Expansion of the Open Lab, a University-Industry Model for Undergraduates

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Higher education is facing declining enrollments, a public that questions its value, and diminishing government support. Penn State Erie, The Behrend College, proposes a differentiating university-industry strategy that increases its competitiveness. Known as *the Open Lab*, this strategy embraces industry as stakeholders in the education of its primarily undergraduate population. The Open Lab has the potential to increase Behrend's market share of a shrinking demographic, return-on-investment for graduates, and diversified funding sources for research. Though successful in its pilot phase, the effort has yet to gain broad support, and without campus-wide implementation, the Open Lab cannot meet its potential.

This improvement project included three components. First, I worked with campus leadership to develop communication opportunities and identify metrics to track implementation. Second, at a Town Hall-style event, I presented the case for the Open Lab Strategy. Participants completed surveys at the beginning and end of the Town Hall to gauge changes in employees' level of understanding of the strategy. The third component, a working group session, identified opportunities to better engage with external constituents.

Following the Town Hall, 87% of participants reported improvement in their knowledge of the Open Lab, and53% expected to change some aspect of their work as a result of the Town Hall. The actionable ideas developed in the working group integrated into an existing, ongoing Corporate and Community Connections group. These discussions are ongoing: While Behrend

faculty and staff agree at a macro level on the benefits of the Open Lab, the success or failure of implementation depends on the micro-level actions and interactions that support or detract from the effort.

Although we successfully communicated the need for the Open Lab, this did not translate into the anticipated behavioral change. For example, while external messaging is rich in Open Lab content, the Behrend website did not feature practical Open Lab messaging or demonstrate participation by the leadership team. Future efforts likely will target campus leadership and faculty who are predisposed to industry engagement. Continued work is needed to ensure consistent support by leadership and align policies and practices that support university-industry engagement.

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Preface

I want to thank the people that supported my journey and pursuit of a doctoral degree.

- Thank you to Dr. Bob Light, who encouraged me and insisted that I pursue a doctorate. He was my most influential career mentor who wrote my letter of recommendation for my University of Pittsburgh application. He is missed by many each and every day. I appreciate his mentorship, and his legacy continues. I hope this would have made him proud.
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1.0 Naming & Framing the Problem of Practice: The Need for Higher Education to Embrace a University-Industry Strategy

"Thirty years from now, the big university campuses will be relics. Universities won't survive. It's as large a change as when we first got the printed book."

Peter Drucker 1997 (Lenzner & Johnson, 1997)

1.1 Broad Problem Area

Higher Education is in a time of radical change. This change stems from declining enrollment, reduced funding for operations and research, and a loss of trust from the public in the value of a higher education degree (Morrill, 2010). If higher education does not respond to these changes, there will be a widening mismatch of higher education operations and the reality of their environment. An important example of this is how higher education *stakeholders* are defined. Those within higher education tend to view stakeholders like students, parents, and research communities; whereas, those outside of higher education have a broader view that includes the organizations or industries that will employ these students (Morrill, 2010). This mismatch threatens the future of higher education, as predicted by Peter Drucker in the quote above.

This persistent mismatch in expectations, cultural norms, and strategic focus areas can create gaps between higher education and its stakeholders. One specific challenge is engaging with

external stakeholders, such as industry, an expectation desired by many, including legislators, parents, students, and employers (Morrill, 2010). Industry can be defined broadly as businesses or organizations which produce a common good or service. Examples of industry categories include manufacturing, hospitality, healthcare, film, and creative writing. Decision-makers in higher education view the inclusion of industry from different perspectives. Many resist the notion that industry stakeholders have relevance to higher education at all. Others start to include industry as a stakeholder by incorporating inclusive language use, but policies and procedures lag. In the best-case scenario, they try to embrace the new stakeholders to explore the possibilities and adjust policies and practices to match the additional stakeholder inclusion.

There are many examples of higher education not evolving with their market. In one study, ninety-six percent of chief academic officers assert that they successfully prepare 96% of their graduates for the workforce, but only 11% of business leaders agree (Weise, 2014). In another, competencies such as professionalism, communications, leadership, and career management were compared from students' perceptions versus employers of recent graduates and found that students rated themselves over two times what the employers would place them on average (Bauer-Wolf, 2018). While these are only two examples, they highlight a dramatic difference in valuation and effectiveness of services. Radical organizational change and policy shift will need to occur for most institutions to remain competitive in an environment with increasing choices for post-secondary education. We witnessed failures in organizations that resist market force change in both General Motors and Eastman Kodak Company. Both suffered from what Senge (2004) refers to as the belief that a sustained set of conditions equates to a formula for success rather than a

formula that will change with a shift in conditions. Higher education may be falling into this same trap.

Although higher education is under pressure to integrate external stakeholders into its mission and vision, historically, education quality and excellence have been viewed from an internal perspective of knowledge discovery and dissemination (Morrill, 2010). Many systems in higher education, such as the promotion and tenure policies, reward academic reputation through activities such as publications but do not necessarily value applying knowledge to practice. The resistance of higher education in integrating external stakeholders into their strategy creates a disparity between expectations and outcomes between higher education and the markets they serve. Systems and policies do not always reward what the market was requesting. Market stakeholders such as employers are often frustrated with higher education's lack of response to their needs. Higher education is frustrated with the growing pressure to integrate its activities, outcomes, and valuation with an external and highly volatile market (Morrill, 2010).

An undergraduate institution can view this shift to include external partnerships as an opportunity with great potential. Undergraduate students are particularly well suited for industry-sponsored applied research and development projects because they do not have to tie this work to a longer two- or five-year degree thesis (as with master's or Ph.D. students). Projects can be agile, evolving, and can pivot as the industry gains knowledge. Undergraduate research is a space where students can integrate academic learning with contextual life experiences (Brew, 2013). This activity can help students shift from being knowledge consumers to knowledge contributors (Brew, 2013). This approach, however, is often met with criticism from those who fear that the feedback loop created between external forces and the university will drive curricula rather than curricula

aligning to the idea of gaining knowledge for knowledge's sake (D'Este & Perkmann, 2011; Morrill, 2010).

Across demographic groups, including students from minoritized backgrounds, the success factors that result from undergraduate participation in research include increases in graduation rate and receiving national awards (Craney et al., 2016; Webber et al., 2013). Craney et al. (2016) found that irrespective of GPA, those engaged in undergraduate research were above the national average in five-year graduation rates and that underrepresented groups, as a subset of undergraduate researchers, were as successful in graduation rates as their peers. Undergraduate researchers were also three times more likely to receive national awards than undergraduates who did not conduct research. (Craney et al., 2016).

The funding for undergraduate research, and research in general, is changing with industry leading the effort. Figure 1 shows that funding for research has been steadily shifting from government sources to business sources over the past several decades.

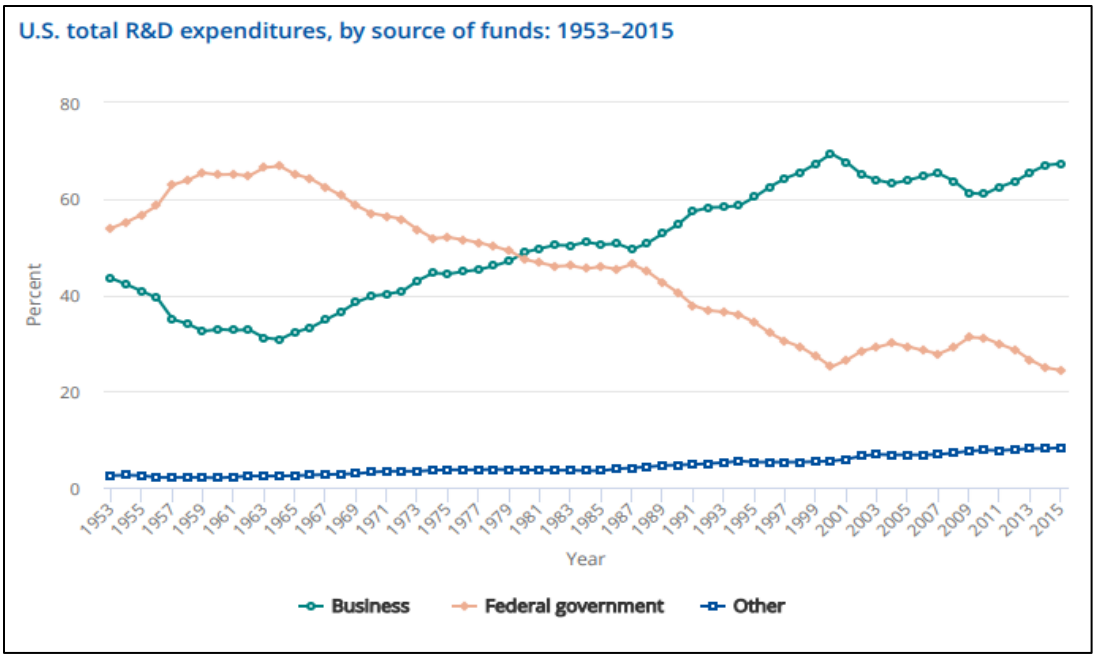


Figure 1: U.S. Total R&D Expenditures, by Source of Funds: 1953-2015 (National Science Foundation, 2018b)

The availability of funding from traditional federal and state sources is shrinking, with business and industry closing the gap. Even with the increased competition for the dollars remaining, the reduction in funding and competition for awards has not yet hit a level where most faculty must look for alternate funding sources. When they do, the incorporation of industry as a stakeholder and processes and policies that encourage that activity will be critical.

Ironically, university researchers with industry funding publish more frequently than their colleagues who publish without industry involvement. Still, that increase of publications diminishes once the ratio of industry–to–government funding exceeds 2:3 (Perkmann et al., 2013), indicating a mixed portfolio is crucial. Publications also decline if the researcher maintains an exclusive relationship of an applied sponsor, suggesting that it behooves the researcher and the organization to pursue sponsorship by different sponsors (Perkmann et al., 2011).

Whether discussing challenges with graduate preparedness, funding, or the workforce's diversity in the STEM fields, many solutions should consider incorporating business, industry, and non-profit influence into curriculum, research, and outreach efforts. The effort is more than just including the words "business" and "engineering." It requires an overhaul of the systems, policies, and processes that support the higher education sector.

For example, hiring faculty from industry may give the hiring process more diversity and a larger candidate pool. If a company derives any value from projects the faculty oversees or the skillset that project gives graduates, they are more likely to fund additional research or provide gifts. If a company can easily navigate the research agreements, they are more likely to engage in research, encouraging them to engage with students. If an organization can engage with students, they are more likely to evaluate them as potential employees. As silly as it sounds, an obstacle such as the need for a parking pass may dissuade a company from visiting campus. If successful, higher education will weave external influence deep in the strategy and operations of a nimbler higher education capable of maintaining consistent quality while mirroring the consumers of their student graduates.

1.2 The Organizational System: Overview of the Behrend Strategy for University-Industry Engagement

Penn State Erie, The Behrend College began in 1948 as a donation of the land and buildings from Mary Behrend, widow of her husband, Ernst. Ernst and his brother, Otto, founded the Hammermill Paper Company, later acquired by International Paper. Today, Behrend is a

standalone college within the 20-campus system of Pennsylvania State University. The College hosts more than 4,700 students and 33,000 alumni. Penn State Behrend offers more than forty degrees at the bachelor's, master's, and associate degree levels. Behrend organizes their academics into four schools: the Sam and Irene Black School of Business, School of Engineering, School of Humanities and Social Sciences, and School of Science.

Due to its beginnings from Hammermill Paper, Behrend has a legacy of tying its success in research, outreach, and scholarship to its history and influence from the external industry. One of its significant niche programs, Plastics Engineering Technology, was driven into existence and continually supported by the local plastics industry. Niche programs such as the PLET program drives student enrollment and retention. In the 1980s, only 15-20% of the student body stayed at Behrend for all four years, most transferring to the University Park campus. Now, 75-80% of the student body treats Behrend as their first-choice destination and stays all four years. The Penn State brand and infrastructure are essential to Behrend's success, particularly in research, enrollment, and development. The internal shadow, however, of such a large research university can have its challenges.

Behrend is in an unusual position. Most higher education institutions worry about freshman to sophomore retention. Behrend is also concerned about sophomore to junior year retention because it is part of a more extensive PSU system. The PSU system design promotes the transition to University Park. The construct of all but five of the Commonwealth Campuses is a 2+2 format. Abington, Altoona, Behrend, Berks, and Harrisburg are standalone colleges that can confer and control degrees. The University Park campus drives the design of many policies and practices because they generate a high percentage of the system's student enrollment, graduate student

research, and D1 sports programs. Successful negotiation with federal agencies such as the National Science Foundation, National Institute of Health, or the Department of Defense drives sponsored research negotiators' hiring and training practices. However, even though it is a small segment of overall research, research with industry is an anchor of Behrend. Negotiating with various-sized manufacturers for sponsored research takes a particular skill set different from dealing with federal agencies.

Penn State Behrend has adopted a strategy known as The Open Laboratory to address the need for external stakeholder engagement. The Open Lab bridges the gap between industry and academia in ways that build effective, long-term research and development partnerships that benefit industry while simultaneously providing students with relevant learning opportunities and keeping faculty technically current. The student opportunities to interact with industry to identify challenges, work on problem-solving, perform research, and present their work as an integrated component of their undergraduate education have been differentiating factors for students upon graduation and Behrend in attracting students and industry partners.

The implementation of the Open Lab has been an ongoing project for the past ten years, either at the local school level or college-wide, though those efforts' success has varied. The Open Lab was initiated in 2009 by Chancellor Ralph Ford, in his former role as the Engineering School Director and me, as the then Director of Advanced Technology Projects. The Director role was an unusual faculty appointment at its inception. Still, dedicated personnel that drives university-industry research and economic development strategies are becoming more common within Penn State and higher education in general. Currently, I hold the position of Senior Director of Corporate Strategy and External Engagement. At Behrend, I am responsible for how the external

organizations, for- or non-profit, engage with campus, including developing engagement frameworks, policy creation and assessment, and responsibility for Knowledge Park, Behrend's research and development park adjacent to campus. At the heart of the Open Lab are the following tenets:

- ✓ Undergraduate students, led by experienced faculty, and post-doc researchers, can generate practical product development innovations that create economic impact for industry partners.
- ✓ An industry-favorable intellectual property (IP) policy where the industry partner owns the IP if the industry funds the project.
- ✓ The promotion of laboratory resources and the students trained to use them for industry projects provide impactful opportunities for students to hone their skills, create impact for industry, and showcase potential hires.
- ✓ The value of hiring faculty who have experience in the private sector could influence their teaching, alter how their departments viewed industry collaboration, and bring their industry networks with their campus to help establish more industry links.
- ✓ A promotion and tenure system values industry-sponsored projects adapted from a system that only valued publications and government-sponsored research.
- ✓ Ability to collocate near campus at Knowledge Park at Penn State Behrend, the College's research and business park adjacent to campus, for short- or long-term engagements and to provide students an ability to be employed in their field while as a student.

The Open Lab formally branded as a strategy in 2010, but the effort and culture between Behrend and industry partners were decades in the making. The Open Lab germinated in the

College's School of Engineering because it represented the College's largest enrollment and the most research-active. While the pilot increased industry engagement and research, the effort has struggled to scale from the original pilot. At the time of the pilot:

- Engineering faculty were interested in conducting funded research supported by industry, and our industry constituents were likewise interested in doing so. To this purpose, Behrend identified barriers in negotiating intellectual property and the promotion and tenure process.
- The school was confident their undergraduate students could perform at a competence level agreeable to industry.
- Across the Penn State system was a growing realization that a dramatic shift in intellectual property policy would be needed to move research and industry partnerships forward, so the timing was fortuitous.
- Knowledge Park at Penn State Behrend created an opportunity to test out some scalable, safe-to-fail experiments.

Knowledge Park began in 1998 with a vision of business and industry locating adjacent to campus to promote cross-collaboration. When Open Lab was launching, the Park fell shy of the original image and essentially ran as a real estate venture separate from the College. Because the College financially guaranteed the Park operations, it cost the College money each year. The region expected the University to serve as an economic development engine to attract and grow companies and bring the resources of a Research 1 (R1) university to bear. The Open Lab initiative targeted Knowledge Park as an opportunity for more engagement. Perhaps most importantly, it represented an opportunity to enhance student educational outcomes.

Evaluating Behrend strengths and learning from like-minded influencers, the definition of the Open Lab evolved into:

> "The Open Lab … is an integrative learning and research environment. In an open laboratory, the processes of education and research come together in a seamless path, from discovery to implementation. Every effort is made to reduce barriers between research and practice, industry and academia, and learning and doing. The open laboratory's focus is on solving a set of pressing challenges in a way that furthers the creation of basic knowledge, develops a community of entrepreneurial knowledge builders and users, and drives regional economic development" (Birx et al., 2015, p. 12).

