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## **Seeing Eye to Eye: How do Public and Private Sector Views of a Biotech Cluster and its Cluster Initiative Differ?**

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## Seeing Eye to Eye: How do Public and Private Sector Views of a Biotech Cluster and its Cluster Initiative Differ?

*ABSTRACT* As clusters have developed from an analytical concept into a key policy tool, numerous cluster initiatives, or collaborative organizations designed to enhance the competitiveness of clusters, have been implemented across the globe. However, while research on clusters is abundant, research specifically focusing on these emerging organizations is scant to date. This paper analyzes one such cluster initiative and its cluster, and in particular examines to what degree the public and private sectors 1) have the same understanding of the cluster's competitiveness and underlying strengths and weaknesses and 2) what activities the cluster initiative should conduct.

### 1. Introduction

Since its introduction in 1990 by Michael Porter, the concept of clusters has rapidly attracted attention from academics, consultants, and policymakers. Many governments and industry organizations across the globe have turned to this concept in recent years as a means to stimulate urban and regional economic growth. As a result, a large number of cluster initiatives were started during the 1990s, and the trend continues as evidenced by the 2005 Global Cluster Initiative Survey funded by USAID in which more than 1400 such cluster initiatives across the globe were identified (Ketels *et. al.*, forthcoming).

More specifically, cluster initiatives are a particular form of public-private partnership and are *organized collaborations between public and private sector actors*, such as firms, government agencies, and academic institutions, with the purpose of enhancing the growth and competitiveness of clusters. Cluster initiatives are generally engaged in a broad range of activities designed to support the cluster, such as joint marketing, training, developing technical standards, coordinating joint R&D projects, promoting commercialization of academic research, supply chain development, improving the regulatory environment, and lobbying for better infrastructure or FDI incentives (Sölvell *et. al.*, 2003).

Before proceeding, it is important to stress a few distinctions regarding cluster initiatives. First, a *cluster initiative* is not a *cluster* in the Porterian sense; rather it is an organization set up to serve the cluster. Second, cluster initiatives are neither exclusively government organizations nor industry organizations. They are, by definition, a collaboration involving *both* public and private actors.

Despite the growing interest and increasing resources invested in cluster initiatives, a literature review revealed that although a considerable body of literature focuses on areas such as the spatial qualities, characteristics, and dynamics of clusters (e.g., Isaksen, 2004; Leibovitz, 2004) and the dynamics of a sub-group of cluster actors such as the cluster's firms (e.g., Bagchi-sen & Scully, 2004), surprisingly little empirical research has investigated *the cluster initiative organizations themselves*. Thus, the goal of this research is not to contribute directly to the ongoing debates in the cluster field, such as the value of a cluster approach and underlying theories of agglomeration or path dependency, but to developing an understanding of these emerging collaborative organizations designed to increase the competitiveness of a cluster.

To achieve this, we draw upon the organizational literature on decision-making groups comprising diverse members (e.g., Maznevski, 1994) and the alliance literature, (e.g., Lerpold 2003) as well as the growing body of public-private partnership literature (e.g., Klijn & Teisman, 2003). Briefly, the first literature has found that decision-making groups with members who represent diverse organizations generally do not have a shared social reality or shared views and values while research in the second area indicates that the member organizations of inter-organizational decision-making tend to have divergent motives and objectives for what they expect to achieve in the collaboration. While these findings are echoed in the public-private partnership literature, this literature is still in a somewhat early stage and researchers have paid scant attention to the particular case of cluster initiatives. With the rapid implementation of cluster initiatives and high expectations for competitiveness improvements by their participants, however, it is important to understand just how the views and objectives of the primary groups of cluster actors compare. This understanding demands attention especially in light of the findings on diverse groups and alliances that such organizations often suffer from ineffective communication leading to obstacles to effective performance and in the case of alliances, frequent failure. Thus, the purpose of our study is to examine the degree to which the public and private sectors differ in their views regarding the cluster's competitiveness since this lies as the foundation for competitiveness improvement efforts as well as how they differ in their objectives for the cluster initiative. This leads us then to our two research questions:

*Research Question 1:* To what degree do the public and private sectors have the same perception of a cluster's competitiveness and its underlying strengths and weaknesses?

*Research Question 2:* To what degree do the public and private sectors agree on the activities the cluster initiative should conduct to improve the cluster's competitiveness?

We investigate these questions through a case study of one cluster in Sweden, the Uppsala biotech cluster, and its cluster initiative, Uppsala BIO. Through an online questionnaire of public and private sector respondents in the Uppsala biotech cluster, we find that these two groups do have significant differences in both the above areas. To anticipate the results, we find that the public sector consistently has a more positive view than the private sector of the cluster's competitiveness as well as higher expectations as to what the cluster initiative will be able to achieve. However, the public sector has less ability to differentiate in terms of the activities the cluster initiative should

conduct. After presenting these results, we discuss our findings in light of the patterns of interaction that these two sectors have with other actors both within the cluster as well as internationally. The article then concludes with a discussion of the implications for the governance of cluster initiatives.

## 2. Previous Research on Clusters, Cluster Initiatives, and Public-private Partnerships

### 2.1 Cluster Research

In 1990 Michael Porter introduced the cluster concept in his book, *The Competitive Advantage of Nations*, later defining clusters as “geographical concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (for example, universities, standards agencies and trade associations) in particular fields that compete but also cooperate” (Porter, 1998, p. 197). Since then, the cluster concept has become widely circulated and used in both academic as well as in policy circles (Benneworth et al., 2003; Martin & Sunley, 2003; Simmie, 2004).

In his earlier work, Porter (1990) developed a model identifying the specific sources of competitiveness (see Figure 1). Essentially, the model proposes that competitiveness stem from four interrelated influences relating to 1) factor input conditions, 2) demand conditions, 3) related and supporting industries, and 4) the context for firm strategy and rivalry. The geographical concentration that occurs in clusters among actors enhances the processes of interaction between these four factors. While the diamond model is well-known to cluster researchers, we feel it is important to briefly present the model here as it forms the basis for our first research question.

