

**Measuring University Involvement with Industrial Clusters:  
a Comparison of Natural Resource Sectors in Chile and Canada**

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It is generally assumed that universities are important contributors to economic development and that local economic development can be promoted through the creation of innovation clusters. However, there is relatively little awareness by university managers and regulators about: the specific roles and techniques universities employ to participate in regional economies and promote cluster development; what universities are actually doing in this regard; and how to manage their involvement better. This is especially so for smaller universities located in peripheral regions dependent on natural resource industries, as the literature tends to focus on high-technology activities in major metropolitan areas.

Our research addresses this gap between general expectation and detailed management techniques . We focus on definition and measurement to design and apply an indicator framework that is comparable across countries and regions. The goal is to increase awareness of this issue among university managers and provide them with tools for improving their management of links to clusters. We define what actions are possible and gather data to show what is actually the amount of involvement, in a form that allows managers to compare their institution against others.

We study Chilean practice and compare it with Canada. We investigate 4 Chilean universities (1 focussed on wine, 1 ecotourism, 1 mining and 1 salmon culture) and 4 Canadian (1 in each of the same resource industries). All schools are small and in peripheral regions of their countries, but in most cases, are those with the greatest national involvement in their respective sectors. Data were gathered from March to November 2007.

From the literature, filtered through the author's extensive professional experience in this area and by a pretest of the questionnaire, we developed a set of 6 roles that describe universities linkage with local clusters. Each role consists of a set of discrete activities and each activity is measured by 1 or more indicators. In addition, we measure how universities manage these roles, with additional indicators. Indicators are (fairly) discrete characteristics such as number of degrees specialized in the resource sector or number of students enrolled in these courses. We considered 86 indicators. The roles are presented below, with summary results of the data gathered.

#### Training People for the Cluster

Universities put their greatest attention on this role. The concentration is on bachelor's level degrees, except for wine, where both the canadian and chilean universities emphasize the PhD. Mining is more balanced in both countries among all degrees. There is less, but significant, involvement with post-degree diplomas, executive education for companies and technician training. Training related to the cluster is concentrated in a few core departments, but there are significant instances where specialized courses are given by other departments. In no case did we find a university-level awareness or management of all the degree training that relates to the cluster.

### Developing Scientific Knowledge Related to the Cluster

The research component of the scientific knowledge generation role is fairly well managed, but we note that in 3 of the Canadian schools the research offices are all new. Unlike teaching, research related to the cluster is far more dispersed among different departments. No university had an overview of the entire research involvement relating to the cluster or general industry. In terms of research outputs, the Chilean and Canadian levels are about the same. Intellectual property has received little attention and there are very few outputs to the cluster. This is changing in the Canadian schools, which have all recently established or greatly expanded their management resources in this area.

### Solving Technical Issues for Cluster Organizations

Nearly all faculty and all Chilean research units are active in consulting. There are no data in an accessible form on consulting contracts carried out by research centres and labs. There are no data gathered in any university on individual faculty consulting; in almost every case of individual faculty consulting, there was a climate of suspicion and conflict between faculty and management. Laboratories are very involved with quality control and production analysis for industry in Chile. Universities make very little effort to promote their research outputs or capabilities to the cluster.

### Developing New Cluster Companies

There is very little involvement by our universities in developing enterprises for the cluster. Incubators are few and all have been established within 2 years. One faculty created a significant number of spinoffs around salmon in Chile, but this activity is rare to nonexistent in most universities. Entrepreneurship teaching is developed in all universities, but courses are all limited to a single faculty. There is almost no teaching of innovation management. Business schools are not involved in 7 of the 8 cases.

### Developing Networks, Awareness and Social Capital for the Cluster

With two important exceptions, our universities are not strongly involved in directly promoting the development of their local natural resource cluster. No university has a formal cluster promotion office. However, 1 in mining in Chile is building a research park, and 1 in salmon in Chile and 1 in mining in Canada also have facilities which carry out part of the research park activity. At this Canadian university we note a professor dedicated years of work to catalyzing a mining sub-cluster, with spectacular results. Membership in sector or cluster-promoting agencies is common in most universities. All universities have media, but very few are oriented to promoting the industrial sector.

### Creating Student and Faculty Links

Students are a critical linking mechanism which has not been exploited to any degree, so it rests completely unused except in 2 cases (salmon in Chile and wine in Canada). Student coop placement, graduate placement and alumni are not monitored or used for any linkage purpose. There is almost no movement of full time faculty between the university and the cluster. Mechanisms to place faculty in cluster organizations in a kind of sabbatical arrangement do not exist. However, in Chile, the large number of part time faculty means there is very high interlinkage with industry. Many of these faculty are consultants. This

has great strength for knowledge transfer in and out of the university, but a weakness in that it almost never relates to research.

