

Open innovation in IT clusters: A comparative study of Indian IT organisations

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Abstract

Open innovation is built on the core principles of interactions, interdependence and exchange of knowledge. Clusters are believed to support organisations' efforts to explore and source external knowledge, commercialise internal innovations and cause externalities through commercial activities. Early research on the innovation capabilities of regional clusters in Europe provides limited understandings of these cluster-based effects through which open innovation is fostered. This study investigates the role of clusters on open innovation practices relating to exploration and exploitation of external knowledge, knowledge sharing, acquisition and sale of IP rights. The results reveal that organisations within a cluster actively participate in inbound and outbound activities and achieve better innovation performance compared to the organisations outside the cluster. The findings are relevant to both the IT clusters and the IT innovation literature as this study sheds light on the role of clusters in improving an organisation's innovation capabilities through open innovation.

Keywords: IT clusters, Open innovation, Inbound innovation, Outbound innovation, Innovation performance.

1 Introduction

The term open innovation gained significant attention among researchers and industry practitioners because of its potential in supporting organisations' innovation efforts. Open Innovation (OI) is the innovation capability achieved through the use of purposive inflows and outflows of knowledge (Chesbrough 2006). Its core principles focus on achieving benefits through networking and collaboration but provide a limited insight into attaining a conducive environment (Chesbrough 2003). This model encourages organisations to share their knowledge and resources with other organisations that are not central to their strategy (Morris et al. 2008). Open innovation does not happen in a vacuum and it requires collaboration and participation from external parties. Coupled with innovation culture, co-location of organisations can promote participation of other organisations in research and development projects (Chesbrough 2006). Clustering enables organisations to utilise knowledge acquired through spill-overs for achieving competitive advantage. In addition to relationships and social networks clusters promote new practices among its members. These value-creating practices will have a positive impact in new product development projects within a cluster (Tracey et al. 2014). However, there is limited evidence to highlight the role of clusters in fulfilling organisations' vision to benefit from open innovation (Vanhaverbeke 2006).

Previous studies (Rangus and Drnovsek 2013; Huang and Rice 2013) focussed on studying open innovation in European organisations. However, there are very few published articles (Hungund and Kiran 2016; Tripathi, 2016), about the need for open innovation in SMEs and open innovation in the Indian manufacturing sector. Moreover, none of these studies include IT clusters. The Indian IT organisations are mainly service providers for overseas multinational companies, but majority of these organisations are behind in terms of innovation. It is important for these organisations to identify ways to improve innovation capabilities and the operational efficiencies to stay ahead in the competition and to maintain their position as preferred IT solution providers (Mehta & Rao, 2015). Thus, this paper focusses on the value creation and value capture of Open Innovation in IT clusters by studying the importance of open innovation, cluster-based effects on IT organisations' open innovation activities relating to exploration and exploitation of external knowledge, knowledge sharing, acquisition and sale of IP rights. This paper aims to address the following research questions:

RQ1. Are there any differences among IT organisations within the cluster and outside the cluster in relation to inbound and outbound innovation activities?

RQ2. Do IT organisations within the cluster achieve better innovation performance compared to the IT organisations outside the cluster?

2 Literature Review

2.1 Open Innovation and Clusters

The core concept of open innovation is to expand innovation processes to industry stakeholders (Chesbrough 2006). In general, larger organisations have access to key resources such as skills and finances as opposed to small to medium sized enterprises (SMEs) (Rahman and Ramos 2010), but scholars argue that organisations with resource constraints can overcome challenges and improve innovation capabilities through open innovation that is constructed over collaboration and networking with other organisations (Enkel et al. 2009; Parida et al. 2012).