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INSERT FIGURE 1 ABOUT HERE

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Regarding the first factor of factor input conditions, the model stresses the importance of specialized inputs as opposed to the more generic classical notion of availability and cost for capital, labor, and land. Such specialized factors develop to fit the needs of a particular economic activity, such as the availability of specially trained labor or a research infrastructure that is specifically oriented to the cluster's needs. These conditions are important as factors of location since they are difficult to move and difficult to imitate in other regions. As for the second factor, while the sheer size of the local market can strongly influence local competitiveness, demand conditions are seen primarily as a qualitative factor in the context of an industrial system. Thus, the diamond stresses that sophisticated and demanding local buyers contribute to a cluster's competitiveness. In terms of related and supporting industries, the diamond model points to the fact that innovation and competitiveness tend to spill over across firms and industries locally. In other words, the presence

of a set of world-leading suppliers in a region may positively impact the upgrading of other firms in the local system by not only helping to streamline production and reduce transportation costs, but by also further enhancing competitiveness through fostering innovation in joint developments. Additionally, the local presence or absence of other industries with activities that are either related or complementary to the cluster's activities can profoundly affect the cluster's competitiveness. Finally, the model underlines the importance of local rivalry. The idea is that local rivalry adds intensity and an emotional dimension to the competition that most firms perceive in the global market. Firms in a local environment tend to develop relations of rivalry, where the firm down the road is often seen as the "prime enemy". Benchmarking in relation to neighbors is more direct, partly for reasons of local prestige and partly, presumably, because direct comparison is simplified (cf. Malmberg & Maskell, 2002).

Alongside Porter's work, other strands of research have continued to develop and have provided some interesting insights, e.g., economic geographers investigating innovation and learning processes in cities and regions and economists focusing on the relationships between agglomeration, specialization, and trade. As a result, the level of attention and number of studies focused on clusters continues to grow. For example, one recent issue of *Urban Studies* (May 2004) was dedicated to clusters in urban and regional development and presented a series of papers focused on three themes: 1) conceptualizing clusters from a theoretical standpoint through primarily addressing the spatial elasticity of the term, e.g., Martin & Sunley (2003), 2) the importance of knowledge and knowledge flows for a cluster's innovation ability and competitiveness, e.g., Power & Lundmark's study of labor movements in an ICT cluster, and 3) the main influences on cluster development and how the key linkages between firms and institutions actually operate throughout different stages of cluster development, e.g., Cooke's (2004a) paper on relatively new dynamic biotechnology clusters vs. Tödting & Tripp's paper on mature clusters in an old industrial region. In addition to the above issues, researchers are investigating the issue of path dependence and to what degree successful cluster dynamics can be seeded, particularly through the actions of public-sector agencies, defined as federal, state/provincial/regional, and local governments as well as public research and higher education institutes (Wolfe & Gertler, 2004).

However, despite the further development of alternative models and the inconclusive findings relating to the impact of cluster efforts on competitiveness, Porter's work on clusters continues to exert the most direct influence on policymakers at all levels (Cumbers & MacKinnon, 2004). Policymakers have been quick to adapt the cluster concept as an overarching framework and guide to promoting economic development (Wolfe & Gertler, 2004), and they are currently making efforts to develop or strengthen clusters across the globe within all kinds of industrial sectors through such means as infrastructure improvements, tax incentives, and research funding programs. As mentioned above, another frequently used vehicle for improving cluster competitiveness worldwide is the implementation of a cluster initiative, which we turn to next.

## *2.2. Cluster Initiatives and Public-Private Partnerships*

Cluster initiatives are *organized collaborations between public and private sector actors*, such as firms, government agencies, and academic institutions, with the purpose of enhancing the growth and

competitiveness of clusters (Sölvell et. al., 2003). As such, they are public-private partnerships (cf Klijn & Teisman, 2003) in the wider sense of the term. While the literature on public-private partnerships has grown considerably in the past two decades, much of it focuses on joint-ventures between government and private businesses as an alternative to privatization that emerged during the 1990s (Linder, 1999). This literature also tends to focus on collaborations in areas such as improving public health (Widdus, 2005), education (Woods, 2005), and construction and infrastructure (Tranfield et al., 2005). There is, however, less research devoted to public-private partnerships in the form of cluster initiatives. One example is Samii et. al. (2002), which deals with cluster initiatives conducted by United Nations Industrial Development Organization (UNIDO) in India. In terms of quantitative research on cluster initiatives, we are aware of only two studies, namely the Global Cluster Initiative Survey (GCIS) 2003 (Sölvell et. al., 2003) and GCIS 2005 (Ketels et. al., forthcoming). Below we provide some of the findings from these surveys.

First, these surveys clearly indicate a rapid growth in the number of cluster initiatives. The 2005 survey identified more than 1400 cluster initiatives across the globe, compared to about 500 two years earlier, and 37% of the respondents were initiated in 2003 or later. Second, they vary greatly in their organizational forms, in terms of size and resources as well as legal status. Some are huge organizations with extensive resources in the form of personnel, offices, and websites while others are modest projects involving just a few companies and a local government agency. Third, in terms of governance, these surveys found that cluster initiatives were usually managed by some kind of board or steering group with representatives from industry, government, and/or a relevant university in addition to a part-time or full-time “facilitator” or manager responsible for the day-to-day activities. These organizations also tended to be generally membership-based, receiving their financial support from sources such as government funding, membership fees from companies, and/or sales of services. Finally, with regard to the cluster initiatives’ objectives and activities, they were found to engage in a variety of activities, e.g., supply-chain development, market intelligence, incubator services, FDI attraction, management training, joint R&D projects, and setting technical standards. While the variation in activities is great between cluster initiatives, it was also found that many individual cluster initiatives engage in a wide range of activities.

Beyond the two above-mentioned surveys, as noted above, we found unfortunately little in our review of the cluster and public-private partnership literatures that provided a deeper insight into these organizations. Perhaps we should not be too surprised given the relatively recent development of such organizations; however, with such a high level of resources being invested globally in cluster initiatives, these organizations do deserve attention from researchers as well. Thus, the purpose of the next section is to develop two overarching research questions related to these organizations.