These efforts resulted in a startling uptick in research awards, research expenditures, and faculty activity between 2009 and 2015. In FY2009, the research expenditures were $3,643,000. By FY2014, the research expenditures had increased 68% to $6,131,000 but trended downward the next four years to $3,996,000 in FY2018. The College was encouraged by the pilot results and attempted to scale the effort College-wide. Attempts to scale the pilot project stalled. This stalling may be due to resistance from the other three schools to using the name "Open Lab" or outright hostility to the idea of shaping education around helping students to find employment (Silver, 2019). The schools not involved in the pilot may have perceived the effort as designed for engineering only. Because the other schools did not have input in the project, some expressed that they wanted to start the pilot effort over entirely. Even those performing Open Lab activities in their activities did not directly associate those activities with the Open Lab. Others aligned with the Open Lab approach but with different branding. This alternate branding occurred in the School of Business, where the Open Lab occurs under the brand of "Learning-By-Doing." The problem is

how to expand that support across a variety of stakeholders and through several different boundary lines.

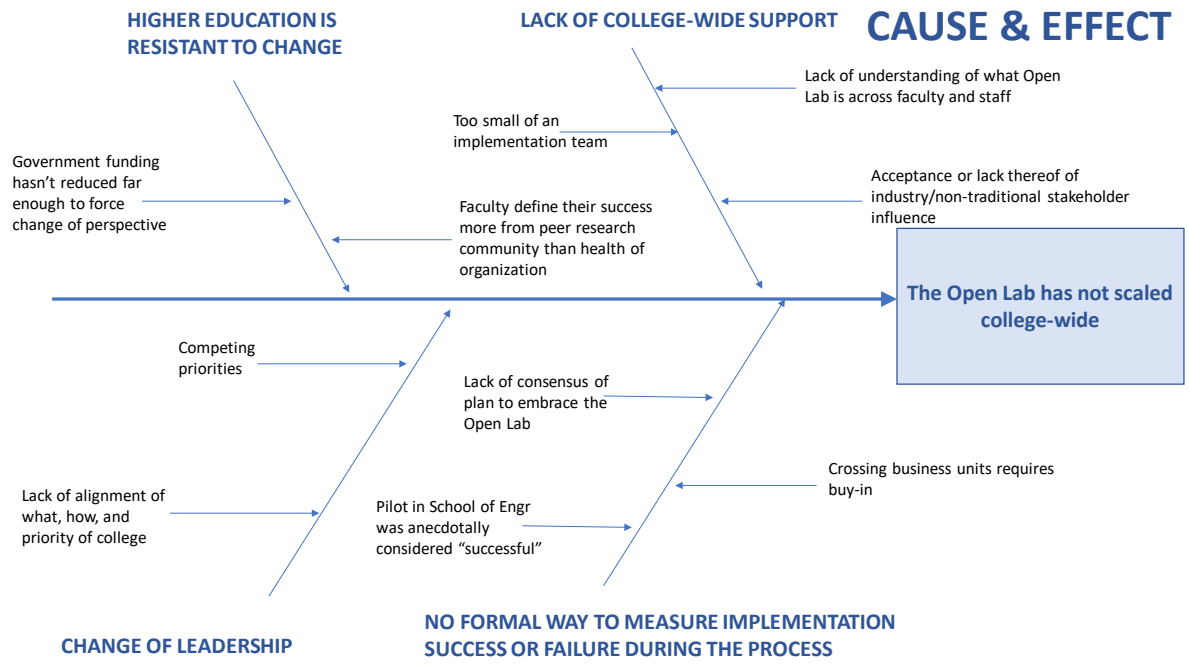


Figure 2: Cause & Effect (Fishbone) Diagram for Why the Open Lab has not Scaled College-Wide

Figure 2 illustrates the causes behind the struggle of the Open Lab in scaling College-wide:

- Higher Education's resistance to change

  This issue is mainly outside our sphere of influence, but it has an impact regardless. As an example, federal and state funding is in a 60-year trend of decline, but that decline has not reached a point low enough to force faculty to seek additional funding sources. Faculty derive their value not from the health and sustainability Behrend but the views of their research peers instead. As long peer-reviewed journals validate through publications, faculty may not align personal interests with Behrend interests.

- Lack of College-wide support

  The Open Lab champions during the pilot phase consisted of a small team of three or four people. When trying to scale, others did not see themselves as part of the initiative, nor were they driven or rewarded to understand the Open Lab and what it could do for them and their students. The addition of industry as a stakeholder is a disruption in the overall higher education existence. Acceptance of this additional stakeholder challenges some faculty in their definition of why they educate (Labaree, 2018).

- No formal way to measure the success or failure of implementation efforts

  The pilot project was deemed successful. While there were metrics that supported that claim, there were no formal efforts to understand which changes in policy, culture or increased understanding led to the differences in outcome.

  During the pilot phase of implementation in the School of Engineering, research expenditures grew 68% in four years. Every presentation included Open Lab in its foundational message. The term "Open Lab" was in the majority of public messaging. There was a significant push for industry experience in all faculty hires. These were all indicators of a culture change adoption into the fabric of the campus.

  In scaling college-wide, the metrics that mattered for the School of Engineering did not translate exactly to what the schools of Business, Humanities & Social Sciences, or Science prioritized. Crossing disciplinary boundaries required buy-in, and the lack of that buy-in hampered overall acceptance.

- Change in Leadership

  During the Open Lab pilot effort, there were substantial leadership changes. Then Chancellor Don Birx departed and was replaced by current Chancellor Ralph Ford. When Dr. Ford took the role, he faced vacancies or interim appointees in his leadership team, including the Associate Dean of Academics, Associate Dean of Research, three of the four School Directors, Financial Officer, and the Chief Administrative Officer. This change in leadership disrupted the strategy implementation, but the drivers for the Open Lab remain relevant.

There is still an interest from the administration to take the lessons learned from the pilot implementation and scale the Open Lab college-wide. Strategic Communications, Admissions, Chancellor Ford, and Behrend's Council of Fellows tout the Open Lab as a differentiating factor for Behrend when recruiting students, attracting industry attention and within the more extensive Penn State system. The Open Lab environment continues to be the key stated strategy of the College for supporting the integration of external business and industry stakeholders into the fabric of everyday life at Behrend. In the vision, the Open Lab brings faculty and students together with scientists, engineers, and technical professionals from business and industry to develop new products, extend existing products, initiate new programs, address market challenges, and improve processes.

1.3 Key Stakeholders at Behrend

Traditionally, stakeholders in higher education have been considered students, faculty, staff, administration, employers, and parents. Behrend adds its industry partners to the stakeholder list. Descriptions of each follow:

- Students: Behrend enrolls 3,618 students, with 97% of those being undergraduates. 78% of those students ethnically are classified as white, and the population is 63% male. 77% of students receive financial aid, and 38% are first-generation students.
- Faculty: Behrend employs 269 faculty that are 55% male and 64% white. The second-largest ethnicity is the unknown category which is an additional 17%.
- Staff: Behrend employs 181 staff, not including centralized staff for business units such as Housing & Food or the Office of Physical Plant. 71% of staff are females, and 82% identify as ethnically white, with the second-largest category of unknown ethnicity representing 12%.
- Industry: Over 250 companies visit campus each year. Behrend hosts a regional career fair that includes 150 companies twice a year, and the college opens its doors to neighboring universities, which cannot create such a strong draw for recruitment. Behrend also hosts 22 companies in its Knowledge Park, where occupation is at 95%. Knowledge Park's tenants (Appendix D) include the world's largest bearing manufacturer, an insurance company, a biofuels R&D lab, a medical device company, an automation and controls company, several

engineering firms, a vertical publishing company, economic development agencies, and a logistics company as examples.

Behrend espouses its Open Lab connection to industry with strength in externally-facing efforts such as marketing, admissions, etc. The internal practices and beliefs, however, do not match what Behrend is marketing. During an interview with Behrend's Associate Dean of Academics, she stated that she did not see how there could be a way in which the stakeholder list would change, but perhaps a shift in the weight of importance was occurring (Silver, 2019). During a strategic planning session in 2020 with the College's Council of Fellows, a college-level advisory council, the commitment to the Open Lab was strong. External stakeholders genuinely embrace the importance of the Open Lab, but internally the leadership team varies in their support. Suppose the Open Lab is going to scale campus-wide in practice. In that case, all levels of the organization will have the ability to articulate the strategy, the urgency to adapt, and why it is essential.

Leadership does not understand the power of the external voice, and its impact indicates the disconnect between academia and the market that supports it. The language that companies traditionally use, such as "quality" and "excellence," is not defined by market forces in the case of higher education; instead, knowledge discovery and dissemination are the measurements of education quality and excellence (Morrill, 2010, p. 60). Systems in higher education do not always support the application of knowledge in an industry setting. For example, the promotion and tenure policies reward academic reputation through activities such as publications but do not necessarily value applying learning to practice. Morrill acknowledges that there has been pressure since the

1970s for higher education institutions to integrate more external stakeholder influence such as federal government, state governments, and accrediting agencies. Still, it has a minimal impact (2010, p. 56).

For faculty, validation often comes from peer research communities, student evaluations, or faculty in their localized department or school (Morrill, 2010). Faculty motivation within the context of university-industry collaboration, particularly in contrast to industry motivations, is not studied (Ankrah et al., 2013). This valuation model can disconnect the faculty from connecting their work in the education of students to the health of the institution. It can create a culture where the faculty do not see themselves as part of recruitment, student success after college, and managers of increasing restraints on budgets. The risk is a faculty member who only values their work from their research validation and not the changing conditions of the market they serve, which puts the College at a distinct disadvantage. Suppose the faculty do not connect a university-industry strategy with the College's ability to attract new students, and recruitment is a passive activity. In that case, it limits the College's ability to adjust to new market conditions.

Industry is an end customer of the students who graduate from the various institutions, but they also fund research, contract workforce training, and have similar diversity and K-12 programming goals. They seek graduates who are ready to enter a changing economy and have the ability to drive innovation and commercialize technology. They are looking for graduates who can shift quickly between mindsets. They are likely graduating from institutions that resist this type of thinking in their business model.

Alignment of what we espouse as a strength externally for Behrend to the internal policies, procedures, and practices will take power and persistence to work against the status quo. Suppose

higher education is to evolve with the market that they serve. In that case, they will need to embrace external stakeholders' feedback into the fabric of the university fabric, which they fear.

1.4 Statement of the Problem of Practice

The Open Lab strategy, which leverages industry and external partners as critical stakeholders, faces powerful internal resistance and has not seen campus-wide implementation. If implemented, the strategy has the potential to help address enrollment challenges at Penn State Behrend.

Higher Education institutions, more specifically land-grant institutions, are now being publicly challenged to prove their value, relevance, and return on investment to their stakeholders (Hillman et al., 2015). U.S. non-profit academic institutions have closed, merged, or consolidated on an average of one per month since 2016 as they attempt to meet increasing demands by their stakeholders, including parents, industry partners, government funding sources, community partners, and donors (Education Dive Staff, 2019; Hillman et al., 2015). Institutions of Higher Education have faced increasing pressure from funding sources, elected officials, and parents to prove their impact on the community in the form of employment opportunities, technology transfer, return on investment, and public funds usage (Viaene & Zilcha, 2011). Penn State Behrend faces these same challenges.

One of Penn State Behrend's strategies to address these issues is strengthening partnerships with business and industry to support undergraduate research, internships, and curriculum relevance. If adopted as an embedded strategy, the Open Lab would influence strategy decisions across all business units. Instead, the responsibility for the Open Lab lies with just one or two people rather than broad integration across departments. The lack of consistent adoption creates misalignment between the campus strategy, the strength of the external messaging of the Open

Lab, College branding efforts, and the day-to-day decisions of the leadership team. The Open Lab is marketed to faculty and staff to use or not as they desire. Some faculty and staff embrace the strategy, and others do not. The same is true for leadership. To scale the Open Lab campus-wide, it will have to gain the leadership team's support which drives decisions on policies, hiring, etc., which can underpin the Open Lab implementation. Several examples of the disconnect between the Open Lab Strategy and daily operations follow.

As one example, new faculty positions often cite "industry experience preferable," but since 2016, few new faculty hires have that experience. In fact, in 2016, over 80% of the engineering faculty had career industry experience, but a census in 2019 saw a decline to just 58% of the faculty with career industry experience. Of the corporate research awarded from 2014 to 2020, 56% of the faculty came from an industry background, 19% had no industry experience, and 26% had unknown expertise.

In 2019, I examined five Behrend job description postings for faculty positions to assess the practice of hiring faculty with industry experience. In four of the five examples, references to industry experience as a requirement or preferred experience occurred. The fifth job description referenced a commitment to excellence in applied research scholarship. School administrators placed advertisements in PSUjobs.psu.edu, HigherEdJobs.com, Academic Keys publication, and the Chronicle of Higher Education. An alternative would be disseminating the advertisements to Penn State’s alumni network or industry-specific publications reaching a more diverse audience, including those in industry who may not realize that they would be eligible for a faculty position and their non-academic skills valued.

Additionally, though the job descriptions reflect the desire for the industry experience (varying years of experiences required) or applied research scholarship, only one of the five successful candidates in these searches meets the preferred qualifications related to that experience.

As another example: leadership drives performance improvement opportunities for faculty and staff as well. Training in communication styles such as writing grants favors traditional funding sources such as NSF or NIH without the inclusion of industry-focused proposals emphasized in the strategic plans. As a result of this disconnect, faculty and research support are possibly demotivated or confused by the mismatch of vision to reality. Corporate research awards have suffered – from almost $1.8M in 2016 to $267K in 2020.

Another downstream effect is a reduced number of faculty with the desire or communication style to work with industry on applied projects or teaching industry-targeted courses. There have been a total of 27 active researchers on corporate research awards. In 2014, 10 active corporate researchers rose to as high as 14 in 2015 but had dropped to just 5 in 2020. Only three faculty participated more than ten times on corporate research awards and had greater than $75K awards. Behrend's Continuing Workforce Programs previously used Behrend faculty primarily as instructors but is now attempting to find industry-minded and enthusiastic instructors from outside entities.

Close alignment of these short-term decisions with the long-term vision of the Open Lab strategy must quickly occur as not to lose the original pilot success. Industry-focused training on writing proposals or engaging with industry would be helpful. The hiring of faculty with industry backgrounds can increase corporate research submittal and awards. Without leadership driving

engagement with industry through its practices, there will continue to be a mismatch between what Behrend is marketing and reality.

1.5 Review of Supporting Knowledge

The purpose of this review of scholarly and professional knowledge is to explore industry partnership strategies like the Open Lab, considering varying stakeholders' perspectives and motivations.

1.5.1 The Motivations of Higher Education Stakeholders

Understanding industry and university stakeholder motivations can better prepare an organization for strategy implementation. Exploring motivations that drive university-industry interactions is well-developed from the higher education perspective and separately from the industry perspective. Still, studies that take a bi-directional approach to university-industry interactions are not as prevalent (Ankrah et al., 2013). The stakeholder organizations discussed in the literature include institutes of higher education, industry organizations, government (federal, state, and local), and intermediaries who translate technology between universities and industry. The challenge of exploration only from one perspective illustrates a desire of academia to keep these stakeholder groups segregated and academia's standard operations preserved.

While universities and industry agree at a macro level on the benefits of interactions such as economic benefits or graduate preparedness, the success or failure of those university-industry

engagements depend on the micro-level constructs that differ in importance between the two types of organizations. Faculty benefits for a university-industry model of engagement include gaining funding for equipment, materials, and student support, applying research theories to practical examples, student training, gathering feedback on curriculum and its relevance, and gathering ideas for future research (Ankrah et al., 2013; Franco & Haase, 2015; Tartari & Salter, 2015). Industry appreciates the independent product testing, speed to market for projects, and increased credibility when efforts are attached to a high-quality university (Ankrah et al., 2013; Franco & Haase, 2015; Tartari et al., 2014; Tartari & Salter, 2015). As the overlap of these motivations is not always evident, one must find the appropriate mutual benefit for all parties. Successful university-industry collaborative models have included inducements and measurements in response to these individual motivations (Birx et al., 2015). Promotion and tenure policies that traditionally value an academician's worth based on peer recognition challenge a university-industry strategy implementation (Alfred, 2006). Franco & Haase (2015) and Lam (2011) found that financial motivations are secondary to traditional reasons, including research relevance, respected publications, and peer recognition.

Further, incentives that enhance faculty motivations, including access to equipment, material, and students that would support the individual researcher, are highly ranked (Ankrah et al., 2013; Franco & Haase, 2015). While publications resulting from industry collaborations occur, the perception that intellectual property and company review could lengthen and possibly limit the project and the publication process (Birx et al., 2015) could demotivate the faculty. Faculty acceptance of these extra steps and increased time requirement may indicate that faculty members

understand the value of collaboration with industry either from an individual or organizational perspective.

Mitigation of concerns from various stakeholder perspectives is essential to the design of successful strategy implementation. Faculty members worry that their academic freedom and responsibility for widespread knowledge dissemination will be compromised (Alfred, 2006). Should publication or patenting be delayed due to industry participation, their data, knowledge, or useful information could become obsolete (Ankrah et al., 2013; Franco & Haase, 2015; Tartari et al., 2014). Faculty also worry that the time and effort it takes to cultivate a successful university-industry interaction will detract from their mission of teaching (Ankrah et al., 2013). This worry is particularly likely for female faculty members who already must expend additional effort to achieve the same ranks as their male counterparts (Tartari & Salter, 2015). Even if faculty concerns resolve, promotion and tenure policies and requirements rarely reward faculty for university-industry interaction (Franco & Haase, 2015).