Interestingly, Open innovation is neither dependant nor controlled, but it is influenced by various industry stakeholders, level of cooperation and knowledge sharing (West et al. 2006). The innovation performance is dependent on interactions between organisations, their participation and the characteristics of regions (Williams 2011). Theories such as industrial districts (Marshall 1920), regional innovation systems (Nie and Sun 2014), regional economies and clusters (Porter 1998) accept the role of location in promoting innovation. Chesbrough (2006) stated the role of a cluster in innovation by defining them as a group of related organisations in a geographical proximity with opportunities for innovation through collaboration and co-operation. An IT Cluster is a group of inter-related companies which cooperate and compete within a geographic location (Belussi, 1999). Technical knowledge is a valuable asset and it can be difficult for organisations to keep it confined within its boundaries. The surrounding organisations may absorb knowledge without paying to gain productivity (Grossman and Helpman 1991). These are externalities caused by commercial activities with agents that were unable to completely benefit from their own Research and Development (R&D) activities (Dumont and Meeusen 2000).

Innovation is considered critical in high-technology industries for continued success, but it comes at a cost (Chesbrough 2003). As clusters stimulate co-operation and collaboration among organisations within a cluster, organisations can promote purposive knowledge flows to overcome challenges associated with resource and budgetary constraints of research and development activities through open innovation projects. According to the cluster theory, organisations can achieve dynamic capabilities through the agglomeration economies which enable development of new business networks and knowledge sharing among organisations in a cluster. Clusters are the focal points of regional growth and lay foundation to the idea of collaborative processes that supports open innovation (Chesbrough 2006). In general, open innovation is mainly linked to IT organisations and hi-tech organisations (West et al. 2006). The location theories suggest that social interactions between skilled people lead to new ideas. Limitations to internal research and development activities, proximity, networks and partnerships are the drivers for opening up innovation activities (Theyel 2013). Thus, co-location of organisations and web of networks play a significant role in promoting innovation. The study was intended to explore differences in open innovation and innovation performance among IT organisations within and outside the cluster.

2.2 Inbound innovation

There has been significant research on ways to benefit from external knowledge (Chesbrough, 2003; Laursen and Salter 2006). The knowledge gained from external sources can be decisive to organisations' innovation efforts (Laursen and Salter 2006). Inbound innovation is associated with collaborative networks. Chesbrough (2003) suggests that collaboration activities with stakeholders can support organisations' efforts to improve products and services. A study by Parida et al. (2012) into vertical and horizontal collaboration, found that collaboration as key source of knowledge residing outside the organisation for internal innovation. Inbound innovation is about organisations' use of freely available external knowledge from its stakeholders, educational institutions and research organisations for internal innovation (Greco et al. 2015). Organisations' capability to search and source external knowledge will influence its innovation performance (Van de Vrande et al. 2009; Busarovs 2013), but, there are controlling factors, which influence organisations' inbound innovation efforts (Zahra and George, 2002). As collaboration and cooperation are the core elements of regional clusters, these inter-organisational linkages will have significant impact on organisations' innovation performance.

2.3 Outbound innovation

Outbound innovation refers to an organisation's expansion of open innovation processes outward freely with a monetary component in the long run through commercialisation of internal inventions (Busarovs 2013). Greco et al. (2015) suggests that it is about the external exploitation of internal knowledge in the form of selling patents or key knowledge resources. Outbound innovation activities involve improving profits through commercialisation of internal knowledge and multiplying this knowledge by transporting it to the outside environment (Enkel et al. 2009). Informal relationships with the the employees can help gain new knowledge about commercialisation of their products (Chesbrough 2006). Van de Vrande et al. (2009) argue that venturing, external exploitation of internal knowledge and employee participation are critical to implementing outbound strategy. Venturing is about opening a new business through incidental knowledge. Selling licenses royalties and sharing knowledge with a monetary component are all part of outward licensing of IP rights. The participation of non-R&D Employees in collaboration projects helps to leverage their ideas and knowledge (Van de Vrande et al. 2009). According to Rigby and Zook, (2002) the OI model implies internal innovations can be accelerated by importing new ideas and exporting proprietary technologies can generate income. Outbound innovation activities are considered complementary to internal development as outward knowledge flows are proven to affect product performance and support internal innovation projects. This implies that there is a strong correlation between an organisation's outbound innovation capabilities and its overall innovation performance (Yang 2012).