### **3. Development of Research Questions**

An organization is a vehicle for cooperative endeavor, one in which the purpose is to coordinate the various activities of its members in order to accomplish a goal that could not be achieved by any of its members individually. Organizations can be characterized by the diversity of their members

along various dimensions, and several have been suggested, e.g., role-related vs. personally inherent (Maznevski, 1994) or observable vs. non-observable (Milliken & Martins, 1996). In the former distinction, role-related refers to characteristics such as occupation, organizational position, specialized knowledge and skills while personally inherent diversity refers to age, gender, nationality, personality, etc. (Maznevski, 1994). This diversity is generally associated with underlying differences in the behaviors, values, and attitudes of members. Moreover, research has found that people in different roles not only notice different information, but that they perceive the same information differently (Maznevski, 1994). As a result, diverse organizations tend to lack a shared social reality with members and their organizations failing to have a common “here-and-now” and perspective (Blakar, 1984).

As discussed above, cluster initiatives are composed of members who represent various public and private sector actors, thus cluster initiatives have a high level of role diversity. Since it is the firms or the private sector that actually determines the viability and competitiveness of a cluster (Wolfe & Gertler, 2004) while it is the public sector or government and academic institutions that indirectly support this competitiveness, we would expect these two types of organizations to develop different perceptions of the competitiveness of the cluster, i.e., divergent social realities. This leads us to our first research question:

*Research Question 1:* To what degree do the public and private sectors have the same perception of a cluster’s competitiveness and its underlying strengths and weaknesses?

While the majority of the above research has focused on intra-organizational groups, research within the alliance literature has focused on temporary organizations created by two or more partners agreeing to cooperate for a limited time, regardless of how long this proves to be. These alliance organizations combine individuals from different corporations, individuals who as a result have unique organizational identities and different corporate loyalties. Furthermore, as a case study of the BP-Statoil alliance revealed, these individuals and their organizations may even have differing motives for entering an alliance and that these motives may change over time (Lerpold, 2000, 2003). These findings are echoed in the public-private partnership literature that has found that this form of collaboration is generally characterized by members with multiple, simultaneous, conflicting interests. On the one hand, the public sector has the goal of creating jobs and increasing public services while on the other, the private sector is dedicated to maximizing the value for its firms. From the perspective of organization and business strategy, however, a collaboration structured for the benefit of the private sector can have negative feedback effects on the goals of the private sector (Trainer et al., 2005) and vice versa.

In the case of cluster initiatives, we would also expect to find multiple, conflicting goals. While the public and private sector organizations have a common overarching goal of improving the cluster’s competitiveness, we would expect that the public sector would be more interested in cluster initiative activities focusing on improving the cluster as a whole such as creating more jobs, improving the quality of the labor force, and attracting foreign investment to increase the tax base. However, the private sector would be more interested in creating “short-term” financial returns for

the individual firm's shareholders through activities focusing on either increasing revenues or decreasing costs, e.g., obtaining marketing partnerships, reducing time-to-market, etc. The above thus leads us to our second research question:

*Research Question 2: To what degree do the public and private sectors agree on the activities the cluster initiative should conduct to improve the cluster's competitiveness?*

#### **4. Study Design and Data Collection**

This study explores the two research questions through a quantitative case study, and biotechnology clusters are particularly interesting for such a study. As noted above, the number of cluster initiatives has grown rapidly in recent years, and regions in more advanced economies have tended to focus on developing and strengthening "high-technology" clusters. In particular, biotechnology clusters are seen as an essential component of regional economic development primarily due to their association with the "knowledge-based economy" (Leibovitz, 2004). In many respects biotechnology clusters characterize the local-global aspects of highly knowledge-intensive clusters, i.e., highly networked both regionally and globally. On the one hand *knowledge production and early exploitation* is rather strongly regionalized due to the necessary presence of a research base in university and research institute laboratories in addition to a significant number of dedicated biotechnology firms while on the other hand the subsequent *knowledge development and distribution and marketing* is highly globalized through connections with multinational pharmaceutical companies (Cooke, 2004a).

Numerous regions across Asia, Europe, and the US are attempting to establish or strengthen their biotechnology presence through emulating the biotech clusters that are revered to be centers of excellence, such as those centered around San Diego, Silicon Valley, and Boston in the US and around Cambridge, Oxford, the Dundee-Edinburgh-Glasgow triangle, Stockholm-Uppsala, and Munich in Europe (Cooke, 2004a, 2004b). Based on this growing interest in biotechnology clusters, we chose to focus on one of these "centers of excellence" - the Uppsala biotech cluster. While the objective in the future is to broaden the investigation to other clusters, due to the exploratory nature of this research it makes sense to begin in a single case and then to re-evaluate on the basis of the findings from this study.

##### *4.1 The Uppsala Biotech Cluster*

Uppsala is just to the north of Stockholm, and similar to other biotechnology intensive regions across the globe, Uppsala exhibits a close historical relationship between industry and academia. Uppsala has an international reputation as "the city of methods" due to its traditional focus on the development and production of biotechnology methods, instruments, and research tools. In brief, at the time of this study in 2003, the Uppsala region employed approximately 4000 individuals in around 50 active biotech companies of which 34 were founded after 1995. Moreover, approximately 8% of the total Uppsala workforce is directly involved in biotech related activities through working in industry, academia, or government organizations. In terms of the research environment, Uppsala

University and the agricultural university, SLU, encompass more than 900 researchers and graduate 900 students each year in biotechnology-related areas. An academic hospital as well as several research centers serves as customers, suppliers, and knowledge resources for Uppsala's biotech companies. Additionally, the universities have created business centers and holding companies that work specifically with the commercialization of research results, while there are a number of related national government authorities, e.g., the National Veterinary Institute, the Medical Products Agency, and the National Food Administration, employing together around 1200 individuals. Recently, Uppsala has seen the growth of an extensive sector of specialized services firms, such as patenting, legal advice, business development, recruiting, auditing and marketing. Finally, a number of local organizations have as an explicit objective to stimulate the development of the region, e.g., the Foundation for Collaboration between Uppsala's Universities, the Business Community, and Society (STUNS), Uppsvenska Chamber of Commerce, Invest in Uppsala. These organizations act as meeting points for representatives from industry, academia, and local and regional authorities (Waxell, 2005).<sup>1</sup>