External stakeholders have their concerns that create a barrier for university-industry interactions. Industry players have concerns about losing confidential information, compromising their competitive edge (Ankrah et al., 2013; Tartari & Salter, 2015). Industry players also worry if a university will perform quickly enough to keep up with a product development schedule (Ankrah et al., 2013; Franco & Haase, 2015). Ford (2015) noted this trend in his attempts to hire faculty members directly from their industry positions (Birx et al., 2015). However, he asserts that hiring academically qualified candidates with industry experience is worth the investment as a practice that helps to bridge the two worlds.

As a policy development stakeholder, the government has facilitated university-industry interactions through funding agencies such as the National Science Foundation, National Institute of Health, or the Economic Development Administration. Through a series of mandates, the facilitation can be successful, but there is still a gap between the knowledge produced and its application in practical application (Franco & Haase, 2015). Industry values competitiveness in product development which creates a dilemma for government agencies that struggle to provide meaningful non-monetary and competition-agnostic incentives (Franco & Haase, 2015). This competitive landscape limits the government's ability to offer meaningful inducements that drive university-industry interactions. For the past sixty years, traditional funding for basic research through agencies such as the National Science Foundation has shifted toward applied research and experimental design. Still, traditionally funded research has not declined enough to entice faculty to consider other funding sources such as industry(National Science Foundation, 2018b, 2018a). I assert that policymakers at the federal and state levels have successfully navigated a career in the very system they are being asked to improve, which may skew their perspective on what changes are needed (Heifetz et al., 2009).

Intermediary organizations, such as technology transfer offices, are one way to bridge the cultural divide between industry and universities. Intermediaries are technology translators between the two types of organizations, such as a university and industry partner. Intermediaries have a highly tuned-in understanding of industry and university motives, giving intermediaries a better perspective in developing effective incentives (Ankrah et al., 2013). However, I assert that intermediaries allow both organizations to ignore necessary market corrections, which is vital if higher education remains competitive in a changing marketplace.

The types of activities that faculty can and will leverage in the collaboration and the personality characteristics of each faculty member can help identify which faculty members are likely to embrace and benefit from such partnerships. Franco & Haase organize interaction channels for faculty into four categories: traditional, services, bi-directional, and commercial (2015). Examples of traditional interactions include publications, recruitment, and joint supervision of student thesis. Services include product testing and participation in industry boards. Bi-directional interactions include basic and applied research, and commercial interactions include academic startups. Female faculty are more likely to engage in traditional industry interactions than other categories (Tartari & Salter, 2015). Female faculty patent at 40% of the rate of their male counterparts and are half as likely to serve on executive industry boards (Tartari & Salter, 2015).

While much of the literature focuses on university-industry interactions' individual or organizational motivations, Tartari, Perkmann, and Salter (2014) take a social-psychology approach to the subject. Their social comparison theory suggests that the intradepartmental and local social contexts are better predictors of successful university-industry interactions than individual characteristics. The study finds that tenured faculty are less likely to engage with industry because the system that formed their careers discouraged that type of interaction. Faculty with industry background experience have a higher likelihood of interacting with industry. Furthermore, a lack of female peer role models is one reason cited for a lower engagement of women faculty (Tartari & Salter, 2015). It explains why personal monetary gain holds little value as a motivator (Franco & Haase, 2015). This assertion creates a barrier to implementation. If tenured faculty are less likely to engage due to the system that they navigated throughout their

career (Tartari et al., 2014), and these faculty are highly influential in shaping the pathways of early-career faculty (Ankrah et al., 2013), then those early-career faculty are being guided by an obsolete system.

Suppose the local context of the university drives the motivation for university-industry engagement. In that case, Lam proposes a categorization of faculty that can help understand a faculty group perspective on university-industry collaborations (2011). Lam categorizes faculty into pure traditional, pragmatic traditional, hybrid, and entrepreneurial (Lam, 2011). A pure traditional faculty is unlikely to engage with industry. The pure traditional faculty member believes that industry and academia should remain distinct and separate. A pragmatic traditional faculty member believes that industry and academia should be distinct and independent, but they are willing to engage with industry to support their academic motivations. A hybrid faculty member believes in collaboration and its use to advance their research. An entrepreneurial faculty member integrates tightly with industry for commercialization and application. These faculty members become the next generation of leadership in the university system. This model of motivation is only from the perspective of the university. A similar exploration of industry player types and perspectives should occur if micro-level constructs are the key to successful university-industry interactions.

1.5.2 Strategy Implementation and the Importance of Support from Stakeholders

Broad support is a critical component of implementing a new strategy in any organization. External stakeholders who would like to influence higher education believe that their organizational experience will transfer to a higher education setting, but those experiences do not

transfer as readily as they would like to the situational and perennial drivers of higher education (Alfred, 2006; Morrill, 2010). The partnerships between industry and higher education suffer from ineffective incentives, asymmetries of information type and sharing, and contradictions in motivations (Kenney & Patton, 2009). One way to overcome these barriers is to build support to augment mandates and incentive programs (McDonnell & Elmore, 1987).

Though a singular, agreed-upon definition does not exist, social capital broadly refers to the values that relationships can bring to various communities and collaborations (Claridge, 2004; Condeluci, 2014; Jongbloed et al., 2008; Metcalfe & Fenwick, 2009; Perkmann et al., 2013; Tartari et al., 2014; Tartari & Salter, 2015). Similarities exist in categorizing different types or forms of social capital into cognitive and relational categories (Al-Tabbaa & Ankrah, 2016; Steinmo & Rasmussen, 2018; Villani et al., 2017). Social capital can take the form of shared experiences, similar interpretations of topics, personal relationships, and shared goals. Those shared experiences, personal relationships, and shared goals can create a framework across an organization that can help to support new initiatives. Building social capital with existing relationships can ease tensions between industry and university collaborators (Jongbloed et al., 2008; Steinmo & Rasmussen, 2018).

Cognitive social capital refers to shared interpretations, systems, languages, and cultural codes (Steinmo & Rasmussen, 2018). With cognitive social capital, shared knowledge is easier to impart (Steinmo & Rasmussen, 2018). Relational social capital develops through personal interactions and shared experiences (Al-Tabbaa & Ankrah, 2016; Steinmo & Rasmussen, 2018). For instance, alumni that are now in industry or faculty that bring their network from industry to their academic role can initiate collaborations.

Social capital is unique to each engagement and changes across time and relational phases. Given the differences in culture, common language, and motivations, it is often a struggle for collaborators to achieve cognitive social capital in the early stages of a collaboration (Al-Tabbaa & Ankrah, 2016; Jongbloed et al., 2008; Metcalfe & Fenwick, 2009; Steinmo & Rasmussen, 2018; Villani et al., 2017). Instead, early collaborations or less mature organizations rely heavily on pre-existing relationships that develop relational social capital (Al-Tabbaa & Ankrah, 2016; Bodas Freitas et al., 2013; Metcalfe & Fenwick, 2009; Steinmo & Rasmussen, 2018; Villani et al., 2017). As depth and breadth of collaborations build over time, cognitive social capital emerges, also reported in mature university and industry collaborations (Bodas Freitas et al., 2013).

Universities and industry enlist the help of intermediaries to help navigate conflicting missions and the task of building social capital and shared experiences (Al-Tabbaa & Ankrah, 2016). Intermediaries could be technology transfer offices, university incubators, and research centers (Villani et al., 2017). As social capital builds, the need for an intermediary can decline but could surge in the effort again if collaborations start to stall or if collaborators are facing contradictory or hard-to-fill mandates (Kenney & Patton, 2009; Villani et al., 2017). In strategy implementation efforts for university-industry models, universities use various mechanisms to avoid changing the academic culture, norms, and communication styles. Intermediaries are an example of a valuable tool in bridging culture gaps to collaborate; however, an intermediary translator allows both industry and academic partners to resist a shift in their operations. Pre-existing relations have a previously built store of relational social capital which is critical for a collaboration (Al-Tabbaa & Ankrah, 2016; Bodas Freitas et al., 2013; Claridge, 2004; Kenney & Patton, 2009; Metcalfe & Fenwick, 2009; Steinmo & Rasmussen, 2018; Villani et al., 2017). There

is a risk that the pre-existing critical relationships develop between the intermediary and the other two collaborators instead of a direct connection between academia and industry.

Academic publications themselves illustrate how academia perpetuates barriers to collaboration. Studies are primarily conducted from a university perspective or an industry perspective but rarely from a bi-directional perspective (Ankrah et al., 2013). University-derived literature often is written from the viewpoint of how industry can better connect to a university and puts the ownness on the industry partner to align its culture with the university system rather than a shift in culture by the university. Studies by Al-Tabbaa &Ankrah and Bodas Friedas, Marques & de Paula e Silva (2016; 2013) are examples of this suggestion where industry moves toward the university culture. Terminology, connotations, acronyms, and semantics matter when bridging two different cultures, such as industry and university (Heifetz et al., 2009). A suggestion by Steinmo and Rasmussen when addressing the challenge of common languages and codes of collaborators is for universities to partner with firms that have Ph.D. level researchers (2018). A more beneficial activity would be for academia to adopt the common languages and codes of the industry sector. The use of an academic tone and wording choices targets university researchers. Still, it would be helpful to mesh the tone and wording with the industry culture so that both communities are likely to read and absorb the literature. Industry will benefit from reading the literature but is unlikely to do so if the language norms are academic. Building cognitive and relational social capital may help to evolve the language difference.

Collaboration between university and industry would require a shift in communication from a university. Aligning visual, oral, and written communication skills is necessary to connect better with industry (Metcalfe & Fenwick, 2009). Industry does not measure its relevance by

university standards but by its ability to produce a commercially successful product from the customer perspective. Contrarily, universities have students as their product validated by the industry's willingness to employ that student (Alfred, 2006). While using an intermediary is an efficient way to collaborate, it allows university and industry collaborators to avoid working on meshing cultures.

Alignment of culture between industry and higher education is necessary to reduce the gap between the cultures. I assert that the shift should occur in moving higher education closer to the industry market it serves. Reduction of the cultural gap will allow academia to become more relevant to industry stakeholders. The willingness of universities to shift their culture, communication styles, and codified systems are crucial to making significant strides versus incremental and localized shifts.

1.5.3 Synthesis

Penn State Behrend's implementation of a university-industry strategy successfully piloted but has not yet scaled to campus-wide performance. One critical piece that hinders campus-wide implementation is a lack of understanding of motivations across various disciplines. This lack of knowledge may have led to a failure to develop enough social capital to sustain the effort through the ebb and flow of implementation.

Faculty become college leaders, which means that their successful career trajectory will shape their viewpoints as they reach senior ranking or administration. Faculty are motivated to participate in industry-engaged activities if they help them gain resources for their research, while

industry is motivated to join in university-engaged activities if it helps them become more competitive or successful financially (Ankrah et al., 2013; Perkmann et al., 2013; Seppo & Lilles, 2012). The system that developed these tenured faculty members is changing due to declining federal and state funding models (National Science Foundation, 2018b, 2018a). Data support that federal funding sources have been declining for the past sixty years. That funding for applied research is gaining support while basic research funding has declined (National Science Foundation, 2018b, 2018a). Even with the trends in funding, faculty have not felt enough of that decline to accept non-traditional funding sources and options that industry offers. This mismatch of reality supports the assertion that Behrend's traditional academic leadership and faculty are likely to work toward what they determine is their department, school, or university interest and not what may be in the best interest of university-industry collaboration.

Early collaborations between academia and industry rely heavily on pre-existing relationships (Al-Tabbaa & Ankrah, 2016; Bodas Freitas et al., 2013; Metcalfe & Fenwick, 2009; Steinmo & Rasmussen, 2018; Villani et al., 2017). As those collaborations build over time, cognitive social capital develops in shared interpretations, systems, languages, and cultural codes (Bodas Freitas et al., 2013; Steinmo & Rasmussen, 2018).

Academia resists industry engagement just by how they approach the subject (Morrill, 2010). Academic research is often studied through the lens of academia or industry but not usually a comprehensive view from both perspectives (Ankrah et al., 2013). Publications written using an academic tone and wording choice are unlikely to interest an industry partner. If research and publications read with language and tone aligned with industry norms, perhaps the research would impact both university and industry actors.

One way to bridge the cultural gap between academia and industry is using an intermediary organization to facilitate collaborations. Intermediary organizations have proven to be adept at understanding both sides of the partnership (Al-Tabbaa & Ankrah, 2016). The unfortunate piece of using an intermediary is the relationship between the university or industry and the intermediary rather than building support directly between the two collaborators. The use of an intermediary reduces the need for adaptation of university systems.

These concerns highlight the need for Behrend college leadership to all work together toward implementing the Open Lab. College leadership needs to make the case as to why the addition of industry as a stakeholder is positive. In doing so, faculty can understand the importance of considering the organization's health. Policies and procedures need to address a change in academic culture and align more closely with industry. Without leadership developing and enforcing policies and processes that support the Open Lab, concerns of declining relevancy for the broader economic community will become very real and impactful for the faculty.

Understanding the motivations of each stakeholder group of the triple helix of academia, industry, and government funding agencies is essential for strategy implementation. Understanding motivations highlights areas of similarity and difference which need to be bridged to reduce the gap in culture. Social capital can augment mandates and incentives to integrate faculty and administration with industry better. As the implementation progresses, there will be different components to the strategy which crosscuts disciplines.

2.0 Theory of Improvement & Implementation Plan

2.1 Theory of Change

By 2022, the aspirational aim of this effort is to scale the Open Lab across the Behrend College by aligning non-performative campus systems such as hiring practices, research, marketing, and industry engagement with the stated Open Lab strategy. Three drivers likely drive this effort (see Figure 3): identifying metrics to track success or failure of implementation efforts, gaining active support and acceptance across all Behrend units, and engaging the College Leadership as active advocates.

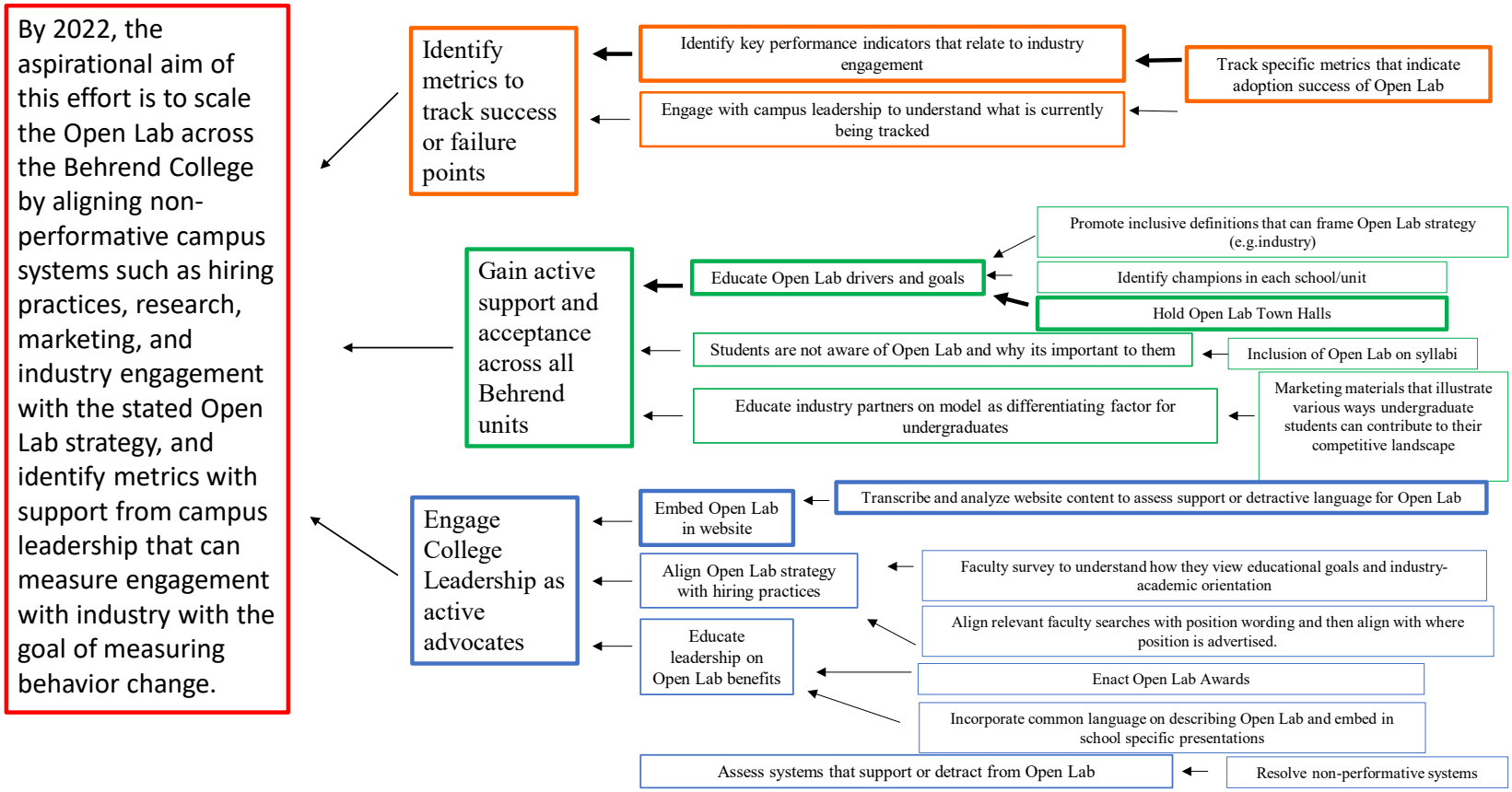


Figure 3: Driver Diagram

This dissertation aims to take the first step toward the overall aim in Figure 5 by garnering support and effect behavior change from employees across all units on campus by sharing information in a Town Hall format to layout a sense of urgency for Open Lab implementation, pilot project results, action steps for broad implementation, and desired outcomes. This project is testing the overall system for organizational change, and the effort is part of several years' efforts to scale the Open Lab across campus. This change test will address specific drivers to effect behavior change outlined in bold in Figure 3. The Open Lab Town Hall will communicate to campus employees the goals of the Open Lab to increase support and acceptance of the Open Lab across all Behrend units. Following the Town Hall, metrics will look for indications of behavior changes. For example, changes in the website content help to understand how the wording and concepts of the Open Lab are being translated and embedded by different units, which will indicate how the leadership of other departments engages as Open Lab advocates. To consider how to move toward the aspirational aim of this project, we can look to several theories that support the effort of organizational change, specifically Schein's Culture Framework, Kotter's 8-step change model, and Kirkpatrick's model of training evaluation.