2.4 Innovation performance

Innovation performance can be the result of organisation's active participation in open innovation activities. Innovativeness is the organisation's capability to develop new practices and processes, modify existing processes, and producing unique products and services (Jimenez-Jimenez and Sanz-Valle 2011). Traditionally, innovativeness is measured by the adoption of number of innovations by an organisation (Irwin et al. 1998). Innovation performance is a multi-dimensional construct. It encompasses research and development activities leading to new products, services and processes (Lee and Pennings 2001). Researchers have used different indicators to measure innovation performance

of an organisation. For example, Lee and Pennings (2001) considered process changes or improvements, number of new products and services introduced by the organisation to measure innovation performance. Whereas, Stuart (2000) used IP rights such as patents to measure innovation performance of an organisation.

Relationships with nearby organisations are essential characteristics of clusters (Hakansson and Snehota 1995). Close geographic proximity allows interactions among organisations and prepares them for adaptation of products and processes relationships (Gadde and Mattsson 1987). Bengtsson and Solvell (2004) suggests that organisations with research and development activities in a cluster turn in high innovation performance, due to climate of competition among firms. However, it is dependent on organisations' capability to explore and exploit new knowledge from external sources (Chesbrough 2003) and outward flow of internal knowledge, which can be challenging in an isolated environment. Diffusion of advanced technologies to the other organisations would be possible in a cluster. A study conducted by Laursen and Salter (2006) suggest the relationship between open innovation activities and innovation performance, which highlights the relevance of inbound and outbound activities to innovation performance. As clusters facilitate interaction and increase collaboration opportunities for knowledge transfer, organisations within a cluster are expected show in higher innovation performance compared to the organisations outside the cluster.

3 Research method

A cross sectional survey design is used to investigate the relevance of the co-location of the IT organisations and their participation in open innovation activities. This research administered an online survey questionnaire during 2016-2017 to collect data from organisations in Hyderabad IT cluster and outside this cluster in India, and collected a total of 307 surveys, which includes 247 surveys from Hyderabad IT cluster and 60 from outside the cluster. The distributions of both populations do not present normal distribution but does indeed show the same distribution of both populations. India was chosen because, majority of the Indian IT organisations are the outsourcees' for domestic and overseas organisations (Sarkar and Mehta 2005) and studying them will provide an in-depth understanding of cluster-based effects in relation to inbound and outbound open innovation activities.

Table 1 outlines sample composition. Survey respondents are from Business process, Consulting, Corporate function/Leadership, Education and Training, Marketing/Sales, Research & Development and Technology fields.

Characteristics	N (%)	Characteristics	N (%)
<u>Main products and services</u>		<u>Respondents field</u>	
BPO and Software Development	174 (56.67%)	Business process	4 (1.30%)
Education, Training & Certification	27 (8.79%)	Consulting	22 (7.16%)
IT marketing & sales	48 (15.63%)	Corporate function/Leadership	52 (16.93%)
IT support & maintenance	33 (10.74%)	Education and Training	15 (4.88%)
Telecommunications & Networking	12 (3.90%)	Marketing/Sales	20 (6.51%)
Research & Development	6 (1.95%)	Research & Development	9 (2.93%)
Others	7 (2.28%)	Technology	182 (59.28%)
		Others	3 (0.97%)
<u>No. of employees in the organization</u>		<u>Customer type</u>	
Small businesses 0-20	50 (16.28%)	Domestic only	84 (27.36%)
Medium businesses 21-200	60 (19.54%)	Overseas only	14 (4.56%)
Large businesses Above 200	197 (64.16%)	Both domestic and overseas	209 (68.07%)

Table 1. Demographic characteristics of the IT organisations

Kaiser-Meyer-Olkin measure of sampling adequacy value (KMO) 0.891 and the average loading of inbound innovation towards innovation performance is 0.663. The KMO value 0.897 and the average loading of outbound innovation towards innovation performance is 0.872. The KMO values greater than 0.7 and the average loadings greater than 0.5 (Hair et al. 2006) suggesting the convergent validity of the constructs. The variance extracted is greater than the correlation square establishing the discriminant validity.

