Exploring Cross-sectoral Transfer of Regional Innovative Capacity: from agriculture biotechnology to health care

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INTRODUCTION

Since the writings of Michael Porter brought the term "cluster" into vogue in the economic development community much has been learnt about their components and functions. This inspires the question, 'what can be done with this knowledge?' and more specifically, "can the competitive advantages afforded by existing cluster assets be extended to additional sectors?"

Wolfe and Gertler (2004) identify three general themes that have emerged within cluster literature. These include the issue of path dependence, the nature of knowledge and learning, and the scale of analysis. Studies of the nature of knowledge and learning have identified the benefits and potential sources of advantage associated with cluster membership. Essentially, this stream of literature has established the fact that clusters are a source of several types of competitive advantage.

Following is preliminary assessment of this project. The first section is an overview of the theoretical background upon which this project is based. Section two includes the preliminary data collected in the two test sectors. The third section is a discussion of these preliminary findings. The final section underscores the critical implications and future directions.

1. BACKGROUND

The long term success of firms situated in clusters has inspired many efforts to understand and recreate these successes. Porter (1990) observed that firms situated within these geographically bound regions were relatively more successful than those outside of the regions. He subsequently concluded that the region, and not the firms

themselves, afforded a source or sources of competitive advantage. The existence of communal advantages does not preclude firm-level advantages but Lawson (1997) suggests communal competencies "supersede firm-level competencies in scope and persistence." (Tallman, 2004: 10) Essentially, firm-level and cluster-level advantages can co-exist but the cluster-level advantages are less easily understood and replicated by competition. This creates the potential to afford their benefits over a longer period of time. As a result, cluster-level competitive advantages are highly desirable.

Competitive advantage is most often studied at the firm level. Competitive advantage is derived from either resources or capabilities. Resources refer to the finite assets available to a firm. Resources can be either tangible (technologies and capital goods) or intangible (know-how, patents and intellectual property rights) (Mathews, 2003: 116). Globalization has generally made more resources accessible however these resources are accessible in varying degrees to firms around the globe. Capabilities refer to a firm's ability to utilize the resources at its disposal. They refer to more than just procedures. Capabilities include the complex web of routines and processes that enable a firm to continually improve their economic performance relative to the social context within which they operate. Some general examples of capabilities include: bringing products to market faster, efficiently implementing new organizational changes, or effectively conducting research. Resources and competencies are the building blocks of firm competencies. As Mathews (2003) notes, the resource based view of the firm suggests firm success is derived from distinctive competencies. Ultimately the resource based view of the firm allows that resources, capabilities or combinations of the two generate competencies and competencies in turn generate competitive advantages.

Tallman (2004) makes the distinction between two types of competitive advantage: those based on traded interdependencies and those based on untraded interdependencies. Traded interdependencies exist in the economic sphere and involve formal exchanges of value for value. They include licensing, alliances, or acquisitions in which formal exchanges take place (Tallman, 2004:8). Existence within the economic sphere infers that traded interdependencies reflect the rational actor principle in efforts to maximize the efficient allocation of resources. Storper (1997) observed that traded interdependences are readily dispersed as industries mature (Tallman, 2004). This can be attributed to a greater understanding of the processes surrounding economic transactions.

Untraded interdependencies are "based on shared knowledge for which no market mechanism exists" (Storper 1993, 1995, 1997 as sited in Tallman, 2004:8). They exist outside the economic sphere. Untraded interdependencies are "comprised of conventions, rules, practices, and institutions that combine to produce 'worlds of production' which present action trajectories for firms within an uncertain world" (Storper & Salais, 1997 as sited in Tallman, 2004:8). Untraded interdependencies reflect the 'knowledge in the air' associated with Alfred Marshall's (1920) 'industrial atmosphere'. These competitive advantages exist in a system that runs parallel to the economic system. Tallman (2004) states that this parallel system works to reduce the transaction costs of exchanges related to traded interdependencies.