Schein asserts four characteristics of culture that affect (Schein & Schein, 2017) the conceptualizing organizational change efforts. Structural stability refers to how culture provides a stabilizing factor for an organization that offers its meaning and predictability and defines itself. Higher education has hundreds of years of developing a culture of education of creating the most educated and well-rounded citizens (Labaree, 1997). The shift to include a university-industry strategy will destabilize the structure that defines this group, and there will be a period of anxiety. While schools at Behrend may have different levels of comfort with an industry voice, the faculty strives for the familiar's stability when it comes to promotion and tenure or the qualifications of

new hires. The second characteristic is the depth of the culture, which is often an unconscious existence of the culture in a group. The breadth of the culture is the third characteristic which covers how culture embeds across operational functions of the organizations. In higher education and, specifically, Behrend, it would include budgeting, promotion & tenure, and hiring policies. The breadth of culture is often space where we can observe non-performatives. For example, Behrend expresses a desire to increase external funding. Still, the School of Humanities and Social Sciences does not allow faculty to have purchasing cards for supplies. The administrative assistants of that school do not have responsibility for post-award support of grants. In essence, we desire a culture that values external funding, but the operational support of that culture lacks in that school. Lastly, culture is a pattern or integration where the ritual, climate, values, and behaviors together. For example, advertisements for open faculty positions at Behrend typically occur in two places: higheredjobsonline.com and The Chronicle of Higher Education. This pattern is an example that supports a culture that sways searches toward traditional academics. If the culture shifted to value industry-based faculty members, then practices such as this will have to be interrupted.

According to Schein (2017), there are three levels of culture. Artifacts are the visible structures and processes that give the culture power. Examples would be the internal and external communications that espouse our values and the promotion and tenure policy documents. These artifacts support the strategies, goals, and philosophies which comprise the second level of espoused beliefs and values. At the heart of the culture is the third level of underlying assumptions common for the organizational culture. Underlying assumptions are beliefs and perceptions that are unconscious and taken for granted that they are nondebatable. When the espoused beliefs and artifacts align with the underlying assumptions, that alignment further embeds the culture. Efforts to change the culture, such as the Open Lab university-industry strategy, will require Behrend to

reexamine some basic assumptions and change some of the more stable portions of our structure. Schein & Schein (2017) refer to this as "frame-breaking." This reexamination will be particularly difficult for the College's leadership, whose challenge is to change a culture in which their career has thrived. However, this challenge will be necessary to avoid incongruence between our strategies and espoused values, artifacts, and underlying assumptions.

The crux of the issue is that the external environment that allowed for a higher education culture is shifting, as discussed in chapter 1. The sands underneath those assumptions are changing, forcing a culture shift--though higher education has been successful in resisting any significant culture shifts of adding external voices in any meaningful way (Morrill, 2010). The length of higher education culture existence and the paradigms taught to newer members creates an environment that is difficult to shift. Still, the College that can adapt will be more successful in the new, evolved environment.

Kotter's (2018) theory on leading change involves eight steps which appear in Figure 6. The first step is to create a sense of urgency. Both faculty and staff need to understand how the framework in which higher education operates is shifting, requiring a culture shift. Kotter (2018) argues that only 10% of change efforts succeed and that a common factor is success in communicating an urgent need for action. The shifting environment in higher education drives the need for new strategies such as the Open Lab not resonating with Behrend's faculty, staff, and administration. Outside of the few champions of the Open Lab, most faculty and staff appear to be indifferent about the Open Lab. Communicating the vision for change from leadership is critically important in creating an environment that motivates the organization to undertake the culture change, followed by the difference in the systems that manage the functions of the organizations. While the leadership communicates a vision, day-to-day processes must follow, including

planning, budgeting, organizational charts, staffing, and problem-solving. If the vision is not clearly and consistently communicated, the organization will seek new leadership that aligns more with the stable culture of familiarity Schein cautions about (2004). This shift toward familiarity occurred with the change at the leadership level of Behrend, who have mixed levels of urgency regarding the Open Lab.

Figure 4: John Kotter's 8-Step Process for Leading Change (Kotter, 2018)

As the communication campaign is a professional development effort, to assess the effectiveness of this initiative, we turn to Kirkpatrick's model of training evaluation (Kirkpatrick & Kirkpatrick, 2016), which considers professional development on four levels:

- Level 1: How do participants **react** to the training?
- Level 2: How much did participants **learn** from the training?
- Level 3: Have participant **behaviors** changed from the training?
- Level 4: What are the organizational **results** to occur due to the training as it changes behavior?

Using Kirkpatrick's model as a guide, evaluation of the effort will occur at several levels, and Figure 5 illustrates the intervention. An assessment administered at the beginning and end of the Town Hall will gauge how the participants reacted to the Town Hall information and increased knowledge of why the Open Lab is essential to the individual and Behrend's success. Because the Town Hall assessment is tracking a singular event, it may take several weeks to observe behavior change. Different college units can experience changes in hiring, research, or marketing in the weeks following. The College’s leadership team will assess the metrics identified in Table 1 to track behavioral changes. This opportunity also will give the Leadership Team a chance to discuss the Open Lab again and identify metrics that can indicate traction in implementation.

Table 1: Metrics

Metric	Relevance	Method of Gathering	Frequency	Ease	Source of Data	Type of Data
Number of applications for Behrend's Open Lab awards are submitted		Manual Process	Monthly	Easy	Open Lab Award Program	Quantitative/ process
Perceptions of the Open Lab awards perceived from the College Leadership Team (comments, Y/N votes)	This shows engagement and types of conversations at a leadership level	Manual Process	Monthly	Medium	CLT Agenda Item	Qualitative/ driver measure
Transcriptions of landing pages of Behrend and each school for the wording of Open Lab, Learning By Doing, and industry	This shows school-specific language use	Manual process	Yearly	Medium	Web site	Qualitative/ Driver measures
The number of uses throughout Web site for Open Lab, Doing by Learning, and industry	This shows embedded language use related to industry-academic engagements	Report run by Strategic Communications	Yearly	Medium	Web site, Strat Comm Reporting	Quantitative/ process

2.2 PDSA Cycle and Timeline

The PDSA cycle had the following phases, steps, and timelines (see Appendices B and C for more details):

1. Plan
    a. Development: (9/30/20-10/31/2020) – presented suggested metrics to the College Leadership Team to discuss and identify a comprehensive

set of metrics to track. Scheduled a Town Hall event via zoom for November. Drafted proposal overview including specific plan, methods, measures, and timelines. Drafted pre-and post-assessments for Town Hall. Shared proposal with the committee and scheduled overview presentation. Sketched an outline of PowerPoint presentation with key points to make and data presentation.

b. Proposal: (10/5/20-10/25/20 with committee review and approval) – finalized proposal with Advisor, Dr. Tom Akiva, and committee members. Prepared and held proposal overview with the committee and complete an IRB.

2. Do

    a. Implementation (10/10/2020-11/30/2020) – Gathered data agreed upon by the College Leadership team as baseline data. Developed Qualtrics pre-and post-surveys and embed in a PowerPoint presentation along with other presentation materials. Created an email invite to Town Hall events and solicit support from the Leadership Team to promote the event to increase attendance. I secured technical support and background staff for Town Hall efficiency and troubleshooting. Held Town Hall event.

3. Study (12/1/2020-4/30/2021)

    a. Tracked metrics for any changes. Analyzed changes for signs of improvement, signs that improvements are at the expense of other

efforts, and assessed changes by unit. Develop recommendations and subsequent actions suggested.

b. Draft DIP chapters

4. Act (5/1/2021-5/15/21)
    a. Share Results – prepared and delivered results at College Leadership Team meeting, considered suggestions and developed future tests of change as a team. Only aggregate information will be shared.
    b. EdD Requirements – finish DiP, schedule and defend, file for graduation.

2.2.1 Planning

The Open Lab Awards at Penn State Behrend award $50 gift cards to faculty or staff who exhibit behavior that directly illustrates or indirectly supports Open Lab activities' expansion. It is a low barrier effort to give rewards to employees. The strategic plan identified a need for more reward programs for faculty and staff to provide small, morale-boosting incentives. The Open Lab Award program is also designed to encourage discussion and open dialogue of the College's Leadership Team as to what does and does not count as Open Lab support. This award is discussed regularly with the College's Leadership Team as they decide who receives the recognition from the nomination pool. The participation level of the leadership team indicates who is engaging versus complacent versus resistant in Open Lab discussion, if a sense of urgency to adopt the change is present, what questions remain, and which champions may emerge.

The Behrend Open Lab Awards were supposed to launch just after Spring Break 2020, but the effort stalled due to the serious effort required to put classes online due to the COVID-19 pandemic. The awards instead launched in July 2020. The Open Lab award program data indicates how many Open Lab nominations come in and how broadly the nominations represent all Behrend units. The leadership team discussion provides evidence for the leadership engagement levels and the types of conversations that occur.

The web pages of Penn State Behrend and the associated news articles indicate how prevalent the Open Lab strategy is and how embedded, and the intervals of communication of the Open Lab as a strategy. As Kotter (2012) indicated, it is easy to under-communicate a vision, and successful organizational change requires daily communication of the desired idea. Increased references to industry wording and collaboration on the School landing pages indicate that the Open Lab is gaining traction. If there is increase word usage on the schools' landing pages, it will show better alignment. For the overall website assessment, the strategic communications department ran a report broadly using the words across the website.

One way to ascertain engagement following the event is to include an ask in the presentation. In this case, there will be an action working group meeting within two weeks following the event where opportunities are encouraged, which creates an environment that fosters industry engagement. I will evaluate participation in the working group meeting using Kirkpatrick's level 3.

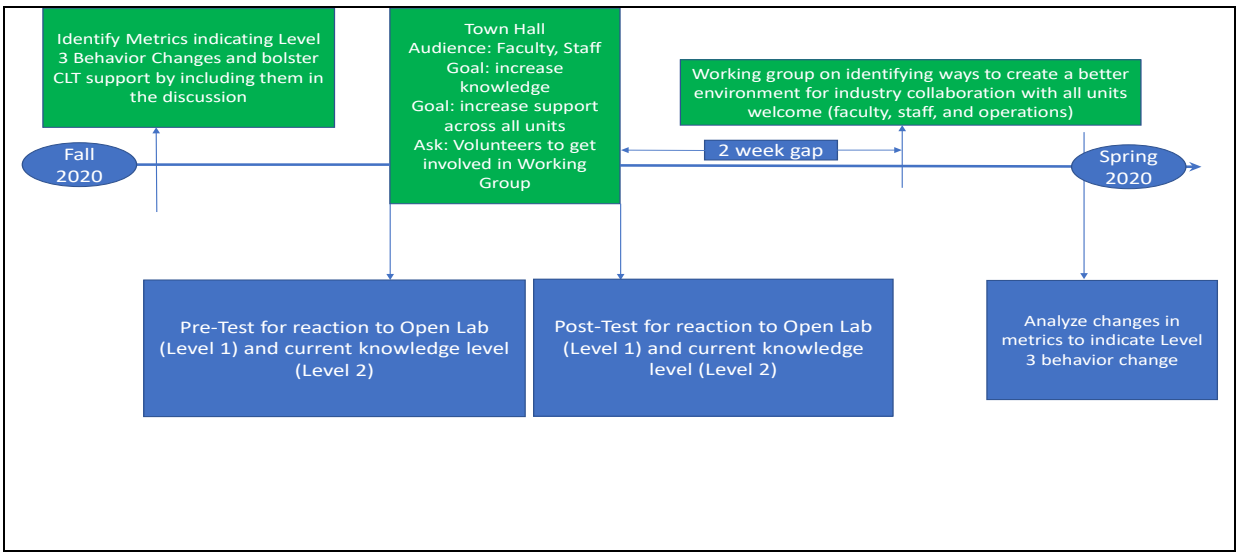


Figure 5: Intervention Map

Increased awareness, knowledge, and urgency of implementing the Open Lab can affect the success of Behrend if every Behrend employee actively champions it. With active championship by the Behrend community, employees can influence decisions at every level of the organization that will align policy, process, and procedure with the stated strategy. This Town Hall event is the inaugural effort to embed the Open Lab as an actual college-wide transformative strategy that increases its ability to attract students, advance research, and graduate better-prepared students.

2.2.1.1 Planning: Protocol and Procedures

Sampling: The Town Hall was purposely a broad, anonymous subset of Behrend stakeholders ranging from faculty, staff, and administration. In the assessment at the beginning and end of the Town Hall, one of the questions was to identify your stakeholder group and any specific school affiliation so that data could be ascertained as a whole and by stakeholder groups.

Town Halls, in-person and via Zoom, are regularly used at Penn State Behrend. Comparing Town Hall attendance indicates interest levels across topics.

Recruitment: The Town Hall was advertised broadly via email; however, additional efforts to have College Leadership promote the event in each of their units were encouraged. Behrend employs 635 faculty and staff (The Pennsylvania State University, 2020). The most popular Town Halls have seen attendance as high as 300. Because the Open Lab applies at all levels of the organization, I made an effort to reach the technical services employees who may not always be a target audience for the typical Town Hall.

Informed Consent: In the recruitment email, the purpose of the Town Hall and its role in the intervention, along with the timeframe, definitions, and consent, was described. This description included the fact that responses were anonymous and voluntary. There was little to no risk to participants. The potential benefit was an increase in knowledge and the ability to apply the Open Lab to the benefit of students, faculty, staff, and the community at large. The pre-and post-assessment questionnaire included informed consent.

Timing: After approval of the Dissertation Committee and IRB project in October 2020, implementation began. The College's Leadership Team identified a set of metrics from Table 1 to gather before the Town Hall, and the data was collected related to those metrics in October 2020. The Town Hall took place in November 2020. I administered a survey at the beginning and end of the Town Hall to understand how well employees felt like they understood the Open Lab strategy, how much it impacted their position, and how important it was to Behrend. The Town Hall concluded with a request for participation in a working group session in two weeks that identified opportunities to increase the number or quality of external engagements. Behavior change indications could include the number of participants, their job

classification, and the types of discussions. The agreed-upon set of metrics were followed in October through January to assess any impact of the Town Hall information. Data analysis, sharing of the results, and decisions about the next steps took place between November 2020 and April 2021.

2.2.1.2 Planning: Methods & Measures

The effort involved observation of faculty, staff, and administration for behavior changes resulting from an information campaign during the fall of 2020. This campaign included observation of a rewards program and level of engagement from college leadership, a Town Hall presentation, survey, and a focus group. The desired learning outcome is increased active inclusion of the Open Lab in Behrend practices across all units.

In reviewing the driver diagram, this test of change accomplished success if increased knowledge occurred and observed behavior changes occur. Indirect measures such as stakeholder interviews and surveys assessed a baseline for perceptions and existing support for the Open Lab. Indirect measures of trends of grant activity and expenditures assessed the funding environment that drives university practices. As a recommendation for future efforts, data sources should achieve consistency from year to year. For data sources with consistency or reliability challenges, a methodology of gathering information needs to be in place to address any potential consistency issues.

