lai, 2012). Few items (IEM 5,6&9) with lower loadings were dropped to get all reliability and validity measures according to the threshold values. Table 1 shows all the values fulfills the minimum criteria with CR values from 0.905 to 0.948, AVE from 0.519 to 0.784. Similarly, all item loadings are above 0.6. While the square root of AVE on the diagonal in Table 1 confirms the values for discriminant validity test.

Table 1. Statistical Quality Indicator

	AVE	CR	R ²	AbsCap	AbsCap	EnvtPerf	IEM	OI
AbsCap	0.784	0.948	-	AbsCap	0.885			
EnvtPerf	0.744	0.946	0.266	EnvtPerf	0.175	0.862		
IEM	0.519	0.905	-	IEM	0.142	0.306	0.720	
OI	0.687	0.916	0.207	OI	0.289	0.425	0.422	0.829

4. Results

After confirming the absence of non-response bias, reliability and validity through measurement model the next step was to test the hypotheses through structural model assessment. Figure 1 shows the path diagram with a standardized coefficient (β) and item loadings in the model. Path coefficients of 0.20 and higher are assumed significant (Hair et al., 2011). For the second stage to check the significance of structural model a bootstrapping technique is recommended with a minimum bootstrap sample of 5000. Also for a two-tailed test critical values of 1.65, 1.96 and 2.58 at the significance levels of 0.10, 0.05 and 0.01 respectively are required (Hair Jr et al., 2016, Chin, 2010). A bootstrapping procedure with 5000 bootstrap samples at a significance level of 0.05 for the two-tailed test was performed. Results indicated that β value for direct relation of IEM \rightarrow environmental performance 0.321 (t-value 3.317 ; $p < 0.01$) is significant.

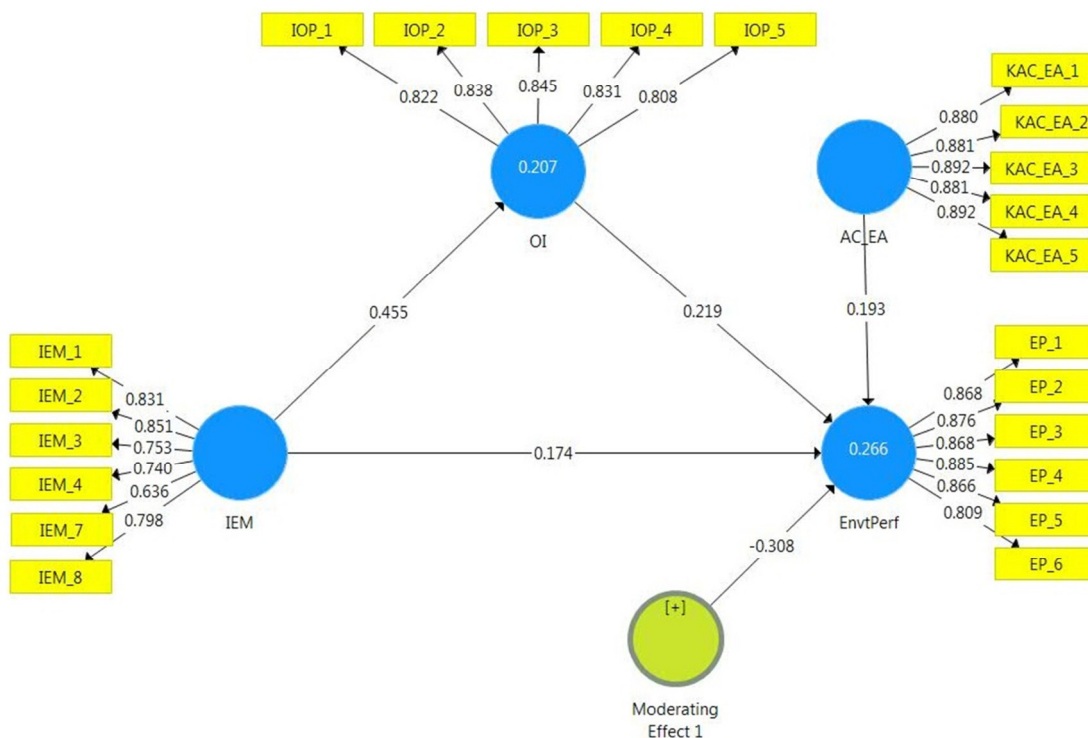


Figure 1. PLS Measurement Model with R², β values, and Item loadings

Using 5000 bootstrapping sub samples along with 95% confidence interval, indirect effect along with confidence interval value was checked to find the presence of any mediating effect. Values in table 2 confirm the presence of a mediator variable. Also non-significance of direct path between IEM and environmental performance and significant beta values for both indirect paths IEM \rightarrow OI 0.455 (t-value 5.120 ; $p < 0.05$) and OI \rightarrow environmental performance 0.219 (t-value = 2.062; $p < 0.05$) confirms the full mediation.

