# Analysis of the Cognitive Role of Agricultural Research & Development Institutes in Sri Lanka

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**Abstract**
Knowledge and information flow in developing countries is focused more towards commercial activities than technology related matters. Further, the capacity of all actors in the agriculture sector to comprehend and exchange work related information can profoundly affect the effectiveness of the knowledge dissemination process. The study's intention was to ascertain the structural behaviour of the R & D institutions based on their absorptive capacity and external openness. A semi-structured questionnaire was employed for this purpose and distributed among a sample of 26 Agricultural R & D institutions. The Study showed that the absorptive capacity of the agricultural R & D institutions in Sri Lanka is reflected fairly accurately by the internal human resource capacity and the combined years of experience of the human capital within each institution. The absorptive capacity of an institution determines its behaviour within the institutional cluster. The study made it clear that agricultural research institutes are of a heterogeneous nature in their absorptive capacity and in the cognitive role they played in the knowledge network. Many research institutes in Sri Lanka act as the knowledge absorbers and mutual exchangers of information within the agriculture knowledge network in Sri Lanka.

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## Introduction

"Absorptive capacity" of a firm has defined as the ability to recognize the value of new information, assimilate knowledge and apply that knowledge to commercial end (Cohen and Levinthal, 1990). According to Lazzari and Pisano (2014), the learning and innovation capability of a firm is primarily determined by its capacity of knowledge acquisition, knowledge assimilation, knowledge exploitation and sharing. Further, Unevenness of the knowledge base and inherent heterogeneity of the firms determine the learning and absorptive capacity of the firm (Cohen and Levinthal, 1990). In addition, Firms cognitive capacity depends largely on knowledge and experiences they have acquired in the past (Boschma and ter Wal, 2007).

The Firms' absorptive capacity provides both opportunity and constraint for firms to learn through its accumulated knowledge. Accumulated knowledge in a firm embodies in its general routines and human resources. A leading firm with the higher absorptive capacity acts as hubs in the network while weaker firms operates as isolated firm in the network (Giuliani, 2002). Therefore, firm's investment in R & D contributes to firms' absorptive capacity through enabling knowledge creation and acquisition from local and external sources. A firm' Economic power, firms' internal competences and organizational strategies make a cognitive structure of the firm (Boschma and ter Wal, 2007).

Access of knowledge by a firm is done through internal and external sources. Access to external knowledge is important and is a vital aspects for firms' research and development activities. Accordingly, external openness reflects the firm's propensity to acquire extra-cluster knowledge. The degree of openness of a firm in a cluster inevitably depends on its member firms and institutions (Giuliani, 2002). It is argued that firms are heterogeneous in their capabilities and knowledge bases and thus have different roles within the cluster absorbing external and internal knowledge bases. In Sri Lanka, Management of research and development, education and extension services extremely poor or disorganized due to limited access to new information and technology. The Importance of individual firm in a knowledge network heavily depends on inherent characteristics of firms. Hence this study intend to analysis association between firms' learning capacity and network structure in Sri Lankan Agriculture sector.

## Methodology

The study has designed to examine the role of Agricultural Research and Development institutes with respect to its absorptive capacity to grab the new technologies and knowledge. The total population of the sample was 36 representing public, University and private R &

D institutions (ASTI). The samples of 26 Agricultural R & D institutes were purposively selected and interviewed using a semi-structured questionnaire. Research officers of the each institute were interviewed.

The absorptive capacity of the each research institutes measured applying principle component analysis using main four correlated variables. As Giuliani and Bell (2005), this study used, (a) education level of the research scientist in the research institutes; (b) experiences of the scientist in the agriculture sector in month; (c) the number of firms in which each scientist has been previously employed, and (d) the type and intensity of R & D undertaken by the research institutes. An index derived from the application of principle component analysis to the data about the two major components.

External openness which reflects the firm's propensity to acquire external knowledge was measured using the number of linkages with other research institutes that considered as sources of knowledge and information. Further, study investigated the structure of the knowledge network in agricultural research sector in Sri Lanka. The Developed Knowledge network determined the position of each individual institutes in the local network. Moreover, it configured the whole knowledge network on the aggregate level. In measuring knowledge relationship between firms in the study, 'roster recall' methods (Morrison and Rabellotti,2009; Giuliani and B ell, 2005) was employed.

Based on the theoretical framework of the study, following hypothesis was tested as the one component of the research study:
**H1:** There is a significant correlation between the absorptive capacity and external openness of the institutions.