#### *4.2 Uppsala BIO – the Life Science Initiative*

While Uppsala BIO – the Life Science Initiative was initiated in 2003 to improve the region's competitiveness, this initiative dates back to a pilot project in 2001 that observed that collaboration between industry, academia, and government needed to be increased to promote the region's long-term growth in biotechnology. In June 2003, Vinnova, the Swedish Agency for Innovation Systems, selected Uppsala BIO as one of three grant recipients of the national Vinnväxt program, thus leading to the kickoff of the Uppsala BIO project in the fall of 2003. Through Vinnväxt, Uppsala BIO is to receive a package of financial support for a period of ten years (up to 10 million SEK per year for up to 10 years to be matched by an equal amount from regional sources yearly).

Uppsala BIO is organized not as a legal entity but rather as a project under STUNS. As such, it does not have a board, but rather a steering committee. This steering committee combines individuals from both the private sector, e.g., CEOs and top executives of Uppsala's leading biotech companies, and the public sector, e.g., top county officials and influential individuals within Uppsala's universities.<sup>2</sup> There are four from each sector for a total of eight members, thus this mix of organizations represented in the steering committee reflects the initiative's and the region's commitment to increasing collaboration between academia, industry, and government. In addition to the steering committee, three part-time to full-time project leaders or facilitators run the day-to-day activities.<sup>3</sup>

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<sup>1</sup> For an in-depth history and description of the Uppsala Biotech Cluster, see Waxell (2005).

<sup>2</sup> Universities in Sweden are generally public organizations.

<sup>3</sup> More information on Uppsala BIO can be found at [www.uppsalabio.com](http://www.uppsalabio.com) or in Teigland et.al. (2005).

### 4.3 Method

There is no generally established method for determining the boundaries of a biotech cluster, with different studies applying different definitions of biotechnology firms, e.g., Estades & Ramani, 1998; Prevezer, 1998; Shohet, 1998. We chose to follow Waxell (2005) who in a study of the Uppsala biotech cluster combined the above definitions and defined the biotech industry as all companies with applications in drug development (including drug discovery, drug delivery, and vaccines), diagnostics and medical technology (including clinical/contract research organizations), bio-materials, biotech supplies (including bioinformatics and chromatography), health food (including health products, functional food/feed, etc.), agricultural biotechnology, environmental biotechnology; and other miscellaneous (e.g., biotechnical activities in dentistry, energy, cosmetology).

Based on this definition, we built our pool of survey respondents from two sources of data. First, a comprehensive study involving interviews and an analysis of secondary material such as predefined lists of biotech firms and articles and job announcements in the media from 2000 to 2003 provided a list of biotech and supporting firms (Waxell, 2005). This list of 141 organizations was then complemented with a list of 222 individuals from across a wide range of organizations that was provided by Uppsala BIO. The basis for Uppsala BIO's list was that these individuals had expressed an interest in biotechnology and in keeping up-to-date with the activities of Uppsala BIO and the Uppsala Chamber of Commerce. After deleting duplicates, the final number of survey respondents was 249, of which 106 completed the entire questionnaire for a response rate of 43%. Below is the breakdown of respondents between the public and private sectors:

*Private sector.* We received a total of 75 private sector responses: 40 from "core" companies comprising biotech product and research companies, i.e., companies whose operations primarily focus on some aspect of biotechnology, and 35 from "support" companies combining financial institutions, e.g., banks, venture capital firms, and specialized services companies, e.g., patent bureaus, law firms, recruiting and staffing firms, management consultants.

*Public sector.* We received a total of 26 public sector responses from government organizations such as Uppsala Municipality, the National Food Administration, etc. and educational, academic, research or healthcare institutions, e.g., Uppsala University, the Swedish University of Agricultural Sciences (SLU).

The survey was divided into two different sections of questions, one representing each research question. We based the first section investigating the degree that the public and private sectors have the same perception of the cluster's competitiveness and its underlying strengths and weaknesses on Porter's diamond model. To develop the appropriate questions, we consulted with the Clusters and Competitiveness Foundation, an independent foundation resulting from the collaboration between Michael E. Porter and the Catalonian government. We then adapted their questions to the Uppsala biotech cluster based on three interviews with individuals from Uppsala BIO.

In order to investigate the second research question, to what degree do the public and private sectors agree on the activities the cluster initiative should conduct to improve the cluster's competitiveness, we adapted questions from the Clusters and Competitiveness Foundation as well

as questions from the Global Cluster Initiative Survey (Sölvell et al., 2003). We then completed this set of questions based on discussions with Uppsala BIO.

We administered the questionnaire using an internet-based survey tool. First, we sent each respondent an invitation by email to complete the survey. In this email, we included an explanation of why the survey was being conducted as well as a hyperlink directing them to each respondent's individual online survey form. Additionally, the survey was created in a manner such that respondents could exit the survey to return at a later time without losing any previously entered data. The invitation emails were sent December 18-25, 2003. Reminder emails were then sent on December 26, January 8, and January 14, with the last available date for replying specified in the last reminder email as January 16, 2004.

## 5. Analysis and Results

### *5.1 Perceptions of the Cluster's Competitiveness and Underlying Strengths and Weaknesses*

As discussed above, we used the diamond model to structure our investigation of the first research question on perceptions of the underlying strengths and weaknesses in the cluster's competitiveness. More specifically, individuals were asked to answer 43 questions focusing on the sections of the model: a) factor (input) conditions (18 questions), b) demand conditions (5 questions), c) related and supporting industries (3 questions), and d) context for firm strategy and rivalry (17 questions). Replies were given on a seven-point Likert scale (1 indicating poor competitiveness conditions to 7 indicating excellent competitiveness conditions). A complete list of all 43 variables and means is provided in Table 1.