Reliability tests are conducted to evaluate the degree of consistency between multiple measurements of a variable with a goal to achieve consistency among the variables in a summated scale (Hair et al. 2006). The Alpha coefficient method, Cronbach's alpha is a measure of reliability which ranges from 0 to 1. It is suitable for likert scale items (eg. 1-5) (Ercan et al. 2007). The alpha values for the constructs inbound innovation, outbound innovation and innovation performance are 0.803, 0.860 and 0.903. The alpha values are above 0.7 and these are considered to be efficient and reliable.

4 Results

As cluster-based effects are believed to influence organisations' open innovation activities, the Mann-Whitney U test was used to compare statistically significant differences between two independent groups (Ercan et al. 2007), IT organisations within and outside Hyderabad IT cluster. Results presented in Table 2 indicate that there are significant differences with regards to inbound innovation activities between organisations within and outside the cluster. There are three statistically significant differences between the two groups. Organisations outside the cluster are more open to purchasing IP rights. However, organisations within the cluster are actively participating in exploration of new partners, adopting business processes to acquire external knowledge.

Inbound innovation	Organisations within cluster (N=247)		Organisations outside cluster (N=60)		Mann-Whitney U test	Asymp. Sig. (2-tailed)
	Mean score (Out of 5)	Std. deviation	Mean	Std. deviation		
Allow others to access its knowledge to develop new products and services	3.84	1.027	3.67	1.160	6889.000	.375
Willingness to purchase IP rights	3.61	1.124	3.20	1.005	5697.5000	.004
Search for potential partners	3.99	0.915	3.63	0.956	5849.000	.007
Standard business processes to acquire external knowledge	4.11	0.894	3.65	1.132	5705.000	.003

*Statistically significant at P<0.05.

Table 2. Inbound innovation activities by the IT organisations within and outside the IT cluster

Results presented in Table 3 indicate that there are significant differences with regards to outbound innovation activities between organisations within and outside the cluster. There are four statistically significant differences between the two groups. Organisations outside the cluster are less involved in outbound innovation activities in relation to sharing knowledge with other organisations, sale of internal knowledge and IP rights, and acquisition of IP rights from other organisations. Whereas, organisations within the cluster have scored high mean scores for outbound innovation activities echoing the cluster-based effects.

Outbound innovation	Organisations within cluster (N=247)		Organisations outside cluster (N=60)		Mann-Whitney U test	Asymp. Sig. (2-tailed)
	Mean score (Out of 5)	Std. deviation	Mean	Std. deviation		
Knowledge sharing with other organisations	3.72	1.063	3.35	1.087	5999.000	.017
Sale of internal knowledge with little cost	3.38	1.180	2.87	0.999	5507.000	.001
Acquisition of IP rights	3.66	1.161	3.25	1.068	5776.500	.006
Sale of IP rights	3.17	1.321	2.65	1.246	5761.500	.006

*Statistically significant at P<0.05.

Table 3. Outbound innovation activities by the IT organisations within and outside the IT cluster

Results presented in Table 4 highlight the difference in innovation performance of IT organisations. There are statistically significant differences between the two groups in relation to innovation performance. Organisations within the cluster have shown high performance for Process innovation, Product innovation, Service innovation and improving number of IP rights. Organisations outside the cluster are comparatively behind in all aspects of innovation.