The importance placed upon traded and untraded interdependencies has changed over time. Originally the advantages associated with the economic sphere received the greatest amount of attention. Traditional agglomeration economics identified advantages related to: lower input costs, development of common suppliers, specialist labour pools,

spillovers of technical know-how, and 'industry atmosphere' (Tallman, 2004: 10). The emergence of globalization was expected to reduce the importance of proximity in attaining these advantages. As clusters continued to sustain competitive advantage the focus shifted to untraded interdependencies. These competitive advantages have been attributed to interaction and the resultant trust that enabled communities to develop what Mathews (2003) refers to as 'learned patterns of adaptation'. Essentially the 'industrial atmosphere' or 'mysteries in the air' are given life in the form of community competitive advantages.

Since all competencies are molded from the same building blocks – resources and capabilities – it is conceivable that these resources, capabilities, and competencies could find relevance in other sectors. The ability of competencies to generate sustainable competitive advantage for a firm is context specific.

2. FINDINGS

The impetus for this project was a study conducted by a local agency interested in investing in an innovative health care sector. The original study explored the existing health care sector from the perspective of regional innovation. The objective was to outline the existing actors, assets, and health innovation trends. This project seeks to combine these limited findings with data from the Innovation Systems Research Network analysis of the Saskatoon agricultural biotechnology sector. Following is an informal summary of the limited results from these two studies. Analysis is ongoing.

A. Health Care Innovation Sector

The health care sector presents a valuable model for the study of developing regional innovation systems. Globally, the health sector is facing a number of ethical, political, and socioeconomic consequences associated with a growing and aging population. Innovation will assume a central role in the solution of these problems.

The regional innovation system for health care innovation was assessed through a two-part study (Karwandy and Ryan, 2003). The study combined a broad, regional analysis of economic development potential with an in-depth, firm-based market feasibility study and business plan for a targeted Information Technology (IT) product - distributed medical imaging. The results yielded an overview of the regional innovation environment and a detailed understanding of the assets and liabilities associated with the development and commercialization process.

A self defining, local health innovation system was not identified and was attributed to the lacking of several critical innovation elements:

1. Innovation in health care requires strategic vision championed by a trusted actor.
2. Relationship building amongst actors is crucial.
3. Local/regional system(s) can benefit from interregional connections. (Karwandy and Ryan, 2003: executive summary)

The non-existence of a sector makes it difficult to discuss local health care innovation in terms of competitive advantages or the resources and capabilities required for development of competitive advantages. Since the original study did not address these items specifically it is necessary to discuss elements of the sector that demonstrate resources, capabilities, or competencies.

Resources:

The general focus of the health study was innovation capabilities. As a result, resources most commonly associated with traded interdependencies were not specifically identified. Those resources that were addressed include: professional and managerial labour, technical labour, and financing.

A huge deficiency was identified in the professional and managerial labour supply. The following comments outline this deficiency: "…although we have tremendous capacity in terms of training and educating professionals and managerial personnel, we lack the ability to attract back to the region those locally trained managers and professionals we continually lose to other markets" and "the region has an overabundance of accountants and lawyers but not enough management-based professionals" that would be necessary for innovation-based initiatives in healthcare and IT (Karwandy and Ryan, 2003: 32). Professional and managerial resources are integral to any sector and thus are prime candidates for cross-sectoral transfer of capacity.

Skilled technical personnel are a plentiful resource in the health care sector. However, the local communities' ability to access and retain this resource was questioned:

> "There is potentially no lack of skilled technical personnel in the local economy" However, the economic reality and problems associated with quality of the work environment (health care sector) has created problems in retaining qualified personnel: "…structural and cultural changes need to be made in order to alleviate imbalances in the system" (Karwandy and Ryan, 2003: 32).

This illustrates the need for capability development that improves the utilization of the skilled technical personnel resources.

Financing resources were also found to be "insufficient" or "unsophisticated" (Karwandy and Ryan, 2003: 33). In a market that isn't considered to be innovative it isn't a surprise that funding resources are not plentiful. The greatest impediment to all resources was culture. In the case of financing the cultural impediment was characterized as "a resistance to excel and to create wealth" (Karwandy and Ryan, 2003:33). Culture as an impediment indicates the need for development of new capabilities to improve the utilization of existing health service resources.

