Interdisciplinary Cluster Hiring Initiatives in U.S. Research Universities:

More Straw than Bricks?

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Abstract

Over the last three decades, interdisciplinary cluster hiring programs have become popular on research university campuses as an approach to fostering interdisciplinary collaboration. These programs have not yet been rigorously evaluated across multiple institutions and multiple thematic fields. The paper reports the results of a survey of 199 cluster hires across 20 research universities, supplemented by interviews with 18 administrators and cluster leads at nine universities. Against the expectation of advocates, the survey responses indicate that cluster hire groups are often loosely organized and members do not typically spend much time collaborating with others in their group. Both the existence of common research agendas and the participation of individuals capable of translating across disciplinary languages are associated with higher levels of satisfaction with the collaborative environment of clusters, net of covariates, as are adequate lab spaces. Even if they do not typically lead to high levels of collaboration, clusters can, in the best case scenarios, help universities to align with emerging research areas in ways that departments may have difficulty doing.

Over the last three decades, interdisciplinary cluster hiring programs have become popular on research university campuses as a means to foster interdisciplinary collaboration and to align research faculty with federal funding priorities (Sá, 2008a). These initiatives are based on the hiring of multiple faculty members, typically between three and eight, to interact in interdisciplinary teams, in most cases with the expectation that they will jointly pursue high-impact research. Following in the footsteps of early leaders in interdisciplinary organization, such as Duke University (1987) and the University of Southern California (1994), the University of Wisconsin-Madison launched the first large-scale cluster hiring program in the late 1990s (Sá, 2008a). Since the late 1990s, at least 84 universities have implemented cluster hiring programs of varying size and scope (authors' calculation).

The popularity of cluster hiring initiatives reflects, in part, an increasing emphasis by funding agencies and professional organizational bodies on the value of interdisciplinary collaborations for problem solving in areas that require the talents of many different types of specialists (see, e.g. Bozeman & Boardman, 2003; Cooke & Hilton, 2015; Corley, Boardman, & Bozeman, 2006).[1] Larger teams composed of specialists from many fields are thought to have greater potential for innovation compared to small teams because of their capacity to access a greater diversity of information (Ruef, 2002), a finding that empirical researchers have tended to confirm (see, e.g., Wuchty, Jones, & Uzzi, 2007). Advocates argue that, compared to discipline-based research, clusters are, in addition, better positioned to address economic development priorities through collaborations with industry, and have greater capacity for resource and equipment sharing and technology transfer (Bozeman & Boardman. 2003; see also Brint, 2005). They have been justified for their capacity to meet "grand challenges" facing the country, such as adapting to climate change, mapping the brain, or ameliorating poverty, which require the skills and knowledge bases of scholars from several disciplines (Hicks, 2016).

The national and global importance of these initiatives have often been heralded on university websites. One website proclaimed that its interdisciplinary hiring "underscores our commitment to innovation in the pursuit of solutions to some of the world's most pressing problems" (Arizona State University, 2018). Another university stated that its clusters were "designed to harness the power of faculty members to help solve the world's biggest challenges" by "(erasing) boundaries and (embracing) creative, bold ideas" (University of Cincinnati, 2019). Similarly, Lehigh University's website observed, "Together (cluster hire) scholars can provide the critical mass necessary to cross new frontiers in teaching and research while addressing some of the

world's most pressing problems' (Lehigh University, 2019) and the University of Central Florida claimed that its cluster hire program "fosters the development of strong, interdisciplinary teams focused on solving today's toughest scientific and societal challenges through teaching and research" (University of Central Florida, 2019). In less grandiose terms, cluster hire initiatives have also been promoted as ways to attract top researchers and to help universities distinguish themselves in particular areas of emerging research priority or existing strength. In some cases, they have been embraced for their potential to add diversity to the composition of the faculty (Urban Universities 2015).

Advocates have contrasted the virtues of cluster hiring with the putative narrowness of traditional departmental hiring. Departments are frequently characterized as reproducing detached "silos" less well adapted to the contemporary research environment. The alleged inertial tendencies of departments are thought to arise from efforts to replace departing faculty with those whose research interests are similar. Departments are faulted for failures to innovate quickly in relation to new opportunities, thereby slowing the circulation of important new ideas and methods. These characterizations have been disputed by defenders of the disciplines (see, e.g., Abbott, 2002; Jacobs, 2013), but they have become articles of faith among advocates of interdisciplinary initiatives, including cluster hiring.

Cluster hiring is an important topic for investigation because of its popularity, because of the size of expenditures that accompany these ambitious programs, and because of their potential to shift some share of control over the direction of university research from faculty members to university administrators.

Investigators have not thus far established the validity of administrators' optimistic appraisals of the potential of cluster hiring. Indeed, the research evidence is

thin and in nearly every case based on work at a single institution, either by independent researchers (Dahlander & McFarland, 2013) or as self-assessments by campus review committees (see, e.g., University of Wisconsin, 2003, 2008). These single-institution studies have identified examples of very successful collaborations, such as the agro-ecology (Patton, 2015) and women's health (Greenberger, 2002) clusters at the University of Wisconsin-Madison, but they have not resulted in comparisons of the performance of a wide range of clusters across multiple universities. The sole multi-site study in the literature is based on interviews with administrators rather than those hired into clusters (Urban Universities, 2015). A broader investigation is necessary to evaluate the success of cluster hiring across a range of universities and the conditions under which cluster hiring is likely to be more and less effective. Given the sizable expenditures that universities have made on cluster hiring, information from such a study could help universities improve their probabilities of obtaining positive outcomes from these expenditures.