2.2.2 Do: What Change Can We Do that will Lead to Improvement and Why?

Gaining Active Support and Metric Implementation

Since its inception in 2010, the Town Hall was the first campus-wide opportunity for people to hear the story of the Open Lab and why it is relevant to them and Behrend. The Town Hall messaging is an attempt to gain active support and acceptance across all Behrend units as identified by the driver diagram (Figure 3):

- Create a sense of urgency in adopting a university-industry strategy
- Increase the participants' ability to explain the Open Lab to others
- Increase the participants' understanding of the Open Lab
- Increase the participants' knowledge of how their specific College position is relevant to the Open Lab effort
- Solicit action-based implementation ideas from participants in a working group session held two weeks after the Town Hall.

The survey assessments at the beginning and end of the Town Hall were used to ascertain the level of change. These assessments are a first step to developing metrics to track success or failure points from the driver diagram (Figure 3). Appendix B lays out the questions asked and the predicted results for the difference in understanding. Following that, level of participation indicated who was willing to take action in support of the Open Lab or if they had already implemented changes to their day-to-day Behrend activities to support the Open Lab better. How strong participation represented across business units indicated broad buy-in.

The metric identification before the Town Hall used data already available, but perhaps not tracked as formally or as a trend which would have been helpful during the pilot study in the School of Engineering in 2010. This metric set was beneficial in tracking any changes, improvements but also created an opportunity to engage college leadership in the process. This data also helped identify balancing metrics where the Open Lab may be expanding to the detriment of another area. Early identification of such balance issues can quickly instigate discussions on correcting those out of balance areas.

Identifying a set of metrics from Table 1 presented an opportunity to engage the College Leadership Team as part of the discussion. It helped solidify the university-industry strategy as an overall College initiative rather than associating it with just one or two champions. During the pilot effort, the College had little formal, measurable way to chart the progress of the implementation, instead of relying on anecdotal stories and individual perceptions and experiences. Connecting facts about the College with the actual business environment helped to drive decisions. The adoption of a university-industry engagement model across diverse faculty and multiple disciplines requires good decision-making. With a heightened understanding of the data beneath the College, the leadership can make better decisions, prioritize efforts, and adjust for organizational culture differences.

2.2.2.1 Do: Data Gathering

The pre-and post-Town Hall assessments were Qualtrics quizzes in the presentation, which allowed for immediate feedback and storage of the data for download and analysis later. There was no identifying information in the assessment data other than a specific school affiliation or stakeholder group of faculty, staff, or administrator. The Qualtrics quiz was voluntary and

anonymous for those attending the Town Hall on zoom. The data was analyzed as an entire subset by stakeholder groups and by the school to assess the different acceptance levels and knowledge of the Open Lab strategy.

At the end of the Town Hall, we asked volunteers to participate in an action group meeting to identify opportunities for better engagement with industry. Ideas presented form the foundation for future improvement science efforts. Who attended helps to identify existing and future champions. This action working group participants and their ideas folded into the existing Industry Engagement Working Group that meets quarterly and encompasses over thirty individuals from many business units. One idea already in process is creating a series of discipline-specific one-page marketing briefs that bolster company visits.

Augmenting the Town Hall effort, I collected additional data in Table 1 ahead of the Town Hall event. This data can illuminate behavior change across different units of the college. The College Leadership Team reviewed the list of metrics to gain consensus and support.

2.2.3 Study: Analysis and Interpretation

The agreement of reliable and consistent data points to assess behavior change with all of the voices of the College's Leadership Team is the first step in garnering broad support for the Open Lab Strategy as well as aligning policy, process, and procedures with the strategy. For instance, the faculty survey attached in Appendix E provided the basis for discussions with school directors this spring. Discussion entailed reviewing the results and discussing the desired balance of answers they would like to achieve. I suggested incorporating the survey into their hiring process

as one of many data points to understand how the hire would affect the attitude towards industry engagement.

The change test ultimately sought to change behavior by presenting the case for the Open Lab strategy, the pilot project, and different data results from that pilot. The Open Lab strategy was discussed consistently in other formats and smaller groups but failed to reach a firm understanding with the stakeholders of faculty, staff, and administrators. The Town Hall provided a comprehensive explanation of the effort to a large number of stakeholders. Ultimately, the change test gauged its level of results, Kirkpatrick's Level 4, for evidence of positive change. Examples include:

- Faculty respond to funding opportunities presented or actively seek projects through their professional networks, increasing research submittals.
- Class syllabi and classroom lessons will include elements of The Open Lab.
- Town Hall attendees reported an increased understanding of the Open Lab and an increased ability to explain the Open Lab to others.
- Leadership understands the value of industry-experienced faculty, which influences: the language of faculty positions in advertisements, advertisement placement choices, or how industry-experienced applicants progress through hiring processes.
- The University-industry strategy aligns with the department, school, and College-wide strategic plans.
- The survey sent to faculty in November 2020 on their views on university-industry engagement sees higher response rates or responses increasing in favor of industry collaborations than when sent in Spring 2020.

- The Open Lab awards see increasing monthly numbers of nominations and a broader representation of nominations and nominators across business units.

I gathered baseline data ahead of the Open Lab Town Hall that occurred in November 2020. During the Town Hall presentation, a pre-and post-survey was administered as part of the Town Hall presentation to gauge differences in understanding of the strategy and its implications at the individual and College levels. The Town Hall concluded with a request for volunteers to meet two weeks following to discuss opportunities for improvement for industry engagement. Following the Town Hall presentation, the metrics indicated any change in support, more or less, for the College's university-industry interaction. The metric development not only supports a specific piece of the aspirational AIM statement, but it will also support the AIM statement broadly as it moves forward.

3.0 Results

3.1 What Effect, if any, Did the Town Halls have on Employee Understanding and Acceptance of the Open Lab?

The Town Hall occurred two times, November 16th and November 17th. A total of 123 attendees attended in addition to the panel of presenters (9). These attendees represent 27% participation for faculty, staff, and administration. Participants logged on strong for the first 50 minutes but dropped off in the last ten minutes of the Town Hall during the question period and post-survey. Even with the reduced participation, 83% of participants stayed within the last ten-minute section, and 80% remained within the final six minutes during the post-survey.

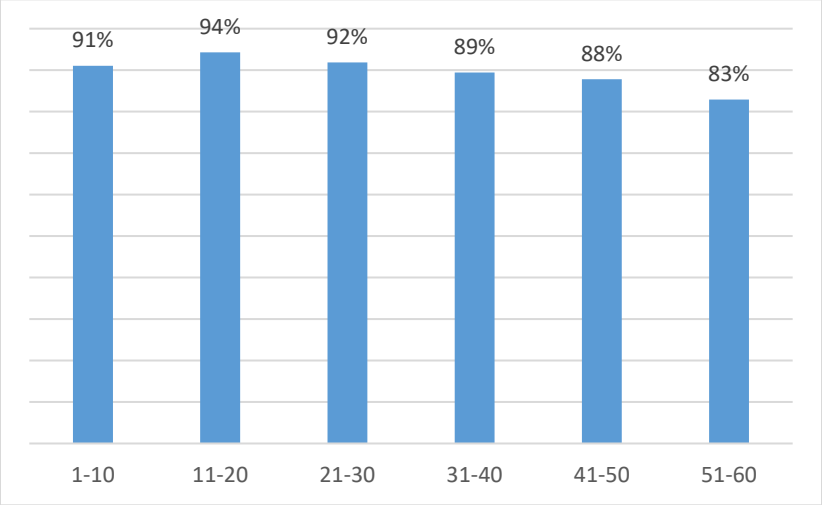


Figure 6: Percent of Participant for Each 10 Minute Timeframes of the Town Hall

During the Town Hall, a poll asked, "Where do your students go after graduation?" Results are shown in figure 7.

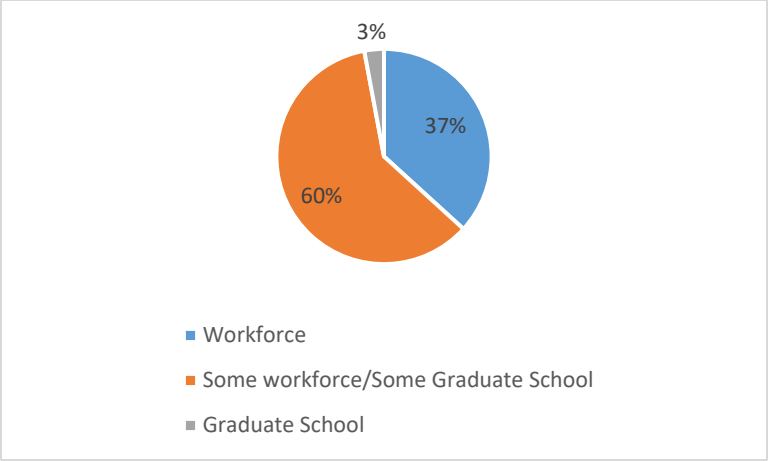


Figure 7: Where Do Your Students Go After Graduation?

Following a slide that explained the definition of “industry” and why Behrend chooses to use it to describe a collective of organizations grouped by their primary activity, a second poll question asked, “How would you prefer to refer to the collective of external voices for the Open Lab? Currently, we refer to it as "industry.” Seventy-four participants responded with just over half preferring the term industry, as illustrated in Figure 8. There was an option for additional suggestions in the chat. Two chat participants suggested external stakeholders, another proposed community-based organization, and another recommended external partners.

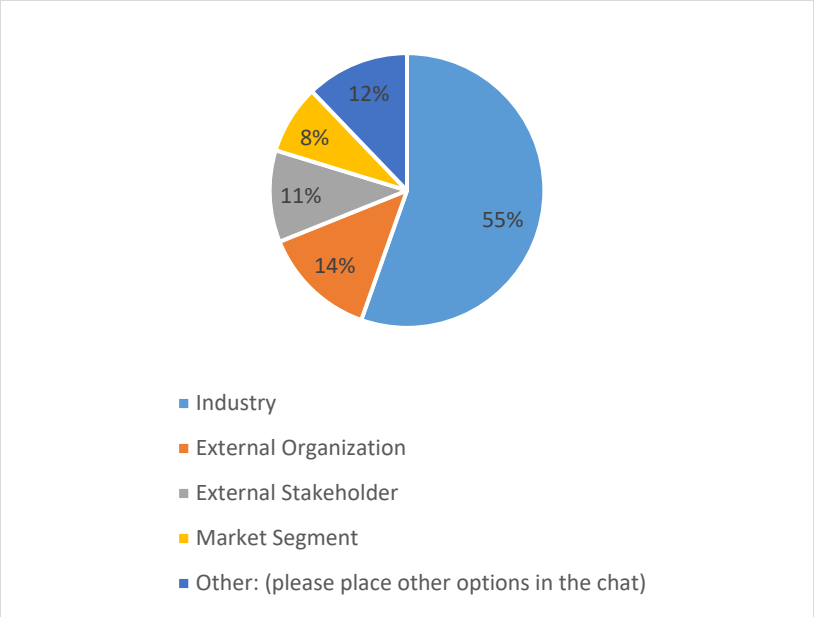


Figure 8: How to Refer to a Collective of Organizations Grouped by Their Primary Activity

In both the pre-and post-Town Hall surveys, the question was asked, "How well do you think you could explain the Open Lab to a stakeholder?" The pre-test reported 128 answers, while only 78 participants answered the post-test. Overall, as shown in Figure 9, responses were, on average, higher at post than pre (3.79 at post versus 3.02 at pre). However, it is difficult to understand whether the "slightly able" and the "no ability" participants did not participate in the post-survey or if they shifted to the "high ability" or "very able" and "moderately able" group. I captured IP addresses in anticipation of understanding pre- and post-Town Hall answers per individual. One limitation discovered using Penn State zoom is that the IP addresses are not specific to a person.

To test the difference between pre-and post-Town Hall surveys, I used an independent samples t-test. I used the 2-sample test because we couldn't tie exact answers of pre-and post- to specific participants due to the IP address limitation. I used the unequal because, upon

examination, the variances were notably different. The two-sample assuming unequal variances t-test conducted was to compare participant ability to understand the Open Lab strategy enough to explain it to another stakeholder. There was a significant difference in the scores for pre-Town Hall ability (M=3.02, SD=1.30) and post-Town Hall ability (M=3.79, SD=.055) conditions; t(203)=-5.87, P = 1.73465E-08. The mean of "post" is higher than the "pre" with a much tighter variance. These results suggest that more participants were on the same page and better-informed post-Town Hall. The effect size using Cohen's D[1] is .77, meaning that the presentation had a strong effect overall. At the end of the Town Hall, a request asked for participation in a Focus Group that would occur two weeks post-Town Hall. Of the Town Hall attendees (123), twenty-one people attended the Focus Group, representing 17%.

[1] Cohen's D is a measure of effect size. Cohen's d of about .2 is a small effect, at about .5 a moderate effect, and at about .8 a strong effect. The Cohen's D in this study was calculated using an online tool at https://www.socscistatistics.com/effectsize/default3.aspx

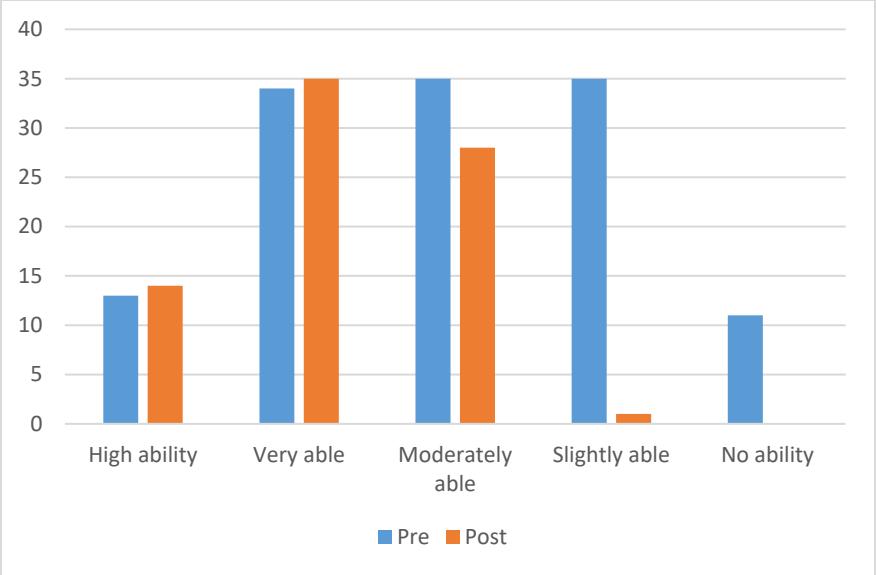


Figure 9: How Well Do You Think You Could Explain the Open Lab to a Stakeholder?

Figures 10 and 11 breaks the results down by staff and faculty responses. The administration participants were too few to be statistically significant.

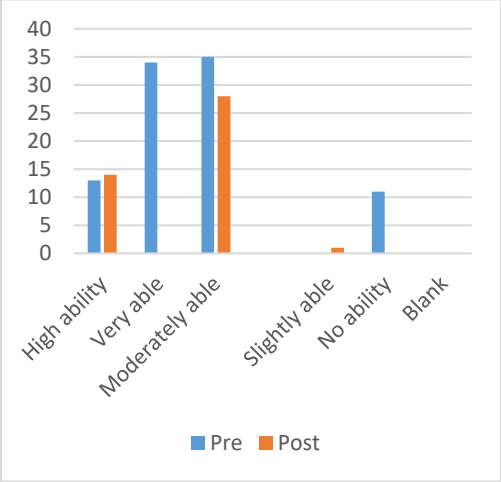


Figure 10: Staff Ability to Explain the Open Lab

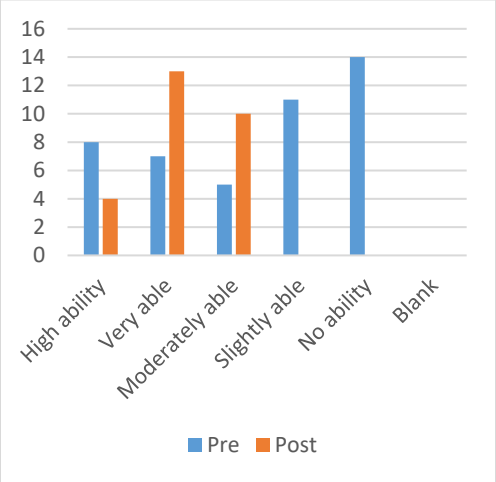


Figure 11: Faculty Ability to Explain the Open Lab

For the staff, a two-sample assuming unequal variances t-test compared staff participant ability to understand the Open Lab strategy enough to explain it to another stakeholder. There was a significant difference in the scores for pre-Town Hall ability (M=2.85, SD=1.09) and post-Town Hall ability (M=3.51, SD=.039) conditions; t(119)=-4.33, p = 3.19E-05. The mean of "post" is higher than the "pre" with a tighter variance. These results suggest that more participants were likely on the same page and better-informed post-Town Hall. The Cohen's D is .80, indicating that the presentation had a more substantial effect on staff than the overall participants.