## Results and Discussion

### *Absorptive capacity of the Agriculture research institutes*

The significant factors of absorptive capacity were (The weights in the each component are mentioned in parentheses. (a) the level of education of the research scientist in the research institutes (0.857); (b) each research scientist's month of experiences in the agriculture sector(0.803); (c) the number of firms in which each scientist has been previously employed (0,786), and (d) the type and intensity of R & D undertaken by the research institutes (0.772). An index derived from the application of principle component analysis to the data with the two major components. The component explains 68.7 percent of the original variance of the variables.

### *Cognitive role of agriculture research station*

The external openness of institutes and the cognitive position of the institute within the local knowledge system are illustrated in Table 1. Five major cognitive roles within the cluster were identified combining the external openness and ratio of In/out degree centrality. Technical gatekeepers are the institutes who have a central position in the network in terms of knowledge transfer to other local institutes. Those actors are strongly connected with other external sources of knowledge.

**Table 1:** Different cognitive roles within the knowledge network

| Intra-cluster cognitive role | External openness | | |
|---|---|---|---|
| | Low ( Below average) | Medium (Average) | High (Above average) |
| Source (In/out DC<1) | | | *Technological Gatekeeper* |
| Mutual Exchange → (In/out DC 1) | *Intra-Cluster mutual exchange* | *Active Mutual exchange* | |
| | | *Weak Mutual exchange* | |
| Absorber (In/out DC>1) | *Local Absorber* | | *External Stars* |
| Isolated or Poorly interconnected In =out and → 0 | *Isolated Firms* | *Locally isolated* | |

Source: Author's own data, 2015

According to the study, Department of Export Agriculture and Plant virus Index Centre act as the technological gatekeepers of the network. Mutual exchangers can be defined as a role-playing by an institutes being central part of the local knowledge system with a balanced source/absorber position within the cluster (Giuliani and Bell, 2005). Mutual exchange institutes have divided into two categories as active and weak mutual exchangers. Active exchangers behave in a similar way to technological gatekeepers by bridging external sources and local knowledge absorbers. Weak mutual exchangers are well linked to external knowledge sources. Compare to Active Mutual Exchangers, weak exchangers are less connected to other firms in the cluster. Sugarcane Research Institute and National Cinnamon R & T institute

in Sri Lanka act as Intra-Cluster mutual exchange. Horticulture Research & Development Institute (HORDI), Post Harvest Technology Institute (PHTI), University of *Peradeniya* and University of *Uwa Wellassa* act as active mutual exchange in the network. Weak mutual exchangers of the network are Rice Research and Development Institute and National Plant Quarantine Centre (NPQC). Local absorbers in Sri Lankan research network are Tea Research Institutes (TRI) and Socio- Economic and Planting Centre (SEPC). External stars have established strong linkages with external sources. Field Crop Research & Development Institute (FCRDI), Fruit Crop R & D Centre (FCRDC), Food Research Unit (FRU), Plant Genetic Resources Centre (PGRC), Grain Legumes & Oil crop R & D Centre (GLORDC), University of *Ruhuna, Sabaragamuwa* University of Sri Lanka and CIC private company has considered as external stars of the network. Even though the plantation sector is a vital part of Sri Lankan economy, Coconut Research Institute, Rubber Research Institute and Veterinary research Institute (VRI) act as isolated firm in the network which were poorly linked to other institutes. Similarly, Horticulture Research & Development Institute (HORDI) and Natural Resource Management Centre (NRMC) were categorized as locally isolated firms in Sri Lankan agriculture research network.

***Correlations between External Openness and Absorptive capacity***

The hypothesis of the research was to test the positive correlation between the absorptive capacity of the research institutes and external openness of the each institute. A non-parametric test was run between the level of institutes 'absorptive capacity and their degree of external openness. The Kendall tau_b coefficient used to measure the correlation between these two variables. The test did not show a significant correlation between those two variables. The Kendall tau_b coefficient is 0.129 with $p<0.01$. This result indicates that the institutions with a higher absorptive capacity do not tend to make effective knowledge linkages with other research institutions.

**Conclusion**

The study made clear that agricultural research institutes are heterogeneous in their absorptive capacity and cognitive role in knowledge network. Nerveless, the concertinaing the network connectivity of the whole cluster is not strong enough since it has more potential to make more linkages between similar institutions. Another striking result shows that only a limited number of local actors were part of the knowledge sources. The absorptive and technical capacity of other research institutes in close geographical and social proximity was a major factor that was considered by research institutes intending to enter into a knowledge relationship with them. Similarly, collaboration between national and international research institutes can bring considerable benefits through Knowledge sharing. However, there was no significant impact of absorptive capacity of the research institutes on creating linkages with external institutes.

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