Some reasons for scepticism about the actual outcomes of cluster hiring can be found in the literature. Rhoten (2004), for example, studied six interdisciplinary research centers and found that none of six were producing break-through collaborative work. Instead, the typical pattern was for researchers to conduct their respective pieces of the research "in near isolation from one another" (p. 6). She also reported that 30 percent of the researchers felt that interdisciplinary research had not helped their careers. The centers typically lacked a well-defined problem definition and consequently became a "nexus of loosely connected individuals searching for intersections, as opposed to cohesive groups tackling well-defined problems" (p. 9). Two of the early leaders in interdisciplinary organization reported limited success with their efforts to "cross boundaries." Only two of 13 interdisciplinary initiatives launched

by Duke University in the early 1990s were still on the books five years later (Geiger & Sá, 2008a, p. 116). Similarly, USC pulled back on the interdisciplinary initiatives it launched in the mid-1990s because of the failure of many of them to gel (Tierney, personal correspondence). Studies of interdisciplinary hiring at Stanford University similarly yielded mixed results, with some evidence that faculty members explicitly hired into interdisciplinary teams failed to gain tenure at the same rate as faculty members hired through traditional departmental means and others hired onto interdisciplinary teams were more likely to separate from the university (Evans 2016). In a few cases, cluster hiring has resulted in unflattering publicity due to faculty allegations of poor planning, opaque processes for selecting clusters, and/or lack of decanal and faculty buy-in (see, e.g. McMurtrie, 2016).

In this paper, we evaluate one outcome of cluster hiring: the environment for collaboration found in clusters. Because cluster hiring is typically intended to enhance collaborations in strategic priority areas, analysis of the actual experiences of cluster hire faculty as partners in collaboration can be considered fundamental to understanding how clusters perform in practice. Our composite measure incorporates multiple sources of satisfaction and dissatisfaction with the collaborative environment. The study is based on survey responses of 199 faculty members working at 20 research universities that have implemented cluster hiring, supplemented by interviews with 17 administrators and cluster leads. As far as we know, ours is the first study to report results for a large sample of individuals hired into clusters at multiple universities and in multiple thematic fields.[2]

Our theoretical position revolves around the conception of clusters as organizational entities subject to the same influences as any other working groups. We anticipate that their success is mediated by conditions that lead to cohesion or division

and to engagement or disengagement. Cohesion inducing mechanisms may be organizational, such as having common agendas or the inspiration of intellectual leaders, or they may be resource-based, such as having adequate lab and office space. Divisions may arise from counter-vailing pressures, such as departmental demands that compete with cluster commitments, or from hierarchical relations that privilege higher-status members of cluster groups or stifle the creativity of lower-status members.

The hypotheses informing the study can be stated as follows:

H1: Perceptions of the organizational design features of clusters are significantly associated with evaluations of the collaborative environment of clusters, net of covariates.

H2: Assessments of facilities are significantly associated with evaluations of the collaborative environment of clusters, net of covariates.

H3: The demographic characteristics of cluster participants are significantly associated with evaluations of the collaborative environment of clusters, net of covariates.

The focus of H1 on organizational design features is supported in the existing case study literature and in the broader literature on interdisciplinarity. This literature suggests that organizational design features may be decisive influences on outcomes. The highlighted organizational design features include: (1) having a recognized intellectual leader (Hollingworth & Hollingsworth, 2000; Dahlander & McFarland, 2013; Mullins, 1973; Rawlings et al., 2015); (2) having a recognized organizational leader (Hollingsworth & Hollingsworth, 2000; Mullins 1973); (3) having a skilled translator or translators who can interpret across disciplinary languages (Collins, Evans, & Gorman, 2007); (4) having a common research agenda (Rhoten, 2004) and (5) having frequent interaction around joint projects (Rhoten. 2004).

The focus of H2 on facilities requires little justification. Working conditions and resource inadequacies are a common cause of faculty dissatisfaction, whether or not faculty members work in interdisciplinary settings (see, e.g., Rhodes, 1998; Finkelstein, Conley, & Schuster. 2016: chap. 7; Schuster & Finkelstein, 2006, p. 151; Trower, 2011). The issue of resource adequacy gains greater prominence in the case of cluster hiring, because investment in these initiatives is comparatively high relative to the hiring of individual faculty members through traditional departmental means, and may also involve the purchase of expensive instrumentation.

The focus of H3 on the demographic characteristics of researchers is well supported in studies of academic productivity and mobility. Women and minority scholars continue to face disadvantages in academe (Finkelstein, Conley & Schuster, 2016: chap. 7: Guarino & Borden, 2017), and these disadvantages may be exacerbated in clusters, which are typically led by senior male scholars (Leahey, Beckman, & Stanko, 2017; van Rijnsoever & Hesels, 2009). In addition, junior faculty may experience pressures to meet the not-always- compatible expectations of members of their clusters and members of their departments. Previous research suggests that these younger scholars may find interdisciplinary research to inhibit the development of their own careers and to cause delay in the publication of their research (Evans, 2016; Leahey, Beckman, & Stanko. 2017).

Sample

To identify potential survey respondents, we utilized a web crawler to search for higher education institutions in the United States whose websites listed any of the following terms: “cluster hire,” “interdisciplinary cluster hire,” “interdisciplinary hire” or “thematic hire.” We also gathered institution names from two other sources, Sá (2008a) and Urban Universities (2015). From these sources we identified 84 institutions

that had engaged in cluster hiring. We contacted the chief academic officer (CAOs) for each of the institutions, requesting their participation in the study. Thirty-two of the CAOs agreed to allow faculty members at their institutions participate in the study. Private, non-profit universities were under-represented in the group agreeing to participate in the study. They constituted 25% (21) of the 84 institutions identified as having engaged in cluster hiring, but 19% (6) of those agreeing to participate in the study. We eliminated a small number of the participating institutions because their cluster hiring programs had just begun. Because we intended to compare the experiences of individuals hired into the same fields at different universities, we selected a final group of institutions based on overlaps in the thematic fields that were most common in the sample. These fields included advanced materials, big data, climate/sustainability, energy, community health and health disparities, neuroscience, new approaches to the arts, race and ethnic relations, and security (including cyber-security). Field selection led to a reduction of participating institutions to 21 in total, with just three private, non-profits represented. The low level of representation of private, non-profit universities is a limitation of the study.

We contacted the academic personnel offices of these institutions for lists of faculty members who had been hired as part of clusters. Based on these responses, we sent surveys to 509 tenure-track faculty hired through cluster hiring initiatives at the 32 universities. We provided online and paper options for respondents and sent two follow-ups by mail. Prior to analysis, we removed non-viable records including respondents who filled out a survey but stated that they were not a member of a cluster group. By the end of the survey period, we had received a total of 199 valid responses[3] from 20 universities, a response rate of 39%.