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To identify differences between the public and private sectors, we used Mann-Whitney's U test, a non-parametric test suitable when normality can not be assumed. For 17 of the 43 variables or 39%, we found significant differences between the two groups, and statistics for these variables are provided in Table 2.

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First, it is notable that the differences between the two groups are highly consistent. The public sector respondents consistently rated the cluster's competitiveness variables higher than the private sector respondents, giving higher ratings to all 17 of the significantly different variables. In addition, it is worth mentioning that although not significant, 21 of the remaining 26 variables were assigned a higher perception of competitiveness by the public sector, and only 5 or 12% of the total number show lower perceptions by the public sector. Second, the significant differences are distributed across three of the four diamond model sections: all except related and supporting industries. Third, the public sector's positive perception of competitiveness was particularly evident for the variables related directly to the performance of the public sector itself. For example, differences for factor conditions were pronounced regarding the effectiveness of local and national government, the physical infrastructure, which is the responsibility of the public sector, and the quality of the training provided by universities, which are public. For demand conditions, public sector respondents find the regulatory system to be particularly effective. However, differences are not limited to conditions only under the control of the public domain. For example, in the section on context for firm rivalry and strategy, public sector respondents perceived the level of competition between cluster companies as well as the level of cooperation of cluster companies with academia and with regional government to be higher than the private sector respondents perceived it to be.

In addition to Porter's diamond model, we also asked questions on the overall perception of the competitive position of the Uppsala biotech cluster. More specifically, individuals were asked four questions on the overall competitiveness position of Uppsala as well as six questions on the level of innovation of the cluster in specific biotechnology areas, e.g., methods and tools for discovery, health food. This set of questions was also based on a seven-step Likert scale (1, "strongly disagree", to 7, "strongly agree"), and differences were again tested with Mann-Whitney's U test.

As seen in Table 3, again we find that the public sector consistently has a more positive outlook with five of the ten questions receiving a significantly different score. The public sector has a higher appreciation of the competitiveness both of the local cluster as well as of the competitiveness of the combined biotech activities in the wider region. Furthermore, they perceive the Uppsala cluster as significantly distinct from the neighboring clusters. However, with regard to the cluster's economic impact in terms of local employment, the difference is not significant.

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With Uppsala's strong reputation in developing methods and tools for discovery, it is not surprising that both respondent groups ranked this field as the strongest, followed by diagnostics. Stem cell research was ranked the least innovative field in Uppsala. However, while both groups ranked the six fields in the same order, the public sector consistently rated each field as having a higher level of innovation than the private sector. Furthermore, as shown in the lower part of Table

3, the differences between respondent groups were larger for the strongest fields. For the weaker fields, differences between groups were not significant.

### 5.2 Agreement on Cluster Initiative Activities

The second survey section dealt with the recently initiated cluster initiative, Uppsala BIO. Respondents were asked one seven-point scale question on how they expected Uppsala BIO to influence the competitiveness of the cluster (1, "strongly reduce", to 7, "strongly improve") as well as one question on whether they felt Uppsala BIO had an explicitly formulated vision (1, "completely disagree", to 7, "completely agree").

Second, respondents were asked to rate on a seven-point scale the importance (1, "not important", to 7, "key purpose") of six main groups of activities that Uppsala BIO could conduct. Additionally, we calculated for each respondent the average importance of all six activity areas as well as the individual's variance in replies. Thus, respondents with a small individual variance in importance of activities have rated all six activities roughly equal (be it high or low). Again we tested for differences between the public and private sector using Mann-Whitney's U test, and results are provided in Table 4.

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In general, we found most of the differences between the two respondent groups to be significant. First, we found that public sector respondents have higher expectations of the effect of the cluster initiative on the cluster's competitiveness, and they found the vision of the cluster initiative more clearly formulated. Second, on average the public sector rates the importance of potential cluster initiative activities more highly than private sector respondents. On a scale from 1 to 7, the public sector's mean activity ratings range from 5.4 to 6.3 while the private sector's mean activity ratings range from 3.8 to 5.8. There are even significant differences for individual activities. The public sector rates the promotion of innovation and research and technical/management training significantly more highly. Furthermore, the non-significant activity differences all show a positive tendency for the public sector. Finally, we find that the variance is smaller in the public sector than in the private sector when looking at the variances across all activities for each *individual* respondent. In other words, the public sector respondents tended to give more similar ratings to all activities than private sector respondents and had difficulty in prioritizing among the activities.

## 6. Discussion

This case study suggests that consistent differences in both the perception of cluster competitiveness as well as the activities that the cluster initiative should conduct to improve competitiveness do indeed exist between the public and private sectors. First, our results indicate that the public sector has a more positive view of the diamond model conditions of the cluster, the cluster's overall competitive position relative to other clusters, and the level of the cluster's innovation. As noted above, research has found that individuals with different roles not only notice different information, but that they perceive the same information differently thus leading to a lack of a shared reality (Maznevski, 1994). Our results indicate a similar finding - a low level of shared reality between the public and private sectors with the public sector having a higher opinion of the competitiveness of the cluster's firms in addition to its own performance in supporting these firms.

We may then ask why the public sector is consistently more positive than the private and not vice versa. Is there some reason for the public sector to be more optimistic and overestimate the strength of the cluster? Or does the private sector underestimate its potential? The present study is not designed to answer these questions, but we could tentatively proffer a rationale for each position. On the one hand, the private sector may have reason to have a more sober view. A cluster's competitiveness is simply a joint product of the competitive positions of the firms in the cluster, and it is a relative concept such that any one cluster's competitiveness is defined in terms of the competitiveness of firms and clusters elsewhere in the world. The private sector may have a more balanced worldwide view since they may be more aware of the relative competitive situation due to their own direct experience from competing on the international market - something that is especially prevalent within biotechnology clusters (Cooke, 2004a). Thus, they can take a more skeptic stance than the public sector towards the sector's "official success story" through balancing it with their impressions of companies in other clusters. Conversely, one could argue that the public sector has the ability to "see the bigger picture" locally, thus going beyond the individual firms and taking a more holistic, long-term perspective of the cluster. While companies in the cluster only interact with perhaps a few other local companies, the public sector has opportunities to appreciate the extent of the cluster more thoroughly due to its interaction with a greater set of local actors, be they firms or other types of organizations.