#### Generating Revenue from External Sources

Cluster internships for students are not available except for the Canadian mining case. Industry scholarships for students are available, much more so in Canada and only for mining in Chile. Research funding from private sources exists, but it is difficult to measure without going to original project documentation. There are no research-related endowments. Surprisingly, hardly any effort is made in Chile to obtain endowments; in our Canadian universities, efforts were modest and very recent, but expanding rapidly.

In terms of methodology, we conclude that the indicators provide a basis for gathering numerical data robust enough to support different types analysis, with the following limitations:

- Numerical and descriptive methodologies alone are not as powerful as combining the two types of analysis.
- The numbers should be used to show general tendencies and relative differences only.
- Simplifying the indicator framework into a ranking system would result in very misleading conclusions. It is highly probable that all media rankings of universities suffer this serious limitation.
- Benchmarking is possible but only against individual indicators, and with the caveat that the university drawing conclusions from the analysis must consider the limitations of the indicators.
- Quality management, regulation and accreditation activities can use these indicators effectively by aggregating them in a flexible way according to the situation, considering the qualifying notes and descriptive data that accompany the indicators and comparing them against the mission.

Since the research also gathered extensive case study data on each university, natural resource sector and cluster, we were able to make some qualitative analysis about why these roles exist in the form and extent we found. We note the following:

- This is not an area where universities claim to have a strategic involvement. No mission statement mentions a cluster; only 3 mention regional development and 1 general economic development. When there is elaboration on the mission, the available documentation indicates no emphasis at all on regional development and industrial linkage. A lack of awareness of how to achieve linkage was noticed in all our interviews with senior university managers.
- Traditional academic culture of collegiality, independence, individuality, isolation and disciplinary theorizing resists interaction with industrial clusters and the management necessary to do it. While this culture allows universities to undertake the roles of teaching and (theoretical) research, it hinders managing the other roles. Universities tend to have greater success when they establish institutions on their borders that can act in a more entrepreneurial, business-like manner, but this does not substitute for a university-wide strategic vision of the competitive environment.
- Four of our universities were founded with explicit mandates to assist local development and with the financial support of local business and community. Yet

academic culture seems to be a factor in causing institutions to drift from this original mission towards an orientation to the international community of scholars producing disciplinary-oriented, theoretical science. This produces outputs of little immediate interest to the local cluster, which needs practically-trained employees and knowledge that solves immediate problems and opportunities.

- We found evidence of academic entrepreneurs building linkage institutions in 7 out of the 8 universities and 1 case of a professor doggedly creating enough social capital in mining in Canada to bring an entire sub-cluster into existence. However, in no case did we find university career structures or other incentives to support this kind of academic entrepreneurship. Generating these supports would have significant, immediate benefits.
- A university's relationship with the sector seems to be limited when the industry is very large and sophisticated, and when the industry is very weak, small and traditional. There seems to be an optimum chance for interaction when the knowledge, social and scale levels are most similar between the university and the cluster.
- All the resource sectors studied display only weak cluster characteristics. This makes it much harder for a university to focus its resources on cluster development and interaction. Mining, the sector with most cluster characteristics in both Chile and Canada has by far the greatest university involvement; ecotourism is the least and with the weakest involvement with universities.
- Natural resource industries have characteristics that cause the clustering dynamic and university linkages to be different than for the much better-known "high-tech" clusters. There are no teenage millionaire entrepreneurs. Mining is highly engineering and technology-oriented, offering the broadest and deepest potential for interaction and financing. Wine industry is science-based, linking on research and PhD training, but only involving core producers, not the rest of the cluster. Salmon is foreign-controlled and hires few skilled people, resulting in low links with research, only consulting to meet regulatory requirements. Ecotourism is fragmented and made up of small firms which limits consulting opportunities, research funding and cluster development.
- Major structural differences between Chile and Canada condition university linkage with industry. The much larger funding that flows into the Canadian system generates possibilities for more and more extensive linkages. The recent history of military rule in Chile caused enormous disruption to universities and abandonment of some linkage activities. The lack of regional power in Chile hampers regional university development and interaction with clusters; extensive regional power promotes them in Canada.

The university is an important contributor to cluster development by providing trained people, advanced knowledge for the future and technical problem-solving and opportunity-realizing for the moment. But its most important role, although hardly practiced yet, may be networking to encourage industry and government to work with the university to build clusters, and building social capital in the industry to catalyze a cluster into existence. All universities can play this role, not just the large, metropolitan ones.