Table 1 provides a list of the cluster thematic fields and types of institutions in the sample, together with the distribution of faculty across the cluster themes and institutional types. In order to maintain confidentiality, we do not report the names of institutions.

[Table 1 about here]

Methods

We first examined descriptive statistics on respondents' perceptions of the modal forms of organization and adequacy of facilities in their clusters, as well as their demographic characteristics.

We then regressed a composite scale measuring satisfaction with cluster collaborative environments on five sets of variables: (1) institutional locations, (2) cluster thematic fields, (3) respondents' perceptions of their cluster's organizational design features, (4) respondents' assessments of the adequacy of facilities, and (5) respondents' demographic characteristics.

Institutions and thematic fields proved to be unimportant predictors of satisfaction, and we do not report the results of regressions including institutional locations or thematic fields.[4] We ran four models on a constrained sample of individuals who responded to all questions. In model 1, we regressed satisfaction with the collaborative environment on respondents' demographic characteristics. In model 2, we regressed the satisfaction scale on demographic characteristics and organizational design features. In model 3, we regressed the satisfaction scale on demographic characteristics and facilities adequacy. In model 4, we regressed the satisfaction scale on all three sets of independent variables, demographic characteristics, organizational design features, and perceived adequacy of facilities. To check on robustness and to provide additional texture, we also analysed separately each of the seven variables that

make up the composite scale. Each of the models is conducted using robust, heteroskedacity-consistent standard errors.

We subsequently investigated individuals hired into the same clusters at the same institutions to identify patterns of organization and satisfaction within the work-group context. This analysis provides a useful complement to the regressions, which are decontextualized from actual working groups. We identified 10 clusters that had a sufficient survey N (four or more respondents) to analyse within-group organization and satisfaction.

Finally, we coded and analysed comment data from the open-ended questions on the survey. Respondents had the opportunity to give open-ended comments as follow-ups to several survey questions. We focused primarily on the question, "What are the major reasons for your satisfaction or dissatisfaction with the joint research activities of your group?" We also carefully analysed comments related to the question, "If you think that the group will cease to function as a working unit within the next two years, what will be the main reason(s)?" We first divided the open-ended answers to these questions into positive, negative, and ambivalent response categories and we then grouped the responses in each of these three response categories by theme. We developed the thematic groupings inductively. For example, a relatively high proportion of open-ended comments concerned the structure of collaboration in the group. We grouped all positive comments on this theme together and all negative comments on this theme separately. We report on the themes that recurred most often. We use fictitious, gender-neutral names to protect the identities of the individuals we quote. Some respondents worked at one of the 60 prestigious American universities that are members of the Association of American Universities (AAU). For purposes of situating the

quoted respondents, we provide additional contextual identification using their cluster field and whether they work at a public or private AAU or non-AAU university.

We supplemented these analyses with 30-60 minute interviews with 18 administrators and cluster leads located at nine of the sample institutions.[5] We used these interviews to test findings from the surveys and to find out additional information pertinent to the study. We conducted these interviews with representatives of universities that, in our estimation, had achieved relatively high and relatively low levels of success with their cluster hiring initiatives, as well as some that seemed to fall in between.[6] These interviews provide valuable information on the motivations for beginning cluster hiring; the processes used to create clusters; events that had an impact on the initiatives; the metrics, if any, used to evaluate the clusters; and the institutions' assessments of the successes and failures of their cluster hiring initiatives

Dependent Variables in Regressions

In regressions we focused on a dependent variable measuring respondents' overall satisfaction with the environment for collaboration in their clusters (alpha=.85). Because researchers hired into clusters are expected to work collaboratively, findings about the quality of collaborative environments are central to understanding the effectiveness of cluster hiring initiatives. The measure was generated using principal components analysis and is based on responses to seven survey questions: (1) level of satisfaction with joint research activities, (2) level of satisfaction with joint social activities, (3) level of satisfaction with mentoring, (4) level of satisfaction with the diversity of the cluster, (5) level of agreement that being hired into the cluster had improved the individuals' scholarly output, (6) level of agreement that being hired into

the cluster had improved the individuals' career, and (7) an estimate of how many years the individual expected the cluster to continue as a functioning unit.

Independent Variables in Regressions

We coded perceived organizational design features based on items measuring whether respondents said their cluster (1) had a joint research agenda, (2) had an intellectual leader, (3) had an organizational leader, (4) had a person capable of translating across disciplinary languages. Each of these variables was measured with binary response categories, yes or no. We also examined (5) how much of their time was spent collaborating with members of their cluster. This variable was coded on a continuous scale from 0 to 100 percent and included in regressions as a binary measured as more or less than 10 percent of research time.

Facilities assessment variables included respondents' ratings of (1) the adequacy of lab space, (2) the adequacy of office space, and (3) the adequacy of staff support. These variables were measured on a scale of 1 ("extremely inadequate") to 4 ("better than adequate.") A small percentage of respondents (10%) did not require lab space. In these cases, we included a dummy variable for "lab space not required."

We coded the following demographic characteristics of respondents: (1) gender, (2) race-ethnicity (measured as white or minority), (3) current academic rank (measured as full professor, associate professor, or assistant professor), (4) status of graduate university (measured as AAU member institution or not), and (5) years since Ph. D. (measured as a continuous variable). (See Table 2.)

[Insert Table 2 Here]

Results

Descriptive Statistics

The sample was comprised primarily of whites (62%) and men (61%). A majority of minorities in the sample were Asian or Asian-American (51% of the minority sample). The majority of respondents were assistant professors (62%) and only slightly more than one quarter (27%) were full or endowed/distinguished professors. The majority of respondents received their doctorate degrees from AAU institutions (68%). The average length of time since the doctorate was more than 12 years, with a notably high standard deviation (8.6 years).

Most respondents reported that facilities were adequate to their needs. A higher proportion of respondents said lab space was inadequate (21%) compared to those who said that office space (7%) and staff (17%) were inadequate.

The descriptive statistics were inconsistent with the notion that cluster hiring is a means to create close collaborative relationships. Most respondents indicated that their cluster group did not have an agreed-upon agenda (60%) and a similar majority said they collaborated with others in their cluster group less than ten percent of the time (62%). Indeed, nearly one quarter of respondents (23%) said they did not collaborate at all with members of their cluster group. Most of the respondents said that their group did not have a recognized intellectual leader (57%), a recognized organizational leader (54%), or a member who acted as a translator across disciplinary languages (58%) (See Table 2).