We were interested in investigating this question further, thus we analyzed a series of additional survey questions looking at the level of interaction with biotech companies both nationally and internationally. Respondents were asked to assess how often their organization interacted with biotech companies nationally on the one hand and internationally on the other hand. This question was adapted from a study by Teigland (2003) and was again on a seven-step scale (1, "not at all", to 7, "to a great extent"). The results are presented in Table 5.

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INSERT TABLE 5 ABOUT HERE

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We found that the public sector organizations interact significantly more with biotech companies on a *national* level than the private sector companies. Conversely, the private sector interacts more often with biotech companies on an *international* level slightly more often, but not significantly, than public sector organizations. Further, for each respondent we calculated the difference between national and international interaction. This value is on average positive for private sector organizations, indicating that international interaction outweighs national interaction, whereas it is negative on average for public sector organizations. This difference is significant and suggests that the public sector has a nationally dominated view of the cluster, while the private sector's input is more international. Thus, these results do not present any conclusive evidence one way or the other since they lend tentative support for both the above hypotheses.

The second set of findings from this study revealed that the public sector has higher expectations on the impact of this cluster initiative and views that cluster initiative activities are in general more important than the private sector. As noted above, the public sector rated two activities, "promoting research and innovation" and "providing technical/management training", significantly more important than the private sector, with the latter showing the greatest difference. This provides very tentative evidence that cluster initiatives are similar to other public-private partnerships in that the partner organizations have multiple, conflicting goals (Trainer et al., 2005). In the case of Uppsala BIO, the public sector appears to be more interested than the private sector in improving the long-term conditions of the cluster through improving the labor force quality as well as the underlying research base. However, the private sector may feel that these activities do not contribute to creating "short-term" financial returns for the individual firm's shareholders.

Our findings have several implications for cluster initiatives and public-private partnerships. Researchers of diverse organizations have consistently found that while diversity may serve to increase the number of potential solutions developed, this same diversity more often than not results in decreased group performance (e.g., Levine & Moreland, 1990; Wanous & Youtz, 1986). One of the primary reasons for this is that effective communication is difficult to achieve due to the differing underlying values and social realities (Maznevski, 1994). This challenge is further increased in inter-organizational organizations such as alliances due to the differing objectives and goals of the alliance members for the collaboration, and in many cases, these differences lead to failure of the alliance (Lerpold, 2003).

The above may provide an explanation for a finding from the GCIS 2003 survey (Lindqvist, 2005) that many cluster initiative managers, or "facilitators", mentioned that a key barrier to success was the difficulty in getting commitment from either the public sector actors or the industry actors. The current study suggests, however, that while lack of enthusiasm or commitment may reflect doubts about the potential benefits of the cluster initiative, these doubts may be grounded in differences in the more fundamental perceptions of the cluster's competitive position and hence the specific needs for action.

However, it is important to note that collaboration between diverse members is not only associated with problems to be overcome. Diversity can be managed productively. Research has found that groups that are able to integrate their diverse members such that they are able to

understand each other and combine and build on each others' ideas are able to work productively and even have a higher level of performance than more homogeneous groups (Lerpold, 2000; Maznevski, 1994). This productivity can be further enhanced through the development of performance-oriented goals that are understood by all and to which all members are committed in addition to the development of an appropriate task strategy with a clear set of rules suitable to the task (Maznevski, 1994). This suggests that cluster initiatives require the *active* participation and collaboration of both the public and private stakeholders in order to be productive. Members should focus on developing an understanding of each other's views of the cluster's competitiveness through systematically evaluating the drivers and barriers to the specific cluster's competitiveness. In addition, they should focus on making explicit the goals and objectives of the various members. As we found in our study, the public sector had more difficulty in prioritizing among the activities that the cluster initiative should conduct in addition to different views regarding the importance of different activities. Thus, cluster initiatives should work towards developing a consensus around the activities that the cluster initiative should undertake in order to avoid falling victim to "alliance failure".

## **7. Limitations and Further Areas for Research**

First we would like to note that there is no one right way to identify respondents of a cluster, and we created our list of respondents based on an "objective" list (Waxell, 2005) and a "subjective" list (from Uppsala BIO). Thus, our results may be somewhat biased and should be treated with caution when interpreting them. Moreover, we are not able to generalize our findings across all types of cluster initiatives based on our conclusions from this single case study. As mentioned earlier, cluster initiatives can take many forms, and they can be located in clusters in industrial sectors ranging from baskets to biotechnology as well as in developing to advanced economies. Thus, additional research focusing on comparing various types of cluster initiatives is necessary.

Second, our analysis has focused on the differences between the public and the private sectors, and each of these sectors has been studied as a unit. However, this approach does not take into account any differences between groupings *within* each of these sectors, or indeed between individual organizations. Studying such differences on a more detailed level, as well as how perceptions change over time, are thus areas for further research.