For the faculty, A two-sample assuming unequal variances t-test compared faculty participant ability to understand the Open Lab strategy enough to explain it to another stakeholder. There was a significant difference in the scores for pre-Town Hall ability (M=3.2, SD=1.71) and post-Town Hall ability (M=4.19, SD=.056) conditions; t(72)=-4.20, P = 7.66564E-05. The mean of "post" is higher than the "pre" with a tighter variance. These results suggest that more participants were on the same page and better informed post-Town Hall. The Cohen's D is .78, indicating that the presentation had a similar size effect on overall participants.

In the pre-survey, participants assessed their understanding of the Open Lab Strategy. In the post-survey, participants considered if their level of understanding improved due to the Town Hall. The results are in Tables 2 and 3. 87% reported drastic or some improvement following the Town Hall. The Administration numbers show 100% reporting some improvement after the Town Hall, but between the pre-question in Table 2 and the post-question in Table 3, administration participation dropped from 7 to 2.

Table 2: How Well Do You Believe You Understand the Open Lab Strategy of Behrend?

	All	Staff	Faculty	Administration
High understanding	9%	8%	13%	0%
Very well	24%	24%	20%	57%
Moderately well	32%	30%	33%	43%
Slightly well	27%	29%	27%	0%
No understanding	8%	9%	7%	0%

Table 3: Did This Town Hall Improve Your Understanding of the Open Lab Strategy?

	All	Staff	Faculty	Admin
Drastic improvement	31%	42%	16%	0%
Some improvement	56%	56%	55%	100%
Average	6%	2%	13%	0%
Little improvement	1%	0%	3%	0%
No improvement	5%	0%	13%	0%

In the pre-survey, participants characterized the relevance of the Open Lab strategy to their position at Behrend. In the post-survey, participants assessed whether they planned to make any changes to how they performed their job due to the Town Hall. Figures 12 and 13 show those results.

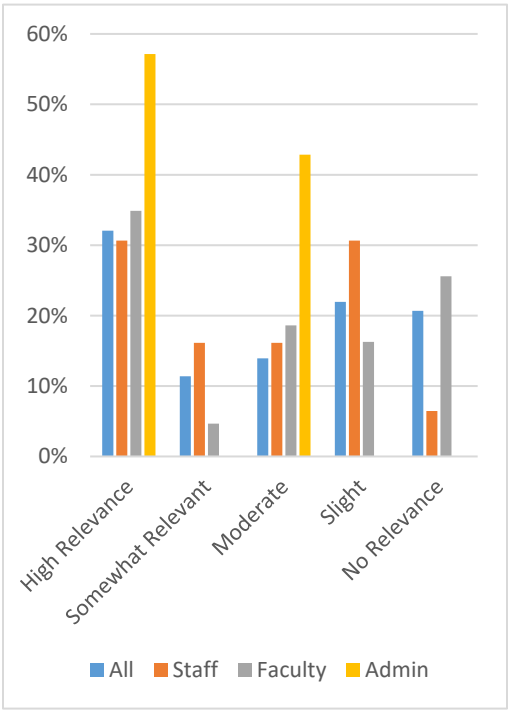


Figure 12: How Would You Characterize the Relevance of the Open Lab Strategy in Your Position at Behrend?

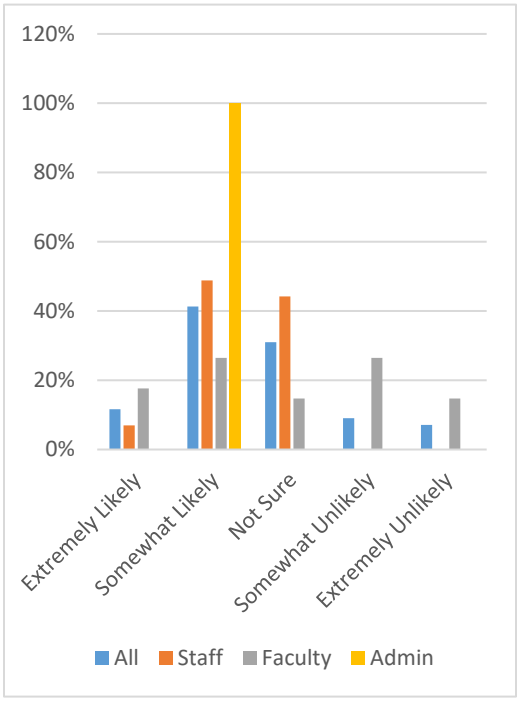


Figure 13: Do You Anticipate Making Any Changes to Your Job or Class Lessons as a Result of the Information

3.2 Did the Town Hall Affect the Usage of Open Lab or Similar Terms on the Web Presence of Behrend?

Following the Town Hall, data points indicate changes in behavior possibly attributable to the event. Increases in word usage such as “Open Lab,” “Learning-By-Doing,” “Industry (or Business),” and “Applied (or Real-World)” indicate congruence of the artifacts and the espoused

beliefs. These words and phrases increased by a count of five from November 17, 2020, to February 6, 2021. All these instances occurred on the Behrend home page, as seen in Figure 14.

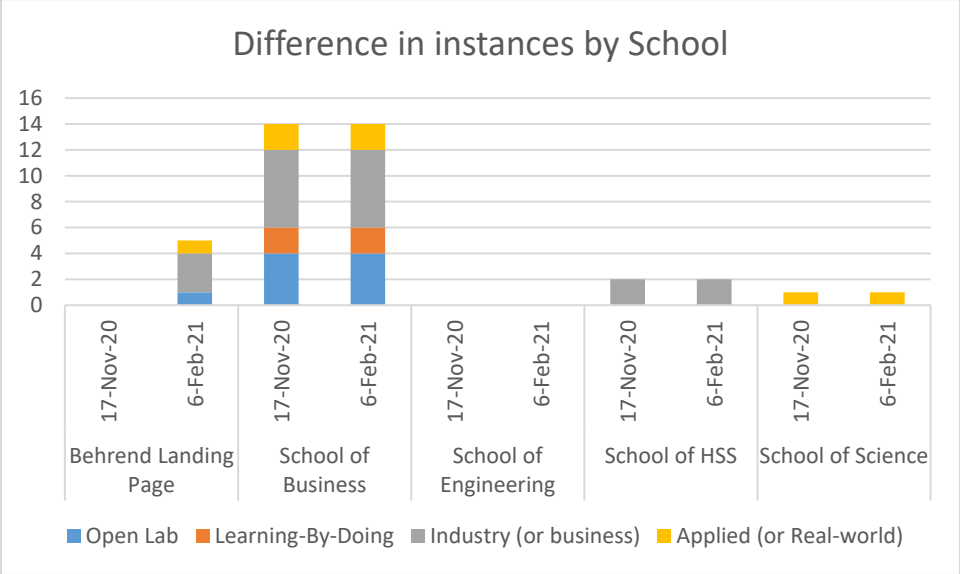


Figure 14: Differences in Instances Found on Web Pages by School

The Knowledge Park web pages within the Behrend website leveraged counts for the words "Open Lab," "Learning-By-Doing," Innovation Through Collaboration," "external," and "industry." The scan occurred before the Town Hall event (November 19, 2020) and after (February 19, 2021). There was an increase in instances by almost double, as seen in Figure 15. The Business School-specific instances of "Learning-By-Doing" and "Innovation Through Collaboration" were not present. Interestingly, the cases for those exact words across all Behrend web pages, profiles, photos, videos, news stories, and publications yielded only a 3% change from

pre- (1423) to post-(1462)Town Hall, with the majority of that change coming from increased use of the word, “industry” in news stories and publications.

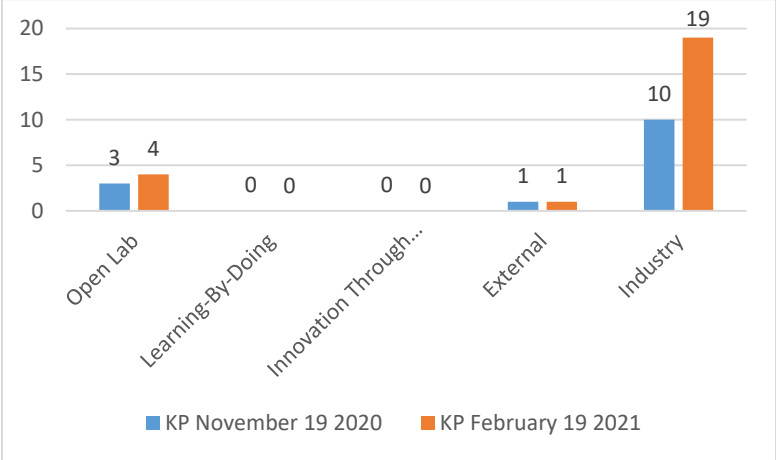


Figure 15: Instances of Usage in Knowledge Park Website

3.3 How Have the Open Lab Award Participation and Leadership Discussions Evolved?

The Open Lab award program began in July 2020 to stimulate campus discussion about Open Lab and encourage discussion within the College’s Leadership Team. The Open Lab Awards yielded a variety of winners from a broad subset of campuses. Figure 16 shows the number of nominees and nominators as the months progressed. Figure 16 shows the breakdown of the nominators, and Figure 17 shows the analysis of nominees. There were twelve unique people as the nominators.

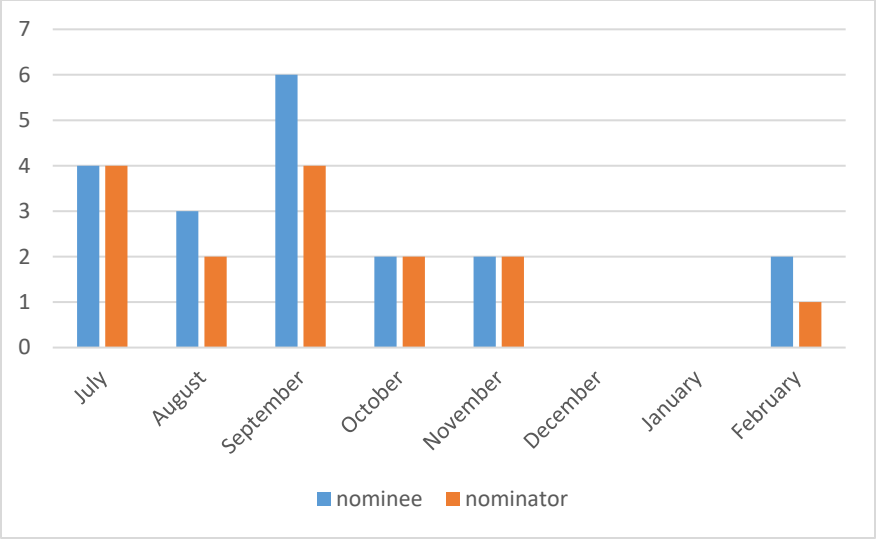


Figure 16: Open Lab Awards Participant Numbers

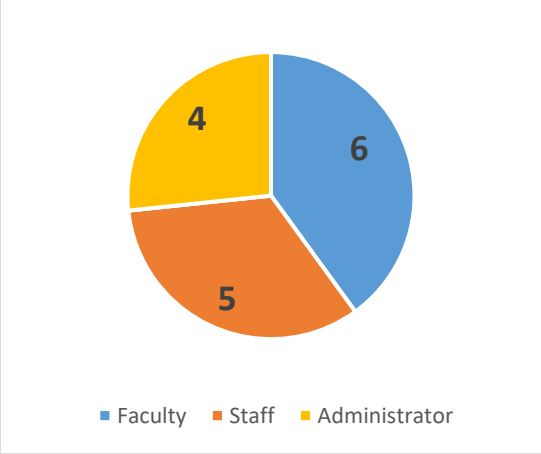


Figure 17: Nominators

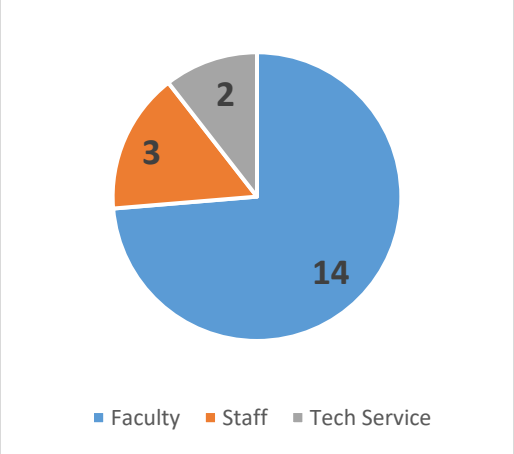


Figure 18: Nominees

The College's Leadership team had nine opportunities to engage in this effort through voting in the Open Lab Awards program, Town Hall attendance, and attendance at the focus group. In tables 2 and 3, the administration's participation dropped from 7 in the pre-survey of the Town Hall to 2 in the post-survey. As categorized on the Behrend website, the six academic leaders include the Associate Dean of Academic Affairs, Associate Dean of Research & Graduate Studies, and the four school directors. Externally facing non-academic leadership include Strategic

Communications, Athletics, Enrollment Management, Development & Alumni Relations, and Human Resources. Internally facing non-academic leadership include Finance, Operations, Registrar, and Administration & Student Affairs.

The externally facing non-academic leadership relies heavily on perceptions of higher education and Behrend to reach their goals. Internally facing non-academic administration success depends on what occurs internally to campus that affects the success of our students. Figure19 shows the average participation of these three subsectors. Figure 19 does not include the Chancellor or Senior Director of Corporate Strategy as they drive this effort, and their inclusion could skew the numbers.

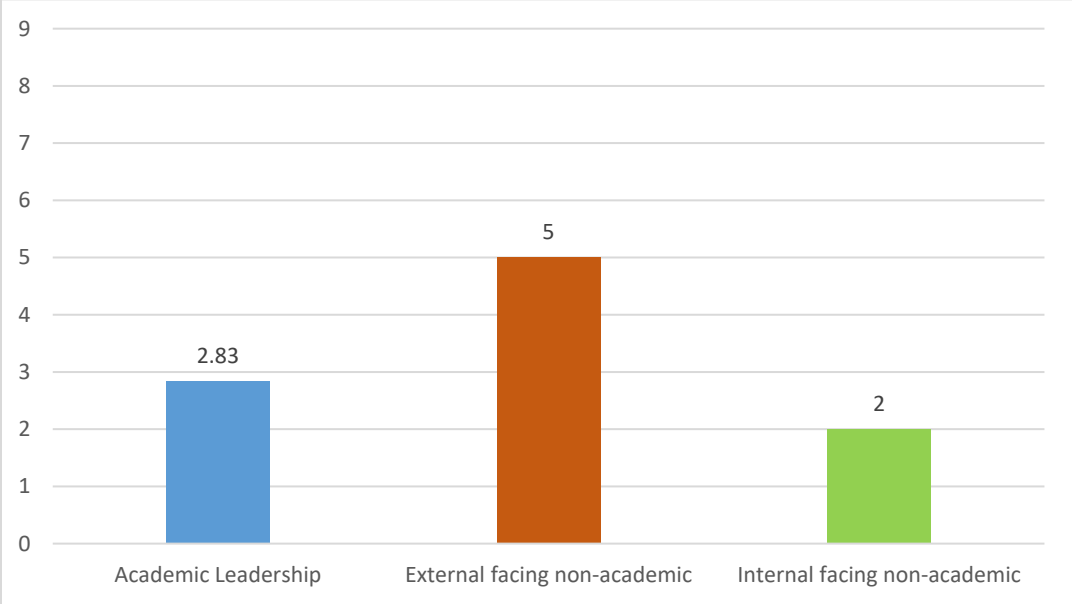


Figure 19: College Leadership Participation Average in Effort (Minus Chancellor and Senior Director of Corporate Strategy)

4.0 Learning and Actions

4.1 Discussion

The change test ended up not being as much about whether the scaling of the Open Lab will be successful; instead, it was more about identifying pathways to move forward that will be more efficient and effective than others. Understanding the level of effort required to effect change and where that effort makes sense in a targeted approach will be more likely to encourage adopting the Open Lab strategy. I learned lessons about communication strategies, instilling a sense of urgency for action, and the support of leadership that drives management.

The Town Hall was one crucial piece of an information campaign occurring in the Fall of 2020. There was an effort to create a burst of communications about the Open Lab, whether on topics of the strategic plan, the Open Lab Awards program, the Town Hall, or the action working group. The Town Hall post-survey showed that 87% of the attendees reported drastic or some improvement in their understanding of the Open Lab. Participants said 53% were extremely or very likely to change some aspect of how they perform their job responsibilities due to the Town Hall. Faculty, specifically, reported 43%, and staff reported 56% as likely to incorporate the Open Lab into their daily responsibilities. The statistical analysis showed that the Town Hall was influential in more participants reaching a similar level of understanding with staff more affected than faculty or administration. The question is whether that increased knowledge resulted in

behavior change. I assessed changes in evaluating the Open Lab Awards program and website uses of relevant words or phrases.

The Open Lab Awards not only are in place to reward university-industry activity, but they support a desire in the strategic plan to create different reward systems for employees to boost morale. After the strategic plan development effort concluded and the daily communication of efforts to push the Open Lab Award eased a bit, nominations quickly reduced. For example, there were no Open Lab Award nominations in December, January, or February. The Open Lab Awards are a low barrier method of keeping the Open Lab in front of the Behrend community. It is unlikely worth putting a tremendous amount of effort into communicating this program. Still, it is valuable as a low effort/low barrier/low reward program to keep the Open Lab in play for various units across campus.