The majority of respondents did not express distinctively high or low levels of satisfaction with the collaborative environment of their clusters. The modal category for four of the seven components of the scale were “neither satisfied nor dissatisfied.” These components were satisfactions with (1) joint research activities, (2) social

activities, (3) mentoring, and (4) diversity. Most respondents also said that they neither agreed nor disagreed that (5) their scholarly output had improved due to their cluster participation. Responses to the final two components of the collaborative environment scale were more positive. Most respondents (56%) agreed that their career had improved after joining the cluster, and a plurality (39%) said they thought their cluster would continue for more than five years.

Regressions

Table 3 presents the results of regressions of collaborative environment on respondents' demographic characteristics, perceptions of organizational design features, and assessments of facilities adequacy. Column 1 of Table 3 shows that no demographic characteristics were statistically significant when entered as the only variables in the model. Nor were any of the demographic variables statistically significant predictors of satisfaction in the remaining regressions, net of covariates. Column 2 of Table 3 shows that the perceived presence of a group research agenda had a significant, positive association with level of satisfaction with the collaborative environment, net of covariates. The existence of a cross-disciplinary translator also had a significant, positive impact, net of covariates. Intellectual leadership, organizational leadership, meeting frequency, and collaboration intensity were not significantly associated with the satisfaction with the collaborative environment scale, net of covariates. Column 3 of Table 3 shows a positive, significant association between assessments of the adequacy of lab space and level of satisfaction with the collaborative environment, net of covariates, but no significant associations between satisfaction and adequacy of office space or staffing. Column 4 of Table 3 shows that having an agenda and a translator across disciplinary languages continued to be positively and significantly associated

with respondent satisfactions with the collaborative environment, net of covariates, but adequacy of lab space was no longer significantly associated with satisfaction when all three sets of independent variables were entered into the analysis. The regression in column 4 explained the highest proportion of variance, 37.6 percent, of the four models tested.[7]

[Insert Table 3 Here]

Regressions on the individual components of the composite scale provide both a robustness check and additional information on how the independent variables were associated with specific features of satisfaction, net of covariates.[8] As in the regressions on the composite scale, having (1) a common agenda, (2) a person who can translate across disciplinary languages, and (3) adequate lab space were the most frequent net covariates. The agenda variable was statistically significant and positive on satisfaction with joint research activities, with mentoring, with diversity, and with assessments of career improvement. The translator variable was statistically significant and positive on satisfaction with joint research activities, with social activities, and with mentoring. The lab space variable was statistically significant and positive on satisfaction with joint research activities, with social activities, and with mentoring. Two other variables showed statistically significant and positive associations on at least two of the individual components. Adequate office space was significant and positive for assessments of improvements in scholarly output and career. Minority members of clusters were statistically significant and positive on satisfaction with joint research projects and optimism that the group would continue for many years.

Working Groups

We identified three patterns in our analysis of the 10 working groups: (1) one relatively cohesive group, (2) six groups with a single or pair of primary beneficiaries, and (3) three low engagement groups. We developed this classification primarily based on group members' reports about the amount of time they spent collaborating with others in their groups. Our intention was to measure the level of cohesion and whether such cohesion as existed benefited many or only one or two respondents.

We found relatively high, though certainly not complete, levels of agreement on our measures of cohesion among members of the one group we classified as "relatively cohesive." The members of this cluster worked on big data computational issues at an AAU public research university in the East. All responding members of this group collaborated with one another. Most said the group had a research agenda, could identify an intellectual and an organizational leader of the group, and thought the group would last more than five years. A majority also reported being satisfied with the joint research projects of the group. This was the only one of the 10 groups that came close to fitting the oft-promoted image of cluster groups as interdisciplinary researchers who work together to advance an agenda of national or global importance. Interviews with administrators at this institution provided a picture of a campus administration that had thought carefully about recruitment into clusters and about an organizational design that could yield positive outcomes. (See the discussion section below.)

The six groups we classified as having "narrow beneficiaries" showed a more restricted pattern of participant engagement. These groups engaged at least a little of the research energy of all or nearly all respondents, but they appeared to benefit one or two members disproportionately. In five of these groups one or two respondents reported collaborating frequently with others in the group (and, for pairs, especially with one

another). These high participation members typically reported that the group had a common research agenda, while other members disagreed or were not sure. Similarly, only one or two respondents could identify intellectual or organizational leaders of the group, while others were unsure or denied that group leaders could be identified. In each case at least one of the principal parties thought the group would last three years or longer, while other members disagreed or were not sure. These "narrow beneficiaries" groups consisted of an advanced materials group at an AAU public research university, two alternative energy groups at non-AAU public research universities, a climate change/sustainability group at the same university as one of the energy groups, a neuroscience group at an up-and-coming non-AAU public university, and a big data group at a private non-AAU research university.

The three groups we classified as "low engagement" seem never to have coalesced. Members interacted infrequently. They were almost uniformly unable identify a common research agenda or intellectual and organizational leaders. Most respondents in two of the three groups said that the group had already ceased to exist. In each of the three groups more members indicated dissatisfaction or uncertainty about the research activities of the group than indicated satisfaction. Interviews with administrators at the two institutions whose clusters were located in this "low engagement" category yielded many institutionally-acknowledged problems with the design and implementation of cluster hiring, as well as evidence of considerable opposition within the campus faculty senates to the processes employed and the outcomes of cluster hiring. The "low engagement" groups consisted of an alternative energy and a climate change/sustainability group at a non-AAU public research university, and a neuroscience group at another non-AAU public research university.

[Insert Table 4 Here]

Open-Ended Comments

Open-ended comments must be treated with caution. Individuals with strong feelings are more likely to take the time to answer open-ended questions (Bishop, Hillygus & Jackson, 2012), and we should consequently guard against the possibility that the comments are unrepresentative of the sentiments of most respondents. Indeed, while the survey responses indicated that most respondents were either neutral or moderately positive about their experiences in clusters, those who commented offered many more negative than positive observations. Nevertheless, the open-ended comments contribute to our understanding of the underlying reasons for positive and negative experiences in clusters.