Capabilities:

The health study identified the core integrators (most central actors) and specialized agencies (non-core actors) in the health sector. The centrality of these actors within an integrated health and information technology sector was analyzed. The core integrators were identified as the actors with the greatest ability to identify, develop, and commercialize innovations in this health sector. The specialized agencies were considered less central to this process, thereby assuming a supportive role. Following is a summary of their collective capabilities.

TRLabs was identified as the most central actor. TRLabs is Canada's largest not-for-profit information and communications technology research consortium operating under an internationally recognized model for collaboration in research. Their industry-university-government model for collaborative research, along with their regional linkages to Winnipeg, Calgary, Edmonton, and Regina provide valuable research, development, and commercialization capabilities.

The Saskatoon Health Regions position as the primary user and adopter of technology infers upon it the unique capability of identifying appropriate research

directions. There most unique capability is attributed to the newly developed business development office. This office operates with a for profit mandate to develop innovative solutions for existing health care delivery. In addition to these innovation capabilities, universities were identified for their capability as "generators of new knowledge" and as "proactive catalysts for innovation" (Karwandy and Ryan, 2003: 19).

The remaining actors, the specialized agencies, exhibit a variety of capabilities related to their product focus. QCC Communications is a developer of information technologies and was valued for its expertise in developing IT solutions for the health care sector. The provincial government, as primary financer of health care, has the capability to set the priorities and direction for innovation. The federal governments Industrial Research Assistance Program was identified for its capabilities in supporting the entrepreneurial efforts of small and medium sized enterprises.

Generally the health sector is in need of innovative transformation. Several actors with limited capabilities have been identified but it seems apparent that success in this sector will require a community effort to over come the deficiencies in resources, capabilities and competencies. The shortfalls of this sector inspire the question of whether or not there are common innovation resources that can be borrowed from the successful and innovative agricultural biotechnology sector.

B. Agricultural Biotechnology Sector

Saskatoon's technology cluster is one of the few identifiable agricultural and food biotechnology clusters in the world. It has more than 20 years of history with a reputation for introducing 'world firsts' into the market. Nevertheless, the cluster

continues to rapidly evolve and is currently establishing itself as Canada's centre for plant and animal genome science. Leveraging recent trends in genomics science and research and capitalizing on federal investment initiatives, the region is actively involved in several projects in animal and plant genomics, which have the potential to develop into various value-added products. Saskatoon's Agricultural Biotech cluster is comprised of a number of actors and institutions, including the Innovation Place research park, which provides a basis for a dynamic, interactive knowledge network.

The following preliminary results are taken from the Innovation Systems Research Network /Agriculture and Agrifood Canada survey of Saskatoon's agricultural biotechnology cluster. This data illustrates the traded and untraded interdependencies that exist within the Agricultural biotechnology sector.

Resources:

I have identified three important categories of resources within the Saskatoon agricultural biotechnology sector: labour, finance, and raw materials. The preliminary results identify a thick labour market, adequate early stage public financing but limited private venture capital, valuable local infrastructure (labs, greenhouses, field trials, etc.), and significant levels of knowledge production in the form of intellectual property, publications, and citations.

The labour market included employees of varying education levels and focus. It was found that marketing, management, and science and technology research staff was hired from other markets by about one third of the firms (Phillips et al, 2004: 56). This suggests that the labour market for more specialized positions is not as thick as that for production and design workers. The positions most likely to transfer across sectors would be those

dealing with the management of innovation. As seen above, these positions are not overly abundant within the community and as such are often sourced from other regions.

Phillips et al (2004: 60)) observed that "in spite of weak private capital markets, the public system has effectively made the biotechnology sector largely tax-free." Relatively universal funding programs (IRAP, tax credits, AAFC MII, and council grants) are complimented by many more targeted programs offered by various government departments, programs and agencies, as well as, industry and producer associations. Private sources of funding are limited to a couple of financial institutions (Royal Bank and CIBC) and a handful of government sponsored venture funds. Early speculation suggests that the division in availability of financial capital reflects the emphasis the cluster actors place on discovery and development over commercialization of biotechnology products.