In one instance, several gift cards ($200 each) went to the entire landscaping crew for indirectly supporting the Open Lab by creating an environment in which Open Lab visitors had a pleasant first impression of the campus. Their unit decided to purchase Open Lab Award Winner t-shirts for the entire crew. The t-shirt was a small way of showing solidarity with a business unit that one would not typically expect to participate in. The team very much appreciated this small gesture and recognition according to their supervisor. The supervisor was also included as a speaker in the Town Hall to be inclusive of all business units. The supervisor has since talked with some of their vendors about ways to impact student learning through the Open Lab and encouraged recruiting research and outreach activities. He has referred three vendor companies to me for further discussion of collaboration. These referrals support a strategy where a more targeted approach to communication seems to bring about change more effectively. Since the Open Lab's inception, there have been targeted approaches with faculty and specific leadership led by the

Chancellor or myself. Still, these efforts have been more aligned with a strategy of grouping together people for a project or who naturally are inclined to think the same way about the subject of university-industry engagement. This cultivation with the maintenance and operations department shows the success of the targeted approach on a unit of campus that doesn't naturally see themselves or their work with the success of the university-industry strategy.

The Corporate Strategy department launched a targeted communications effort with two Humanities and Social Sciences faculty members over the past several years. This group has been historically resistant to the phrasing of the Open Lab and the influence of external voices in student education. Professor Chris Shelton fully embraced the Open Lab, and efforts to support his externally facing virtual and augmented reality lab have been very successful. Professor Lisa Jo Elliott is now heading up the application development side of Behrend's Innovation Commons. Both of these faculty members can now try to enlist additional faculty from the School of Humanities and Social Science with a long-term goal of creating a critical mass of support from faculty.

Following the communication campaign, which included the Town Hall, a snapshot of the use of the targeted words (Open Lab, industry, Learning-By-Doing, etc.) revealed that usages of these words and phrases did not increase by any substantial amount. The only page that changed content was the Behrend home page which added seven mentions. The Behrend website shows that an overwhelming majority of support of the Open Lab comes through actual news articles. Strategic Communications writes these stories and has the responsibility for the home page.

Strategic Communications has been a champion of the Open Lab strategy since its formalization in 2010.

At the end of the Town Hall, one of the suggested ways that faculty and staff could support the Open Lab was to assess their web pages to incorporate language that supports that strategy. None of the four schools changed their content other than new articles. It could be that content is not often adjusted on the school home pages other than recent articles. It is also possible that during the 2020-2021 COVID-19 pandemic, there was a focus on mission-critical efforts with course delivery and on-campus mitigation efforts so that changes to content were not a priority. A more targeted approach may work well in adjusting website content.

The Town Hall messaging created the opportunity to instill a sense of urgency about the inclusion of a university-industry strategy. I communicated the sixty-year trend in research funding, closures of higher education institutions, and our declining enrollment. There were very few questions about the changing landscape of higher education. Faculty, staff, and administration still have a hard time connecting their reality to the systemic changes. The post-surveys of the Town Hall indicated that the event was effective in increasing understanding of the Open Lab and the transfer of information. Still, it does not appear compelling enough to translate into behavior change.

For example, a zoom chat exchange during the Town Hall between a faculty member who is involved in promotion and tenure and one of the Town Hall presenters shows a pull to the status quo rather than understanding the changing environment. One of the Town Hall panelists was the most active externally-sponsored researcher from overall external awards, corporate awards, or expenditures. This faculty member is a dual-appointment faculty both at Behrend and University Park's Material Research Institute. She has successfully achieved tenure using her industry-

sponsored research. She has degrees in engineering and polymer science, and her research spans from basic to applied in nature which earned her an NSF Career Grant Award. By all accounts, she embodies an Open Lab researcher record. In her Town Hall presentation of her perspective, she emphasized collaboration and how funding agencies have shifted their thinking. A comment came in through the chat feature,

> *"Having been on the college P&T committee, I will say that the committee really wants to see the faculty member being the primary author on some publications, and sometimes collaborative papers are hard to judge in this way. So faculty that engage in industry collaborations need to just be cognizant of this."*

Her response, *"Thanks for the input. That hasn't been communicated to me before. In our field, the professor, if not an Assistant or new professor, is almost always the last author rather than the first."*

The final comment from the participant was, *"That means that they need to be clear in the dossier about what their contribution to the paper is, i.e., primary author, secondary author, contributing author, etc."*

I would have hoped that a faculty member with an externally-sponsored research history of one award totaling $70,000 as a single Principal Investigator would have listened to arguably Behrend's most robust researcher and would like to learn from her experiences. He could have been intrigued by collaborative research programs and why this professor successfully obtains external awards with that strategy. He could have been fascinated by the School of Engineering's progressive promotion and tenure policy. He could have understood that research funders value

collaboration. Instead, his comment was more about how she should be mindful of how things are "done here at Behrend." This example is where the faculty member did not understand the changing landscape of higher education or research funders. He did not understand the urgency to shift some basic underlying assumptions to stay relevant for higher education. As Schein discusses whether to change beliefs and values before behavior or to focus on changing behavior first, this is one example where faculty disconnect between their personal experience and the shifting reality of higher education. Data does not seem to resolve this disconnect (Schein & Schein, 2017). The challenge is that this faculty member serves on a committee that determines the progression of the careers of others. It appears this faculty member views promotion through a lens of where it has been rather than where it is heading.

As we consider Schein's suggestion that changing behavior first lends itself to future adjustment of beliefs and values, it is valuable to look at the differences in management systems versus leadership from Kotter (Kotter, 2018; Schein & Schein, 2017). The leadership in the College's Leadership Team has a mixed reaction to a university-industry engagement strategy such as the Open Lab. There are champions in that team that see the value in recruiting students, increasing relevance of the student education, and realizing the Vision of a Behrend Grad. There are just as many in the leadership who do not see the value.

Schein discusses a case study of Ciba-Geigy, who had acquired the Airwick product to compete in consumer-oriented marketing where the company typically focused on activities that "had a clear scientific base and that dealt with major global problems such as disease and starvation" (Schein & Schein, 2017, p. 156). Schein tells of an event where the president proudly espouses the value of the Airwick line while senior leadership sitting next to Schein bemoaned that it wasn't even a product (Schein & Schein, 2017, p. 155). The implementation of the Open

Lab feels very similar to that experience. The Airwick line was profitable and a way to diversity their relevance in the market, but they ended up selling it because the leadership couldn't reconcile their move into a non-scientific enterprise.

Kotter talks quite a bit about some people's resistance to accept change and attempts to convince them on the merits of the change often waste a lot of time and still fail at the end (Kotter, 2018). In leadership positions, people who resist can create havoc on an organizational change effort, mainly if we believe we can just maneuver around them. Kotter calls these employees "reluctant players." My observation is that we have quite a few reluctant players in the College's Leadership Team. Some of these players believe that a strong industry voice is a conflict of mission for the College, much like Ciba-Geigy saw in acquiring the Airwick product line. As described by Kotter, it is not just one indiscrete element or habit that stands in a reluctant player's way of embracing change. It is dozens of interrelated factors putting pressure on them to switch back to the status quo (Kotter, 2012). These leaders thrived in the system that they must challenge. We are asking them to question their basic underlying assumption that knowledge is for knowledge's sake.

There were nine opportunities for the leadership team to engage in this effort (Figure 19). The average participation was 3.88. Suppose you remove two of Open Lab's original architects, the Chancellor and myself, then the average drops to 3.33. Two of the four schools had participation under that average, and two of the leadership team did not engage at all. The academic leadership participated to a lesser degree than the staff members. This evidence is concerning because these reluctant players in leadership roles can, at best, prioritize the implementation of the

Open Lab in a low position. At the worst, they can undermine the entire effort. These are also the people that will drive the behavior frameworks that will hopefully change the belief system.

The engagement levels of the Leadership Team show that there are some champions and some reluctant players, which derives from the inconsistency of the design logic. Open Lab champions have been working under the assumption that not everyone has to support the Open Lab fully. We will work with the people that are open to the inclusion of industry as a voice. Still, I believe that cannot be the case when it comes to the leadership team as it creates subcultures that work at odds with one another, and we will fail to create an environment that motivates acceptance of a change.

If we focus on behaviors rather than changing belief systems, we focus on functions that drive and reward behavior, such as planning, budgeting, organizational charts, staffing, and problem-solving (Kotter, 2018). The challenge is that many of these functions are within the sphere of control of the very leadership that may not prioritize the Open Lab. If we approach the areas in which industry has a strong voice as product lines, we would have economic development, community workforce programs, youth education outreach, career service (internships, recruiting), research, and Knowledge Park. Economic development, community workforce programming, and Knowledge Park are all under my corporate strategy departmental control. The areas outside of my departmental control are of mixed championship efforts. The youth education outreach unit has been a strong champion of the Open Lab. Career Services has experienced high turnover in the past two years. The most recent supervisor cited a lack of employer relations focus as one area of concern. Industry research, which has always been an anchor of the Open Lab effort, heavily relies on academic leadership support and policies and processes. The academic leadership team represented marginal participants in this project, limiting Open Lab implementation. The policies

and practices developed at University Park do not always reflect the nuanced differences of working with industry. Without strong Behrend advocacy from the leadership, these University park policies and procedures are without challenge.

4.2 Next Steps and Recommendations

I recommend continuing with a targeted approach to communication and behavior changes at the first-line faculty and staff positions. Efforts to engage individual faculty within the School of Humanities and Social Sciences have been successful. Even though the Director pushes back against the Open Lab in many ways, he is an actively engaged leader. He is continually trying to find pathways to support the effort, even if they are not as overt as others. While none of the School-specific landing pages on the website changed due to the Town Hall, a targeted approach of developing the actual wording and presenting it to the School Directors may be more effective. Particularly for the school director who is supportive but struggles with prioritizing changing website content, providing a fully developed suggested wording can help reduce the work needed to make the desired change.

Low barrier efforts to engage and discuss university-industry engagement, such as the corporate and community connections group or the targeted industry subgroup or the Open Lab Awards program, should continue even though their immediate value is relatively low. The effort required is also low, and these efforts bring consistent communication and dialogue around the

Open Lab, which Kotter recommends. It would be wise to develop a student-centric effort similar to these to communicate more directly with the student body.

During the strategic planning process, one suggestion was to transition to a portfolio model to help students capture their learning and experiences throughout their careers. Portfolios are relatively popular in recruitment efforts. I recommend that Behrend adds in a feedback loop from the hiring managers reviewing these portfolios. Feedback to the individual student applicant can help identify strengths and opportunities for improvement as their employment search continues. Input to the School and College, which includes which portfolio sections influence hiring managers during the student application process, can clarify weighted variables by major or company that can affect the curriculum. The information can also help future student applications. For instance, if a student desires to work for Company A at the end of their degree completion, information about where Company A focuses in the portfolio and trends in hiring from a portfolio view can help them design their degree progression with this information in mind.

Lastly, suppose the Open Lab is a top priority of Chancellor Ford. In that case, an authentic dialogue should occur between him and each member of the College's Leadership Team to assess possible subculture existence. It may be that the Open Lab is simply inconsistent with the vision of the type of institution that the leadership wants Behrend to become. Currently, we espouse the applied nature of Behrend and how we integrate industry into the fabric of campus to external stakeholders through our news articles and presentations to others such as our Council of Fellows. Still, it is inconsistent as a priority of over half of the leadership team. Suppose subcultures exist that are inconsistent with the Open Lab effort. In that case, Chancellor Ford can strengthen the desired subculture through elevating Open Lab champions into critical positions of power even within levels of the leadership team (Schein & Schein, 2017). Suppose leadership cannot fully

embrace the Open Lab as a high priority, or Chancellor Ford identifies a competing subculture that should be the priority. In that case, Open Lab could be discarded or implemented as a lower priority initiative that isn't espoused externally as a focus. Otherwise, we will continue to have subcultures that work at odds, and the effort is unlikely to succeed even with a targeted approach. While a targeted system may work for the faculty and staff who wish to work directly with companies, it will not work if leadership is inconsistent with their support.

In summary, this effort illuminated a need for two different approaches: one for leadership and a more targeted approach for faculty and staff. From an individual faculty and staff perspective, increased regular communication such as a Town Hall, the Open Lab Awards program, and specific conversations with interested faculty and staff will help spread the Open Lab across units. This approach of "working with the willing" is ineffective when applied to the College's Leadership Team. Decisions made, processes and policies developed, and staffing decisions from a traditional higher education perspective differ when comparing Open Lab to conventional academia. The two approaches create an environment that is at odds with one another and results in competing subcultures. Agreement on a primary strategy for leadership will drive decisions that support the expansion of the Open Lab while still allowing individual faculty and staff the ability to exist in either approach as higher education evolves to its future state.

5.0 Reflections

"Work at a Place Where People Grow, Or Not" (Berger & Johnston, 2015)

The first part of that phrase sums up my wish for Behrend, and the second reflects my fear if Behrend does not embrace the Open Lab. In reflection over my learning journey, the thing that strikes me the most is how laser-focused I have been since the beginning. While my cohort has taken winding roads, ended up back where they started, or in places they never dreamed they would be, my focus has stayed resolute since the first entry that I have documented. My stubbornness and passion for including an industry voice in our students' educational process do not waiver. I am as dedicated to this university-industry strategy as I have from the beginning of the Open Lab.

In the narrative I wrote in my application to the EdD program, I expressed that I wished for the academic credentials and the research foundation to back up my passion. I believe I have achieved that. I have stressed my strategy to my team as the "60% plan," which I now refer to as improvement science. I have long believed one of my strengths is developing a vision, creating a plan, and then executing that plan into reality. I now see that same process through Heifetz's balcony and dance floor analogy. My small experimental pilot programs, I now refer to as safe-to-fail initiatives. My assertion that the leadership team did not "feel" like a good fit for me now recognizes as gnashing of competing subcultures.

My team now regularly uses cause & effect (fishbone) diagramming to brainstorm potential drivers of questions. Everyone on my team has three consistent measures related to support for Open Lab, support to reach a 2% increased enrollment goal and supporting diversity and inclusion

efforts on campus. These three goals align with the College's strategic plan. Aligning policies, processes, and goals to a vision so that management efforts support the vision is a continual discussion point. Non-performatives and small tests of change discussions are a regular course of business at our team meetings.

When I began this program, I had just opened the 60,000 sq ft Advanced Manufacturing and Innovation Center (AMIC) in Behrend's Knowledge Park. We were in year 2 of our Innovation Commons rapid prototyping commercialization lab. I had just assumed responsibility for our Community & Workforce Development team. Industry research was the anchor leg of the Open Lab strategy.

Three years later, I just signed a 30,000 sq ft lease to bring our occupancy in Knowledge Park to 96%, with another negotiation pending for a smaller potential tenant. The new lease includes 5,820 of the AMIC building plus the balance of our Fryling Road building. Knowledge Park is a standout in the Penn State system from a pure occupancy and net revenue perspective. The Innovation Commons and its multi-university collaborative model are now benchmarked nationally and held up by the Economic Development Administration and the Appalachian Regional Commission as a model to emulate. Our Community & Workforce Development group is now a benchmark within the Penn State system to balance revenue with grant awards that diversified their funding stream. This diversification was critical during the COVID-19 pandemic.