Table 2. Significance of Indirect Effect for Mediation Analysis

Hypothesis	Relationship	Indirect Effect	SE	t-value	95 % LL	95% UL	Decision
H2	IEM \rightarrow OI \rightarrow EP	0.163	0.058	2.825	.057	.281	Supported

The third hypothesis states a moderating effect of absorptive capacity between the relation of inbound open innovation and environmental performance. To test this hypothesis an interaction between absorptive capacity and inbound open innovation was created. Results showed that this interaction was significant with a negative beta value and it showed that absorptive capacity negatively moderates the relationship between inbound open innovation and environmental performance ($\beta = -.308$; $t\text{-value} = 2.663$; $p < 0.05$) for SME's of Pakistan. This result showed the absence of employees ability and skills to get benefit from the externally acquired new knowledge by the SME's of Pakistan. They might be able to explore and acquire new relevant knowledge and that is helpful to improve environmental performance. But looking only at the inbound open innovation results does not give the true picture. This negative moderating effect presents another dimension or perhaps the real situation out there.

5. Discussion, Managerial Implications, and Limitations

Improving manufacturing processes to prevent environment from its harmful effects is not only necessary for the current generation but it is also the right of future generations to get a clean environment for living. It is the responsibility of every single individual, industry, sector, country, and region to play its role no matter how small or big to achieve this target of the clean and pure environment. This study was an attempt to follow the guidance of prominent scholars to find out empirical proof of the relation between individual GSCM practices and performance dimensions (Jabbour et al., 2015, Zhu et al., 2008). It was also among the first attempts to incorporate the highly useful concept of inbound open innovation to increase the efficiency of GSCM practices for attaining higher environmental performance. Results proved that inbound open innovation fully mediates the relationship for SME's of Pakistan. As scholars have mentioned that only acquiring a new knowledge or technology is not enough, a company should have the capability to make the best use of that newly acquired knowledge (Lewandowska, 2015, Vanhaverbeke et al., 2008), a moderating role of absorptive capacity was also tested. Results proved that it has a significant impact but unfortunately its direction is negative. It can be explained as SME's of Pakistan are not focusing on hiring competent employees and neither focusing on their training to improve their abilities to handle externally acquired knowledge. Management of SME's considers it enough to explore and acquire a new technology that will solve all of their problems. While the actual situation is in the absence of well-trained man power their investment on finding and acquiring a new technology will also be wasted as the introduction of moderator shows a huge drop in environmental performance value.

This study gives some clear guidance to the management of Pakistani SME's that they should bring environmental consideration in their top priorities. The first step in this direction is to apply internal environmental management steps. Like many other studies, this research work has also proven its importance. To get positive results in minimum possible time SME's of Pakistan should encourage a culture of innovation and adopt open innovation principles in its true spirit. They can collaborate with their multinational supply chain partners to get the necessary external knowledge to improve their processes and green working. But to fully utilize that external knowledge they must develop and maintain internal R&D and innovation capability. They also need to retain and enhance that capability by hiring talented and skillful people and then provide them regular training. Only through this, they would be able to not only get maximum benefits of externally acquired knowledge but that could bring them in a position to exploit that knowledge by creating their own new products or technologies and become a supplier to others by applying outbound open innovation.

This study has focused only one GSCM practice and only one dimension of triple bottom line performance i.e. environmental performance. Future researchers can test multiple related combinations of practices and also can incorporate economic and social perspectives to extend the existing study. This study has taken a sample of SME sector only, future studies should take a holistic view of the Pakistani industry by taking a larger sample including large scale manufacturing sector as well. Similarly, some longitudinal case studies can provide more in depth details about the studied phenomenon.

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