Discussions with actors in the biotechnology sector have identified several valuable inputs: ability to conduct field trials, presence of suppliers, specialized infrastructure, and the prevalence of knowledge outputs. Respondents the ISRN survey identified infrastructure as the second most important source of advantage in the Saskatoon region (Phillips et al, 2004: 47). Infrastructure includes the public and private labs, greenhouse facilities, and incubator facilities. Phillips et al (2004) reported that the majority of public and private firms have intellectual property management strategies with trade secrets and patents being the most popular forms.

Capabilities:

The ag biotech sector is rich in routines that enhance the sectors ability to adapt. Phillips et al (2004) identify the significant investment in agricultural genomics in the

Saskatoon region as evidence of the regions ability to restructure. They report measures of centrality and density for several functions (research and development, services, financial, high quality personal, and networking) within the biotechnology cluster. The networking function is described as "commercial or social interaction that does not relate to formal exchange of goods, services, capital and labour" and most closely reflects the advantages associated with untraded interdependencies (Phillips et al, 2004: 50). The centrality and density measures reveal 8 core actors that best reflect the capabilities inherent in the cluster.

The density measures demonstrated variation across functions but indicated "quite a highly linked community for industrial policy and promotional efforts but relatively weak financial intermediation" (Phillips et al, 2004: 53). Ag West Biotechnology was identified as the actor with the greatest capability for networking and thus for influencing the communities ability to adapt.

Phillips et al (2004) observed that the 8 core actors: Agriculture and Agrifood Canada (AAFC), Ag West, Canadian Light Source Inc (CLSI), National Research Council – Plant Biotechnology Institute (NRC-PBI), National Research Council-Industrial Research Assistance Program (NRC-IRAP), POS pilot plant, Saskatchewan Research Council (SRC), and the University of Saskatchewan (U of S) were dominated by public institutions. This suggests that public institutions exert the greatest influence over social fabric of the cluster and the associated untraded interdependencies.

The resources and capabilities of the core actors in the Saskatoon biotechnology cluster reflect the advantages identified by the members of the cluster. The strengths lie in creation and dissemination of knowledge. Public institutions are producing leading

edge research. The shortfalls of this sector are in the translation of research findings into commercial products. The lack of financial resources reflects the disadvantage the Saskatoon cluster experiences in area of commercialization.

C. DISCUSSION

Can the resources, capabilities, and competencies of the Saskatoon biotechnology cluster be used to nurture a developing health care innovation sector?

The health sector has few resources and capabilities on which to build an innovation cluster. Aside from a small local market and the capabilities of a few actors this sector faces a large cultural hurdle. All actors along the health care industry value chain need to develop "learned patterns of adaptation" to meet the changing needs of the global health care sector. This can be achieved through the strategic combination of capabilities to identify, develop, and commercialize new health care products.

The preliminary findings suggest that resources and capabilities are highly industry specific. For instance, labour markets for biotechnology are comprised of employees with highly specialized skills. These employees can not be expected to support innovation in the health care sector. The scientific research outputs, intellectual property, trade secrets, and publications can not be used as resources in the health care sector.

However, several resources could eventually generate synergy between the two sectors. The biotechnology sector identified a shallow market for employees with managerial skills. An emerging health sector would provide more firms in which

innovation managers could be employed thus making the region more attractive to these sorts of labour. Similarly, the biotechnology sectors success in developing and utilizing untraded interdependencies could be extended as a model of development to the health sector.

Since the health sector is non-existent in terms of resources, capabilities, and competencies it is difficult to consider which biotechnology sector assets it could adopt. What has become apparent is that two sectors developing along side one another could jointly develop competencies related to the social side of innovation including: leadership, project management, innovative financing, management development, etc.

D. IMPLICATIONS

Cross – sectoral comparison by specific resources and capabilities is largely ineffective because of industrial uniqueness. Future analysis should incorporate comparison across innovation functions: research and development, services, financing, high quality personnel, and networking. A more comprehensive investigation and categorization of the data will allow for a more detailed analysis.

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