Forty-six percent of the 131 comments could be categorized as unambiguously negative. Consistent with the descriptive statistics, a common theme in the comments is that many cluster groups do not have much, if any, organizational structure. Respondents found this lack of structure to inhibit their success. Respondents noted that their institution had hired a collection of individuals who did not act as a group. They stated that group members acted as individual principal investigators and worked on their own projects. In some cases, collaboration existed but it was limited in scope or based on shared interests independent of formal structure.

"The group has no formal structure, and no organized activities. The collaborations that have resulted from the cluster hire were thanks to an introduction through the funding organization responsible for the cluster hire, but have been primarily independent pairwise collaborations."
- *Leslie, Big Data Cluster Member at an AAU Public Research University*

"I have never met anyone else hired in my cluster. There has been no leadership or mentorship. The group is non-existent and the teaching and research expectations for those hired in my cluster have been unclear."
- *Ashley, Alternative Approaches to Art Cluster Member at a Non-AAU Public Research University*

In several cases, leadership and mentoring were identified as lacking.

"I really like the other new junior faculty hires and I'm excited about the work we've started on together. However, the senior members of the cluster don't make much effort to mentor us or engage us in projects and proposals."
- *Jamie, Climate/Sustainability Cluster Member at a Non-AAU Public Research University*

In cases where a leadership structure existed, it did not always contribute to satisfaction.

Some comments reference issues with leadership styles, lack of consistent leadership,

and a "freezing" out of junior members by senior members who serve as leaders.

"I think the major problem with clusters such as ours where there is a group leader and tenure-track assistants is the general feeling of too much recognition going to the group leader."
- *Charlie, Advanced Materials Cluster Member at a Non-AAU Public Research University*

"The cluster is focused on sustainability, which is supposed to follow themes of economics, equity, and environment. However, the primary focus of the cluster's work is environment, and physical science in particular. Thus the grant and research opportunities that are often discussed have little relevance to the type of work I do."
- *Alexis, Climate/Sustainability Cluster Member at a Non-AAU Public Research University*

Several respondents stated that their research did not align with that of their cluster

group, so they could find no opportunities for collaboration or participation. Others

wrote that the cluster area was too broad to facilitate collaboration or that the members

of the cluster were too diverse in interests to ensure a cohesive group. In these cases, it

appears that institutions hired a collection of individuals without considering how well

matched these individuals were.

"We haven't done any single joint research activities. Because we were all spread to different departments. Each faculty had to follow each department's tenure rule, thus no one has (an) interest in joint research. They all try to fit themselves to the assigned department to survive."
- *Chris, Advanced Materials Cluster Member at a Non-AAU Public Research University*

Other respondents also noted tension between their departments and/or their tenure

aspirations and the expectations of their cluster group. As Chris's quote suggests, this

tension does not facilitate collaboration or the construction of a cohesive group. Several

assistant professors who wrote comments indicated that it had proved difficult for them to maintain balance between department demands, tenure-building research, and cluster group expectations. Some added that expectations between departments and cluster groups were not clear or coordinated.

One-quarter of the comments could be characterized as unambiguously positive. In these cases, respondents often highlighted the virtues of productive collaborative relationships.

"I was able to build expertise in new areas, leveraging collaborations with my colleagues. It is also very helpful to be able to bounce ideas off another person. We were also able to save time by joining some activities (website maintenance, computer cluster administration etc)."
- *Jordan, Member of an Advanced Materials Cluster, AAU Public Research Institution*

Some of these more positive respondents also referenced the capacity of the group to leverage external funding or community support.

"The group has been highly effective at creating the synergy and support needed for the scientific excellence and innovation that has enabled us to succeed in securing research funding and recognition for our work. It also enables us to attract top students that contribute to our success. It would not have been possible to achieve this level of success as independent scholars."
- *Drew, Member of a Community Health/Health Disparities Cluster, Non-AAU Public Research Institution*

"Coming into a new position, this cluster approach provided both a social and academic support system. We get along well, and push each other's research beyond its current form. I think that this could have been less effective if the hiring committee wasn't as careful as they were about selecting people with overlapping yet (at its core) diverse research programs. The cluster hire also garnered a great deal of attention from local community members and organizations which has greatly facilitated our community-based research and clinical efforts (e.g., letters of support for grant applications, recruitment)."
- *Taylor, Member of a Community Health/Health Disparities Cluster, AAU Public Research Institution*

Interviews with Administrators and Cluster Leads

Interviews with administrators and cluster leads reinforce a contextual point about the diverse meanings universities attach to the term "cluster hiring." Cluster hiring is a term

anthropologists would describe as a “condensation symbol”; it is a single term that covers a wide variety of concrete practices.[9]

These practices can be described along two dimensions: the first characterizing the level of university expectations concerning collaborative work and the second characterizing the mechanisms used, if any, to encourage collaborative work. Not all universities have explicit expectations that faculty members hired into clusters will work together. One administrator at an AAU public university told us that his university had hired a number of scientists in high-impact areas but had no set expectation about whether these individuals would decide to work together. The principal goal, he indicated, was simply to add human resources in fields the university had identified as ascendant in federal research policy.

More typically, university administrators expressed the expectation that those hired would work together, but left open the extent to which they expected high levels of collaboration. In our interviews, we found only two cases in which universities set as explicit goals high levels of ongoing collaboration among cluster hires. In one case the university’s practice was to hire individuals who were already collaborating with one another at another university or at a non-profit research organization. In the other case, the university had explicitly designed clusters as collaborating units focused on extending the work of an individual or individuals who were leading researchers in fields at which the university excelled. From the interviews it is clear that most provosts and vice presidents of research have concluded that successful researchers cannot be mandated to work with others. Instead, collaborations are the product of shared interests, productive lines of inquiry, compatible personalities, the existence of ongoing funding opportunities, and other factors (see, e.g., Brass et al., 2004).