Finally, while not the purpose of this study, we would like to comment on the Uppsala biotech cluster's competitiveness compared to other biotech clusters. We realize that we may be sticking our heads out since our survey provides no information about the perceptions of people from outside the Uppsala region. However, we feel a cautious analysis could be interesting. Looking at both sets of respondents, we find that they perceive that the cluster fulfils the diamond model's conditions for a high level of worldwide cluster competitiveness to a medium degree. Observed relative cluster weaknesses based on the respondents' replies are the following: 1) local and foreign capital is somewhat difficult to obtain, 2) foreign labor with special skills is somewhat difficult to recruit, 3) local demand is neither very large nor sophisticated, 4) local suppliers are considered to be on average competitive compared to competing locations, 5) rivalry is modest despite the

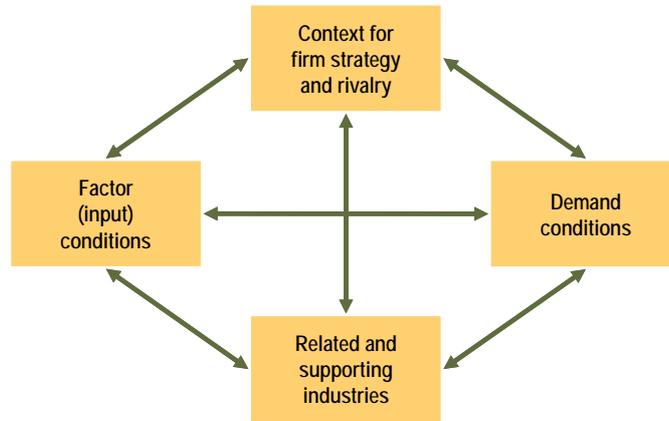
somewhat low barriers to entry, and 6) government organizations and policies are not considered to be very effective in furthering the cluster's competitiveness. Thus, one interesting area for further research could be to focus on systematically comparing competitiveness across various types of clusters to better understand the underlying drivers.

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**Figure 1.** The Diamond Model (Porter, 1990)

**Table 1.** Perceptions of cluster's strengths and weaknesses: means, standard deviations (SD), rank differences, and Z-values for Mann-Whitney's U Test of difference between respondent groups

Variable	Private			Public			Rank diff. <sup>1</sup>	Z-value
	Mean	SD	N	Mean	SD	N		
Factor (input) conditions								
1. Geographic location advantage	5,460	1,228	87	5,517	1,353	29	+	-0,493
2. Cost of doing business	3,816	0,934	87	3,607	0,916	28	-	-0,890
3. General physical infrastructure	4,364	1,136	88	4,897	0,939	29	+	-2,499**
4. Swedish capital availability for SMEs	3,220	1,397	82	2,880	1,424	25	-	-1,184
5. Foreign capital availability for SMEs	2,772	1,250	79	2,760	1,012	25	-	-0,079
6. Quality of local/regional government	3,116	1,332	86	4,115	1,532	26	+	-2,870***
7. Government subsidy frequency	2,699	1,197	83	2,960	1,338	25	+	-0,741
8. Ease of recruiting skills from Uppsala	5,434	1,191	83	5,808	0,801	26	+	-1,229
9. Ease of recruiting skills from rest of Sweden	4,639	1,312	83	4,731	1,002	26	+	-0,386
10. Ease of recruiting skills from outside of Sweden	2,974	1,395	78	3,000	1,058	26	+	-0,427
11. Quality of recruitment from Uppsala universities	5,543	1,225	81	6,036	0,793	28	+	-1,805*
12. Quality of recruitment from Stockholm universities	5,407	1,181	81	5,929	1,052	28	+	-2,158**
13. Quality of recruitment from other Swedish universities	4,738	1,260	80	5,143	1,268	28	+	-1,641
14. Quality of recruitment from Uppsala high schools	3,513	1,475	80	3,808	1,625	26	+	-0,720
15. Investment encouragement from taxes and regulations	2,974	1,235	77	3,550	1,356	20	+	-1,564
16. Effective government R&D incentives	2,041	0,985	74	2,500	1,147	20	+	-1,617
17. Effective local government	3,104	1,283	77	4,136	1,390	22	+	-2,930***
18. Effective national government	3,449	1,213	78	4,619	1,071	21	+	-3,859***
Demand conditions								
19. Advantage of Sweden's market size	2,513	1,384	78	2,800	1,414	25	+	-0,981
20. Swedish demand for new features	3,027	1,394	74	3,762	1,411	21	+	-2,244**
21. Demanding Swedish regulatory standards	3,870	1,550	77	4,750	1,032	24	+	-2,507**
22. Demanding European regulatory standards	4,584	1,472	77	5,217	1,166	23	+	-1,833*
23. Demanding non-European regulatory standards	4,584	1,550	77	4,864	1,390	22	+	-0,691

<sup>1</sup> + indicates public sector responses were higher than private sector responses; - indicates public sector responses were lower than private sector responses.

\*  $p < 0.1$ ; \*\*  $p < 0.5$ ; \*\*\*  $p < 0.01$

**Table 1 (cont'd.).** Perceptions of cluster's strengths and weaknesses: means, standard deviations (SD), rank differences, and Z-values for Mann-Whitney's U Test of difference between respondent groups

Variable	Private			Public			Rank diff. <sup>1</sup>	Z-value
	Mean	SD	N	Mean	SD	N		
Related and supporting industries								
24. Competitive local suppliers of components and materials	3,949	1,431	79	4,095	1,480	21	+	-0,048
25. Competitive local suppliers of machinery and equipment	3,859	1,307	78	4,095	1,480	21	+	-0,424
26. Competitive local suppliers of specialized services	4,545	1,382	77	4,762	1,179	21	+	-0,557
Context for firm strategy and rivalry								
27. High number of local/regional competitors	2,782	1,383	78	3,625	1,245	24	+	-2,559**
18. Fierce local/regional competition in the cluster	2,688	1,195	77	3,304	1,146	23	+	-2,067**
29. Strict competition laws	3,795	1,236	73	3,600	1,046	20	-	-0,859
30. Ease of domestic start-up establishment <sup>2</sup>	-3,347	1,438	75	-2,696	1,105	23	+	-1,797*
31. Ease of foreign establishment <sup>2</sup>	-3,595	1,498	74	-3,130	1,180	23	+	-0,967
32. Cooperation among companies	4,308	1,282	78	4,636	1,002	22	+	-0,991
33. Cooperation companies with academia/healthcare	5,103	1,373	78	5,739	0,752	23	+	-1,926*
34. Cooperation companies with regional government	3,833	1,343	78	4,417	1,213	24	+	-1,915*
35. Cooperation companies with regional financial institutions	3,671	1,408	76	4,565	1,161	23	+	-2,679***
36. Cooperation companies with IFCs	4,278	1,503	72	5,000	1,206	23	+	-2,083**
37. Cooperation companies with specialized service firms	4,581	1,385	74	5,091	1,019	22	+	-1,476
38. Level of cross-disciplinary research	4,613	1,532	75	4,750	1,567	24	+	-0,427
39. Level of labor mobility between cluster companies	4,671	1,482	73	5,136	1,082	22	+	-1,248
40. Degree of openness about ideas <sup>2</sup>	-3,986	1,255	74	-4,227	0,813	22	-	-0,919
41. Effective local IFCs	4,149	1,459	74	4,818	1,053	22	+	-1,940*
42. Effective national IFCs	3,767	1,253	73	4,286	1,189	21	+	-1,644
43. Effective intellectual property protection	4,566	1,427	76	5,050	0,999	20	+	-1,484