Innovation performance	Organisations within cluster (N=247)		Organisations outside cluster (N=60)		Mann-Whitney U test	Asymp. Sig. (2-tailed)
	Mean score (Out of 5)	Std. deviation	Mean	Std. deviation		
Process innovation	4	0.908	3.58	0.979	5711.000	.004
Product innovation	3.97	0.887	3.50	1.050	5615.000	.002
Service innovation	4.09	0.890	3.73	1.006	5979.500	.014
IP rights	3.79	1.064	3.43	1.095	6027.000	.019

*Statistically significant at $P < 0.05$.

Table 4. Innovation performance of IT organisations within and outside the IT cluster

4.1 Discussion

This research aims to investigate the role of cluster on open innovation practices and innovation performance of IT organisations. This study examined whether open innovation is widespread in a cluster, how organisations' location influenced their involvement in open innovation practices both inbound and outbound, and innovation performance.

First, we investigated whether organisations' location has any influence on their efforts in exploring and exploiting external knowledge from other organisations. The results suggest that location does not have any influence on organisations' willingness to allow other organisations to access its internal knowledge. However, results highlight the importance of clusters in facilitating interactions among organisations within a close proximity (Porter 2000, Nie and Sun 2014). These interactions are important as organisations' competence with searching and sourcing external knowledge influences their innovation performance (Van de Vrande et al. 2009). Organisations within the cluster scored high for acquiring IP rights from other, searching new partners for open innovation projects and adopting standard business practices to acquire external knowledge. These results are consistent with the view of Chesbrough (2006) that organisations within a geographical proximity will have high interaction opportunities.

Second, we studied the impact of location on organisations ability to expand its open innovation processes outward to commercialise internal innovations. Organisations within the cluster have outperformed the other group in all outbound innovation activities. Organisations outside the cluster are less active in terms of sharing knowledge with other organisations and acquisition of IP rights. There are significant differences between the two groups with regards to sale of internal knowledge and sale of IP rights. The organisations outside the cluster are less involved in commercialising internal knowledge and intellectual property.

Third, we studied the role of clusters in improving organisations' innovation performance. Results presented in Table 3 indicate that organisations within the cluster have achieved high mean scores for process innovation, product innovation, service innovation and IP rights compared to the other group. These results highlight the relevance between innovation activities and innovation performance (Laursen and Salter 2006).

5 Conclusion

Open innovation concept is built on the core principles of interactions, interdependence and exchange of ideas and knowledge sharing. The findings of this research elaborate the role of cluster-based effects in enabling open innovation among organisations by their location. Clusters are believed to support organisations' efforts to explore and source external knowledge, commercialise internal innovations and cause externalities through commercial activities, joint ventures and strategic alliances. The cluster-based effects such as interactions among organisations and knowledge sharing are proven to be critical for open innovation. This research provides supporting results in relation to the environment through which open innovation benefits can be improved. This study identifies significant differences among IT organisations within the cluster and outside the cluster in relation to

inbound and outbound innovation activities. Results indicate that organisations in a cluster are more involved in open innovation activities. The organisations within a cluster led the way compared to the other organisations located outside the cluster. Overall, the organisations within a cluster have achieved better innovation performance compared to the organisations outside the cluster. This suggests the supporting role clusters play in exploring and exploiting external knowledge, commercialising internal innovations and sharing knowledge with other organisations.

The Hyderabad IT cluster has been chosen for this study as this cluster was initiated by the local government to regional economic growth. The main limitation with this research is, it utilises the data collected from the IT organisations within and outside Hyderabad IT cluster. Future research into comparison of data collected from IT organisations in other IT clusters can provide a more balanced approach and the knowledge can elaborate the potential of clusters in facilitating open innovation.

This study makes several contributions. From a theoretical perspective this study contributes to the literature of open innovation in Indian IT clusters. From a practical point of view, this study investigates the influence of clusters in promoting open innovation and the factors associated with organisations' involvement in open innovation practices. This knowledge will enable managers and policy makers to adopt appropriate practices to enhance open innovation.

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