University administrators do, however, have a number of tools at their disposal to encourage collaboration. These tools include recruitment of individuals who express an interest in collaborating with existing cluster members, seed grants for collaborative proposals, funding for seminars, explicit memoranda of understandings between organized research units (ORUs) and departments about expectations, joint funding of lines by ORUs and departments, and the purchase of expensive shared equipment as a locus for collaborative activity. The universities in our sample ranged from extensive to no use of these mechanisms. At one extreme, one major public research university engaged solely in joint hires between institutes and departments with explicit memoranda of understanding detailing the expectations for cluster hires with respect to their institute and departmental responsibilities. This university also employed each of the other tools identified above to encourage collaborations among those hired into clusters. The vice president for research indicated that the university's goal was to create conditions that would allow the university to be competitive for major federal research center and training grants.

At the other extreme, administrators at four of the nine institutions said they used none of these mechanisms to encourage collaborations. All but one of these four were non-AAU public universities. For these institutions, the process of identifying cluster topics, planning for facilities' needs, and hiring individuals into clusters constituted the entire campus-level planning effort. At two of these institutions, the initiatives were quite extensive, including a majority of new hires during peak periods. At each of the four institutions, some of the new hires were highly satisfied with the collaborative environment in their clusters. Our judgment of the low level of success at these institutions is based consequently not on the unrealistic standard that all hires failed, but on the plurality of evidence from the collaborative environment analyses, and

on candid assessments by interviewees. These problem-laden initiatives can serve as cautionary tales for institutions currently contemplating the use of cluster hiring.

Each of these cases was marked by decanal and faculty pushback following limited consultation.

There were more losers than winners among the solicited proposals, which led to a lot of disappointment…The deans felt that the clusters took funding from their needs…They felt disenfranchised.
- *Cluster lead, non-AAU public university*

Instead of a deliberative process, we had a chaotic process in a rush to make major investments after (the campus) had announced a major initiative to hire hundreds of new faculty…Most of the hiring was to be done through clusters…. The deans eventually pushed back and got more control.
- *Vice-chancellor for Research, non-AAU public university*

I was surprised by the virulence of the opposition…If I were beginning all over, I would work harder at communicating what this was and what this wasn't. I would try to dispel the mythology that developed…
- *Provost, non-AAU public university*

Most of these initiatives included opaque processes for choosing successful proposals, no design features to encourage collaboration, not enough money to guarantee adequate facilities for newly recruited faculty,[10] and no metrics by which to evaluate their impact.

If we could start over, I would want a more transparent process to evaluate proposals with metrics for assessment purposes. I would have gone more slowly…. Because of a change in the budget model (that occurred simultaneously), the provost's office did not know what commitments were being made (by the colleges) for start-up packages, and we ended up overspending for start-ups.
-*Provost, non-AAU public university*

We were going to launch into the third round of cluster hiring when the financial crisis hit. We had to give back $120 million to the state and that eroded some of the existing allocated dollars…This led to a lot of disappointed people.
-*Cluster lead, non-AAU public university*

Leadership transitions played a disruptive role at several of these institutions. In one case, a president committed to cluster hiring left and was replaced by a new president with different priorities. In two other cases, provosts who led the initiatives

were replaced after faculty pushback led directly or indirectly to their departures. New provosts scaled back the initiatives or ended them entirely. At one of the institutions all reference to cluster hiring was removed from the campus website.

Discussion

Cluster hiring has been heralded as a way to improve the research contributions and funding opportunities of universities through leveraging the complementary talents of many researchers to work together on interdisciplinary projects. Our study finds that this ideal has been rarely met in practice. Instead, the individuals in our sample do not, for the most part, appear to be working in intensively collaborating units. Most units were closer in organization to the loose lines of affiliation and collaboration found in academic departments. Most respondents said that their clusters do not meet often; only seven percent of respondents said they meet at least weekly and one-quarter said they did not meet at all with other group members. Majorities of respondents also reported that their groups did not have an agreed-upon research agenda, did not have either intellectual or organizational leaders, and did not have members who were adept at translating across disciplinary languages.

We hypothesized that organizational design features, adequacy of facilities, and members' demographic characteristics would influence participants' satisfaction with the collaborative environment of their cluster groups. We did not find support for hypotheses concerning participants' demographic characteristics. These findings are discordant with the research literature on the experiences of women and minorities in higher education (see, e.g., Finkelstein, Conley, & Schuster, 2016, p. 277). Our findings may be influenced by the large proportion of Asian and Asian American faculty

members in our sample of minorities and by the emphasis of some cluster hiring on contributions to faculty diversity.

However, some organizational design features mattered for participants' satisfaction with the collaborative environment of their clusters. The regressions revealed that agreed-upon agendas and cross-disciplinary translators were significantly and positively associated with respondents' levels of satisfaction. We also found support for the importance of adequate lab space as a factor related to respondents' satisfaction.

These findings are consistent with the findings of our analysis of working groups, and that analysis adds important contextual evidence on how clusters operate in practice. Only one of the 10 working groups could be characterized as a cohesive working unit. Many working groups appeared instead to be loosely organized with considerable variation in levels and satisfaction, and in most cases also a lack of agreement among participants about the key organizational features of the group, such as leadership, agendas, and numbers of meetings held during the academic year (see Table 4). Some working groups appear to revolve around the work of a single or pair of tenured professors, with declining levels of collaboration and satisfaction for those whose work falls outside the activity of this core member or core pairs. In their open-ended comments several assistant professors explicitly indicated dissatisfaction with the collaborative opportunities provided by their clusters, with the leadership of their clusters, and with the difficulties they experienced in balancing departmental and cluster demands.

Given the large amounts of money allocated for cluster hire programs and the fanfare associated with their roll-outs, it is surprising, at first reckoning, how little organizational structure has been put in place at most institutions to facilitate

collaborations between cluster hired faculty. When collaboration occurs in the groups we studied, it is more often due to the shared interests of particular researchers, rather than to the forethought that has gone into organizational design or to the careful recruitment of researchers who have complementary skill sets.

There are exceptions to this rule. One university in our sample stood out for its thoughtful approach to cluster hiring. At this university cluster hires are co-funded by research institutes and departments, and constituted in part by written agreements about the time commitments expected in both units. Institute directors are top scientists and scholars in their fields, and, together with their advisory committees, identify new research areas that can be addressed effectively through cluster hiring, given existing institute faculty programs. Deans and department heads are brought in early and are required to approve the cluster hire plan and to compete for lines. Institute heads and their associates scout the available talent, including new doctorates, and make initial inquires about fit and availability. New cluster groups are provided with seed grants to support collaborative research and cluster directors are expected to hold seminars that will engage members of their groups. The stated goal is not to solve the world's problems but to help the university become more competitive for federal center and training grant funding, as well as to enhance the university's research profile in new high-impact fields (see also Sá 2008b).