<sup>1</sup> + indicates public sector responses were higher than private sector responses; - indicates public sector responses were lower than private sector responses

<sup>2</sup> Reverse coded

\*  $p < 0.1$ ; \*\*  $p < 0.5$ ; \*\*\*  $p < 0.01$

**Table 2.** Significant differences in perceptions of cluster's strengths and weaknesses: rank differences, means, and Z-values for Mann-Whitney's U Test of difference

Variable	Rank diff. <sup>1</sup>	Z-value	N Private	N Public
Factor conditions				
Effective national government	+	-3.859***	78	21
Effective local government	+	-2.930***	77	22
Advantage of local/regional government	+	-2.870***	86	26
General physical infrastructure	+	-2.499**	88	29
Quality of recruitment from Stockholm universities	+	-2.158**	81	28
Quality of recruitment from Uppsala universities	+	-1.805*	81	28
Demand conditions				
Demanding Swedish regulatory standards	+	-2.507**	77	24
Swedish demand for new features	+	-2.244**	74	21
Demanding European regulatory standards	+	-1.833*	77	23
Context for firm strategy and rivalry				
Cooperation - companies with regional financial institutions	+	-2.679***	76	23
High number of local/regional competitors	+	-2.559**	78	24
Cooperation - companies with IFCs	+	-2.083**	72	23
Fierce local/regional competition in the cluster	+	-2.067**	77	23
Effective local IFCs	+	-1.940*	74	22
Cooperation - companies with academia/healthcare	+	-1.926*	78	23
Cooperation - companies with regional government	+	-1.915*	78	24
Ease of domestic start-up establishment <sup>2</sup>	+	-1.797*	75	23

\*  $p < 0.1$ ; \*\*  $p < 0.5$ ; \*\*\*  $p < 0.01$

<sup>1</sup> + indicates public sector responses were higher than private sector responses; - indicates public sector responses were lower than private sector responses

<sup>2</sup> Reverse coded

**Table 3.** Perception of cluster's competitive position: means, standard deviations (SD) and Z-values for Mann-Whitney's U Test of difference between respondent groups

	Private			Public			Z-value
	Mean	SD	N	Mean	SD	N	
Cluster's competitive position							
Competitiveness of the Uppsala cluster	4.077	1.215	78	5.000	0.571	22	-3.497***
Uppsala-Stockholm region's world leadership	4.141	2.980	78	4.875	2.810	24	-1.969**
Uppsala's cluster distinct from Stockholm's	3.804	2.599	92	4.519	2.798	27	-1.856*
Uppsala's cluster's share of regional employment	4.325	1.038	77	4.217	0.905	23	-0.500
Cluster's level of innovation							
Methods and tools for discovery	5.611	1.593	72	6.217	1.087	23	-2.116**
Diagnostics	5.268	1.370	71	5.783	0.996	23	-1.893*
Life science in general	4.781	1.507	73	5.174	1.787	23	-1.399
Drug discovery and development	4.333	1.972	72	4.652	1.510	23	-0.827
Health food	3.829	1.999	70	4.174	1.787	23	-1.009
Stem cell research	3.217	2.026	69	3.478	1.988	23	-0.674

\*  $p < 0.1$ ; \*\*  $p < 0.5$ ; \*\*\*  $p < 0.01$

**Table 4.** Expectations and importance of cluster initiative activities: means, standard deviations (SD) and Z-values for Mann-Whitney's U Test of difference between respondent groups

	Private			Public			Z-value
	Mean	SD	N	Mean	SD	N	
Expectations on the cluster initiative	5.657	1.136	67	6.478	0.665	23	-3.276***
Cluster initiative has an explicit vision	5.145	1.671	55	6.368	0.597	10	-2.862***
Importance of activities							
Promote cluster expansion, e.g., spin-offs, firm attraction	5.885	1.309	78	6.238	1.136	21	-1.277
Lobby government authorities to improve cluster conditions	5.346	1.689	78	5.619	1.161	21	-0.207
Promote biotech innovation and research in cluster	5.338	1.501	77	6.318	1.211	22	-3.031***
Promote cooperation with other biotech cluster	5.273	1.553	77	5.762	0.768	21	-0.907
Promote research about cluster and build networks	5.247	1.763	77	5.714	1.271	21	-0.785
Provide technical and/or management training for cluster	3.870	1.780	77	5.429	1.121	21	-3.665***
Individual's average importance of activities	5.135	0.981	74	5.857	0.561	21	-3.408***
Individual's variance in importance of activities	2.288	1.889	79	1.216	1.205	21	-2.477**

\*  $p < 0.1$ ; \*\*  $p < 0.5$ ; \*\*\*  $p < 0.01$

**Table 5.** The level of interaction by the respondent's organization's with biotech companies either nationally or internationally: means, standard deviations (SD), and Z-values for Mann-Whitney's U Test of difference between respondent groups

	Private			Public			Z-value
	Mean	SD	N	Mean	SD	N	
Level of national interaction	3.758	1.733	66	4.447	1.353	19	-1.754*
Level of international interaction	3.955	2.003	66	3.389	1.685	18	-1.063
Difference between national and international interaction	0.197	2.454	66	-1.167	1.237	18	-2.463**

\*  $p < 0.1$ ; \*\*  $p < 0.5$