Such planning is far removed from most of what we observe in our survey responses, and in our interviews with administrators and cluster leads. These responses suggest that in the universities we studied cluster hiring is a loose umbrella term that encompasses a wide variety of concrete interactions, ranging from intense, multi-investigator collaborations to no interactions whatsoever. The majority of our respondents participated in groups that leaned in the latter direction. Their clusters

operate more like small departments than as cohesive research units, with participating professors interacting and collaborating infrequently as they pursue their individual research careers. In this respect cluster hiring seems to be closer to one of the managerial fads described by Birnbaum (2001) than to a serious effort to reorganize universities for enhanced societal contribution.

Yet the hidden benefits of cluster hiring for university managers should not be ignored. Even where cluster hiring does not result in many collaborative relationships, the university can benefit from announcing that it has hired some number of new faculty to work in an important emerging field. The "cutting-edge" image that universities covet (Brint 2005) is enhanced through these well-publicized programs. And of course it is possible that if the fields chosen are well supported by funding agencies, one or more of the new hires will be well positioned to obtain high levels of research funding. University administrators may also feel that cluster hiring enhances their capacity for action. It does so by shifting a share of control from faculty who are experts in solving disciplinary problems to administrators who are experts in aggregating resources and planning and publicizing new large-scale initiatives. If these are the true reasons for cluster hiring, the design of effective work groups may be beside the point.

Supporters of the academic professions worry that cluster hiring, like other interdisciplinary initiatives, may threaten the priority of the faculty in determining the intellectual direction of universities (Brint 2018: 267-70), centralize authority in the hands of university administrators (Jacobs 2013: 210-3) and, given the applied nature of most interdisciplinary initiatives, may even represent a long-term threat to basic science and scholarship (Alberts 2012; Goldstein and Brown 2012).

Such concerns seem premature, given the limited scope of most cluster hiring initiatives. We found very large-scale cluster hiring efforts at only two of the 20

institutions in our sample. In these cases, cluster hiring represented a majority of all new faculty hiring during several consecutive years of implementation. Two other institutions among the 20 allocated dozens of lines to cluster hiring during the years of implementation, but cluster hires remained a minority of all faculty hires during the relevant years of implementation. By contrast, the majority of universities in our sample have utilized clusters in a targeted way, allocating only a relatively small proportion of total hiring lines to them. In these cases, clusters do not represent a major threat to department-based hiring authority. Departments are often involved in the hiring process, and typically retain control over promotion and tenure decisions, which further limit the threat to departmental authority (Sá 2008b).

Rather than being evaluated primarily as threatening alternatives to traditional departmental hiring, at most institutions clusters may be more properly evaluated for their role in quickly and flexibly adding human resources and new instrumentation to emerging national, state, or regional research priority areas. Some have succeeded in this way as adaptations to changes in the research funding environment and as mechanisms to build strength in areas of campus comparative advantage.

At the same time, advocates of cluster hiring have tended to take at face value the narratives that university administrators adopt when promoting new cluster hiring programs to donors, the faculty, and the public. Our findings support critics who doubt whether cluster hiring programs, as currently implemented, are the most effective means for ensuring the level of interdisciplinary collaboration that can lead to important breakthroughs. If a sincere goal of cluster programs is to encourage hired researchers to work together, then more thought and effort needs to be put into recruiting complementary individuals and forming effective work groups. Factors important to network formation such as previous work together, similarities or complementarities of

personality and motives, work group proximity, and cluster organizational design (see, e.g., Brass et al., 2004) will need to be more carefully planned and more conscientiously implemented.

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Notes

[1] The contemporary era of heightened interest in interdisciplinary organization can be dated from the mid-1980s. Beginning at this time, with authorization from Congress, both the National Science Foundation and the National Institutes of Health used augmented budgetary appropriations to create a network of interdisciplinary research centers in areas related to new technologies and medical therapies. These funds were used to initiate large-scale center grants, as well as for many smaller-scale initiatives, such as NSF IGERTS (graduate student training grants). Federal guidelines did not explicitly require interdisciplinary teams be formed to constitute center grants, but such teams were widely considered to be important factors in successful applications (Bozeman & Boardman, 2003; Brint, 2005). States too took a heightened interest in the capacity of universities to contribute to state economic development goals through the harnessing of faculty talents from disparate disciplines (Feldman, Lanahan, & Lendel, 2014).

[2] In a separate forthcoming paper, we discuss productivity and impact analyses conducted on individuals in the cluster hire sample.

[3] Many of the analyses are based on 198 cases rather than 199. One individual did not provide his or her name, employing organization, or thematic field, and we consequently dropped this individual from analyses requiring such information.

[4] These regressions are available on request.

[5] We anticipated interviewing at least three individuals at nine of the participating institutions. However, senior administrators at several of the institutions referred us to one or two lead persons who were authorized to respond to our questions. The senior co-author interviewed six provosts or former provosts, five institute directors, three vice presidents/vice chancellors for research, two associate provosts and two faculty cluster leads at the nine institutions. The institutions included one AAU private university, three AAU public universities, and five non-AAU public universities.

[6] As in the case of survey respondents, the names of individuals and institutions are masked for purposes of maintaining confidentiality.

[7] In the unreported regressions, we included institutional locations and cluster thematic fields. The inclusion of these variables failed to improve model fit and yielded few statistically significant net associations. In the majority of regressions individuals who were members of a medicine-related cluster showed significantly higher levels of satisfaction, net of covariates, but no other thematic fields stood out either positively or negatively. Nor did any institutions stand out, net of covariates, as locations of high or low levels of satisfaction.

[8] These regressions are available on request.

[9] The term "cluster hiring" itself is not universal. Some universities use alternative terms such as "thematic hires," "signature hires," or "transdisciplinary areas of excellence."

[10] One vice-president for research said that as many as 75 newly recruited faculty at his institution did not have labs available to them when they arrived on campus – or a timeline

specifying when the labs would be ready. This was an extreme case, but not the only one demonstrating a failure to match hiring plans with facilities requirements.

Table 1. Cluster Themes and Types of Institutions

A. Cluster Type

Cluster Type	Freq.	Pct.	Cum. Pct.
Advanced Materials	26	13.13	13.13
Agriculture	1	0.51	13.64
Big Data	34	17.17	30.81
Community Health	20	10.10	40.91
Education	1	0.51	41.41
Energy	24	12.12	53.54
Genomics	1	0.51	54.04
Health Disparities	8	4.04	58.08
Medicine	5	2.53	60.61
Microbiology	3	1.52	62.12
Neuroscience/Brain	16	8.08	70.20
New Approaches to Arts	13	6.57	76.77
Race/Ethnic Studies	18	9.09	85.86
Security	3	1.52	87.37
Sustainability/Climate	25	12.63	100.00
Total	198	100.00	

B. Institution Type

Institution Type	Freq.	Pct.	Cum. Pct.
AAU Member Institution	61	30.81	30.81
Non-AAU Public Research	129	65.15	95.96
Non-AAU Private Research	8	4.04	100.00
Total	198	100.00	

Table 2. Descriptive Data

A. Independent Variables

Independent Variables	N	Mean	SD
Academic Rank	198	1.590909	0.8181434
Agenda	179	0.273743	0.4471294
AAU Ph. D. Institution	198	0.6616162	0.4743592
Collaboration	188	0.3776596	0.4860964
Intellectual Leader	186	0.4247312	0.4956363
Female	199	0.3467337	0.4771304
Lab Space	164	2.92517	0.820027
No Lab Space Needed	164	0.1036585	0.3057507
Non-White	189	0.3809524	0.4869107
Office Space	194	3.195876	0.6046311
Organizational Leader	187	0.4652406	0.5001294
Staff	190	3.005263	0.7663379
Translator	175	0.4171429	0.4945018
Years Since Ph. D.	191	12.26702	8.613142

B. Dependent Variable and Components

Independent Variables	N	Mean	SD
Satisfaction Scale [1]	156	-0.0000000045	0.7232484
Joint Research Rating	175	3.051429	1.411238
Joint Social Rating	170	2.994118	1.481631
Mentoring Rating	169	2.846154	1.480026
Diversity Rating	179	3.452514	1.294644
Scholarly Output	181	3.325967	1.210528
Career Improvement	182	3.56044	1.186562
Working Unit	184	2.809783	2.13524

1. Crohnbach’s Alpha for scale is 0.8480

Table 3. Regression of Respondent Satisfaction on Demographic, Organizational, and Facilities Characteristics

	(1) Demo.	(2) Demo. + Org.	(3) Demo. + Fac.	(4) Full
Female	0.0632	0.0475	-0.0304	-0.0143
	(0.160)	(0.134)	(0.151)	(0.130)
Non-white	0.182	-0.00168	0.237	0.0605
	(0.143)	(0.137)	(0.134)	(0.134)
Associate Professor	0.222	0.187	0.193	0.150
	(0.203)	(0.197)	(0.187)	(0.199)
Full/Distinguished Professor	0.235	0.174	0.174	0.135
	(0.300)	(0.303)	(0.252)	(0.285)
AAU Ph. D. Institution	-0.258	-0.102	-0.252	-0.125
	(0.151)	(0.139)	(0.138)	(0.135)
Years Since Ph. D.	-0.00726	-0.00869	-0.00898	-0.00945
	(0.0123)	(0.0109)	(0.0113)	(0.0107)
Agenda		0.450**		0.372*
		(0.138)		(0.143)
Intellectual Leader		0.0206		0.0481
		(0.131)		(0.131)
Organizational Leader		0.0336		-0.00850
		(0.123)		(0.114)
Cross-disciplinary Translator		0.280*		0.282*
		(0.121)		(0.119)
Collaborate >10% Time		0.225		0.181
		(0.122)		(0.116)
Adequacy of Lab Space			0.192*	0.131
			(0.0785)	(0.0749)
Lab Space not Required			0.318	0.217
			(0.367)	(0.335)
Adequacy of Office Space			0.0431	0.00735
			(0.110)	(0.104)
Adequacy of Staff			0.166	0.131
			(0.0866)	(0.0839)
Constant	0.131	-0.265	-1.001*	-0.964*
	(0.158)	(0.174)	(0.401)	(0.385)
Observations	114	114	114	114
R^2	0.060	0.316	0.195	0.376

Robust standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4. Working Group Interaction Patterns (N=10 groups with 4 or more survey respondents[1])

Group Classification	% of Time Collaborating	t Have Agenda	Intel-lectual Leader?	Organi-zational Leader?	Will be Active 5 or More Years	Joint Work Satis-factory
A. Relatively Cohesive						
U#1: Big Data (N=7)	>20%=5	Yes=5	Yes=3	Yes=4	Yes=5	Yes=4
B. Narrow Benefits						
U#1: Materials (7)	>20%=2	Yes=2	Yes=3	Yes=2	Yes=2	Yes=2
U#2: Neuroscience (4)	>20%=2	Yes=1	Yes=2	Yes=1	Yes=3	Yes=1
U#3: Energy (5)	>20%=1	Yes=0	Yes=2	Yes=2	Yes=1	Yes=1
U#4: Energy (4)	>20%=1	Yes=0	Yes=3	Yes=2	Yes=3	Yes=1
U#4: Climate (6)	>20%=0	Yes=1	Yes=2	Yes=3	Yes=2	Yes=1
U#5: Big Data (5)	>20%=1	Yes=2	Yes=1	Yes=3	Yes=2	Yes=2
C. Low Engagement						
U#6: Climate (7)	>20%=2	Yes=0	Yes=0	Yes=0	Yes=0[2]	Yes=0
U#6: Energy (7)	>20%=0	Yes=1	Yes=0	Yes=2	Yes=1[2]	Yes=2
U#7: Neuroscience (4)	>20%=0	Yes=0	Yes=0	Yes=0	Yes=1	Yes=1

Notes

[1] Not all respondents in clusters answered every question in the survey. We report raw numbers on the assumption that those who did not respond to particular questions either did not know how to answer or did not want to report negatively about their experience in the cluster. In either case, the raw numbers reported would not misleading.

[2] A majority of respondents stated that the group had already ceased to function.