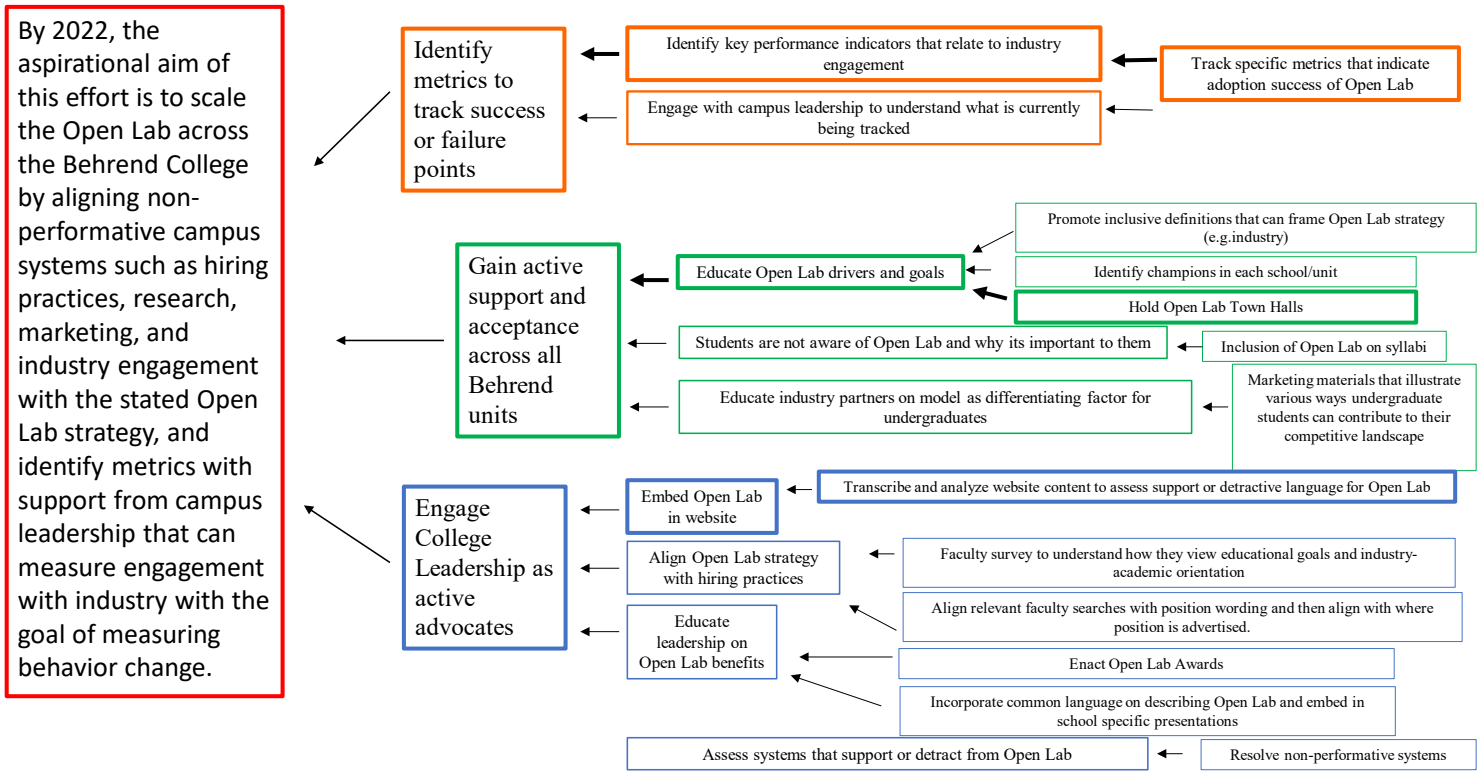
I am known for having innovative ideas. Our collective thoughts are almost unstoppable with a team of the right people when you partner those ideas with persistence, consistent effort, and constant communication. The Open Lab is genuinely one of those ideas. What started as an idea from a school director resulted in my current career, transferring from another Penn State unit to help develop this idea as an experiment and pilot. I initially would have described that pilot

effort as a safe-to-fail experiment. We have made progress in several areas. We have gathered several champions along the way.

The following "big idea" presented in April 2021 to a funding source is an idea that has been gathering force since 2011, when we first submitted a funding application. It has evolved into a community identity roadmap in collaboration with another university. When I presented this $35M project as part of a four-person team, I was the only female and the only one without a "Dr." title in front of my name. That credentialling matters. I am confident that the presentation given will be the last time I stand alone without that title.

When I started this journey, subtle messages spoke about an impending "shake up" of higher education. In October 2020, Forbes reported that the "shake up" had arrived (Nietzel, 2020) and used an article in the Chronicle of Higher Education to support its point. In the Chronicle's article, Robert Kelchen paints a dim picture of higher education, citing permanent layoffs at Ithaca College and the University of Akron (2020). Higher education is at a crossroads. "Adapt or perish" has never been a more realistic notion for higher education than it is today. My journey as an improver has increased my sense of urgency to implement a university-industry strategy as a necessary adaption mechanism. Implementing the Open Lab is no longer a safe-to-fail experiment but an essential shift for Behrend's continued success. I am glad to have the academic credentials and the foundational theories to support my passion and stubbornness on this topic in this volatile environment.

Appendix A Driver Diagram



Appendix B PDSA Form

Tester:	Amy Bridger	Date:	October 2020
Change Idea:	Use a Townhall event to increase Open Lab activity across campus		
Goal of the Test	To ascertain whether data existence and presentation of that data increases university-industry engagement		

1. PLAN	
Questions:	Predictions:
PRE How well do you think you could explain the Open Lab to a stakeholder?	On a scale from 1-5, average would be 2.
PRE How well do you believe you understand the Open Lab strategy of Behrend? Scale 1 to 10	40% report understanding Open Lab strategy
PRE How would you characterize the relevance of the Open Lab strategy in your position at Behrend? Scale 1-10	15% see relevance
POST How well do you think you could explain the Open Lab to a stakeholder?	On a scale from 1-5, average would be 4.
POST Did this townhall improve your understanding of the Open Lab strategy of Behrend? Scale 1 to 10	40% report knowledge increase as a result of Town Hall. Avg increase of knowledge is 20%
POST: Do you anticipate making any changes to your job or class lessons as a result of the information presented today? Scale 1-10	5% anticipate changing some aspect of their job or class lessons.
POST How would you characterize the relevance of the Open Lab Strategy in your position at Behrend? Scale 1-10	25% see relevance

Details:

Gather data agreed upon by the College's Leadership team for measuring Open Lab (university-industry activity) across campus. The data will be used as a baseline. Hold a campus-wide townhall where there will be a pre- and post- anonymous survey at the beginning and the end to measure individual change in perspective or knowledge about how relevant the Open Lab is to the participant and their role at Behrend. An ask at the end of the Town Hall for participation in a working group session will allow for action to follow the information. Then look for changes in data in items such as Open Lab award nominator/nominee for number and breadth of nominations, representation on web site or syllabi for Open Lab, or response on yearly faculty survey as examples.

2. DO:

3. STUDY

What were the results:

What did you learn?

4. ACT

Appendix C PDSA Timeline

Due Date (all components): April 30, 2021

Determine Problem Statement → Explore Problem Area → Determine Drivers → Review the Literature → Develop Test of Change → Analyze Data → Draw Conclusions

	Complete by	
☐	Mid-September 2020	Conduct Dissertation Overview Examination and Advancement to Doctoral Candidacy to committee. Complete IRB.
☐	October 2020	Present doctoral project to College Leadership Team and discuss data to be collected and measured.
☐	October 2020	Gather, document data points agreed upon by College Leadership Team as baseline for Town Hall. Develop presentation for Town Hall.
☐	October 2020	Hold Open Lab Town Hall. Conduct short two-question survey at beginning and end of Town Hall..
☐	October 31, 2020	Document follow-up discussions.
☐	November 31, 2020	Document follow-up discussions. Analyze data.
☐	December 31, 2020	Compare data points against previous baseline for evidence of change.
☐	January 31, 2021	Draw conclusions and write up findings.
☐	February 28, 2021	Share results and analysis with College Leadership Team. Scheduled the EdD Benchmark 6: Defense of Dissertation in Practice and Demonstration of Scholarly Practice.
☐	March 31, 2021	Conclude the Defense of Dissertation in Practice.
☐	April 30, 2021	Walk in Graduation with all requirements complete.

Appendix D Knowledge Park Tenant Listing

Ben Franklin Technology Partners

Cybersonics

Cyient Technologies

Deugro

Direct Allergy

Erie County Gaming Revenue Authority

Erie Insurance

Penn State Behrend Graduate Admissions

Hero BX

Homeopathic Holdings

Indeck

Microbac

Novus Applications

Penn State Behrend Office of Community and Workforce Programs

Process & Data Automation, Member of the Krones Group

SKF

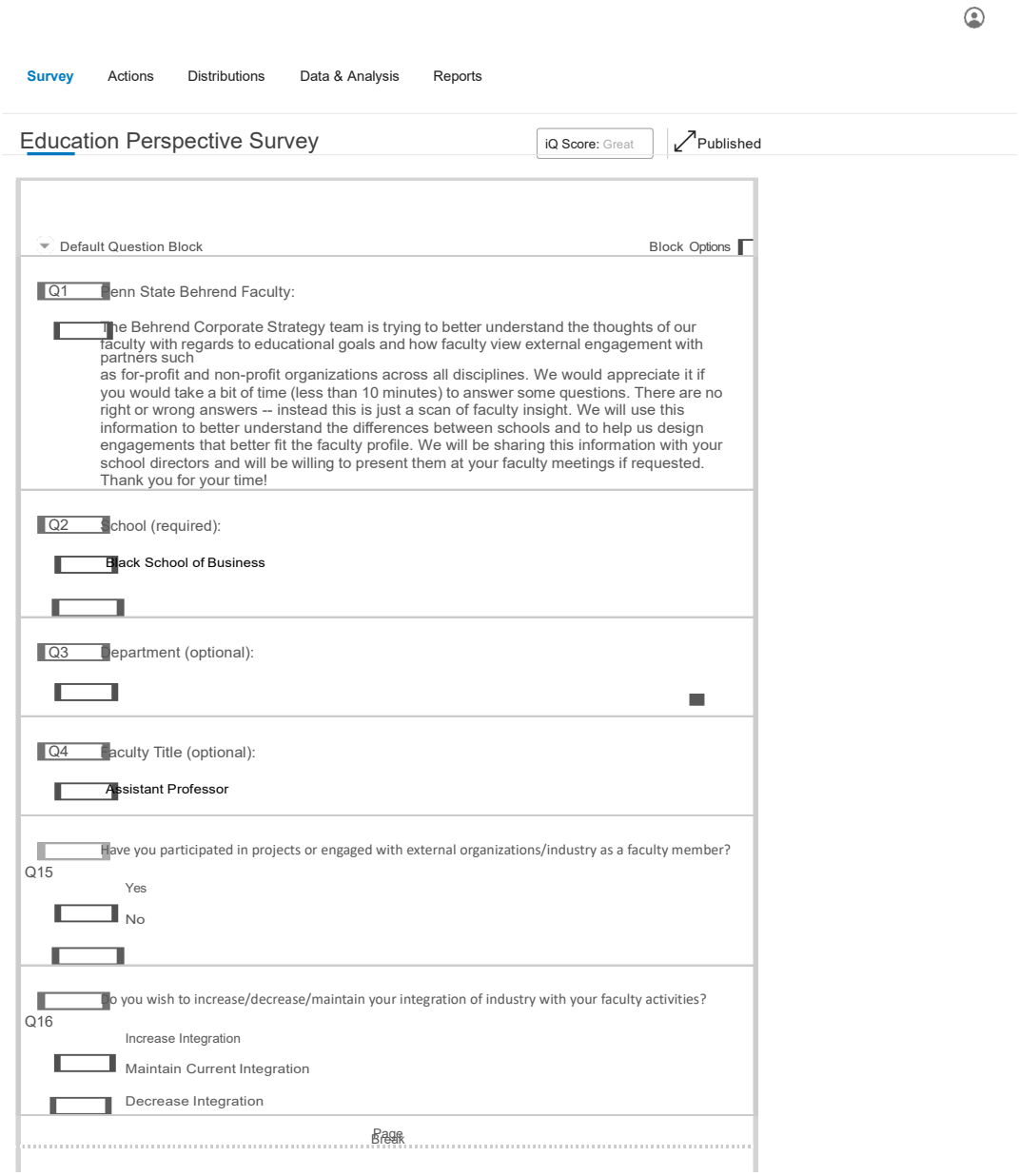
Szymanski Consulting

CMI

Truck-Lite, a Clarience Company

Vert Markets

Appendix E Spring 2019 Faculty Survey



Q7 Labaree (1997, p. 42) puts forth the challenges facing education in terms of a political perspective where schools do not understand from their many stakeholders what kind of schools are wanted and who supports which educational values. Please read the following goal descriptions, and then choose which one most closely aligns with your perspective.

Democratic Equality:
Excerpt that describes the goal: "From the *democratic equality* approach to schooling, one argues that a democratic society cannot persist unless it prepares all of its young with equal care to take on the full responsibilities of citizenship in a competent manner. We all depend on this political competence of our fellow citizens. Since we put ourselves at the mercy of their collective judgement about the running of our society. A corollary is that, in the democratic political arena, we are all considered equal (according to the rule of one person, one vote), but this political equality can be undermined if the social inequality of citizens grows too great. Therefore schools must promote both effective citizenship and relative equality. Both of these outcomes are collective benefits of schooling without which we cannot function as a polity. Democratic equality, then, is the perspective of the citizen, from which education is seen as a public good, designed to prepare people for political roles."

Social Efficiency:
Excerpt that describes the goal: "The *social efficiency* approach to schooling argues that our economic well-being depends on our ability to prepare the young to carry out useful economic roles with competence. The idea is that we all benefit from a healthy economy and from the contribution to such an economy made by the productivity of our fellow worker. As a consequence, we cannot allow this function to be supported only by voluntary means, since self-interest would encourage individuals to take a free ride on the human capital investment of their fellow citizens while investing personally in a form of education that would provide the highest individual return. Instead, society as a whole must see to it that we invest educationally in the productivity of the entire workforce. Social efficiency, then, is the perspective of the taxpayer and the employer, from which education is seen as a public good designed to prepare workers to fill structurally necessary market roles."

Social Mobility:
Excerpt that describes the goal: "The *social mobility* approach to schooling argues that education is a commodity, the only purpose of which is to provide individual students with a competitive advantage in the struggle for desirable social positions. The aim is get more of this valuable commodity than one's competitors, which puts a premium on a form of education that is highly stratified and unequally distributed. This, then, is the perspective of the individual educational consumer, from which education is seen as a private good designed to prepare individuals for successful social competition for the more desirable market roles."

- ○ Democratic Equality
- ○ Social Efficiency
- ○ Social Mobility

Q8 How do you predict the majority your peers in your *school* will answer the same question?

- ○ Democratic Equality
- ○ Social Efficiency
- ○ Social Mobility

Q9 How do you predict your peers in the whole *College* will answer the same question?

- ○ Democratic Equality
- ○ Social Efficiency
- ○ Social Mobility

Page Break

Q10

Alice Lam (2011, p. 1360) talks about motivations of faculty scientists and how they view academic-industry engagements. She describes four perspectives of faculty and their orientations towards university-industry links. Based on the orientation, Lam then ties those orientations to motivations for faculty groups. Again, there are no right or wrong answers here. Please read the following orientation descriptions, and then choose the one that most matches your perspective as a faculty member.

Type I: Pure Traditional
Description: "believes academia and industry should be distinct and pursue success strictly in academic arena." Faculty with this orientation "defy the growing pressures for commercialization and contest its legitimacy. They may develop some collaborative links with industry but typically have no intention to pursue commercial activity and can be said to be *amotivated*."

Type II: Pragmatic Traditional
Description: "believes academia and industry should be distinct, but also recognizes need to collaborate for pragmatic reasons." Pragmatic Traditionalists adopt a more accommodating attitude and recognize a need to meet the growing institutional expectations for commercial engagement. They are prepared to experiment with commercial practices in anticipation of possible benefits. However, commercial engagement does not sit comfortably with their value and tends to cause much inner conflict.

Type III: Hybrids
Description: "believes in the fundamental importance of science-business collaboration for scientific advancement, but also recognizes need to maintain boundary." "Unlike the traditionalists, the hybrids did not appear to experience psychological discomfort when they embarked on commercial ventures. They perceived such endeavors as largely legitimate and desirable for their scientific pursuits…. They seek identification with commercial activity by reconstituting its meaning so that it becomes more congruent with their professional goals and values."

Type IV: Entrepreneurial
Description: "believes in the fundamental importance of science-business collaboration for knowledge application/exploitation." Entrepreneurial faculty see the "boundary between academia and industry as entirely permeable, that they believe in the fundamental importance of science-business collaboration for knowledge application and commercial exploitation. To them, science is inherently compatible with their academic role."

- ○ Type I: Pure Traditional
- ○ Type II: Pragmatic Traditional
- ○ Type III: Hybrid
- ○ Type IV: Entrepreneurial

Q11

How do you predict the majority your peers in your *school* will answer the same question?

- ○ Type I: Pure Traditional
- ○ Type II: Pragmatic Traditional
- ○ Type III: Hybrid
- ○ Type IV: Entrepreneurial

Q12

How do you predict your peers in the whole *College* will answer the same question?

- ○ Type I: Pure Traditional
- ○ Type II: Pragmatic Traditional
- ○ Type III: Hybrid
- ○ Type IV: Entrepreneurial

Add Block

End of Survey — Survey Termination Options...

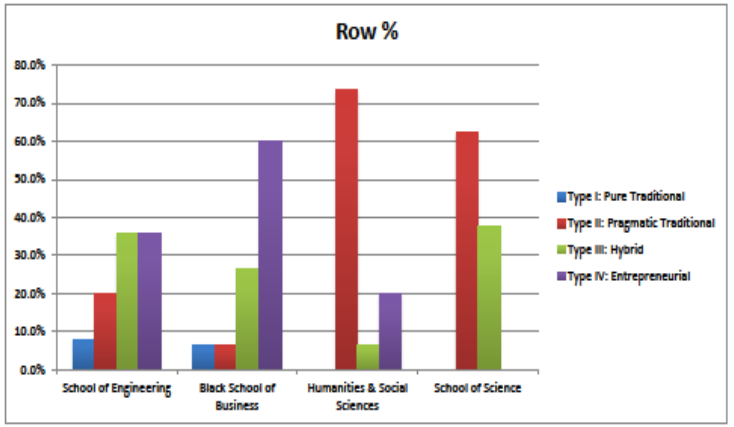
Appendix F Faculty Survey Spring 2019 Results

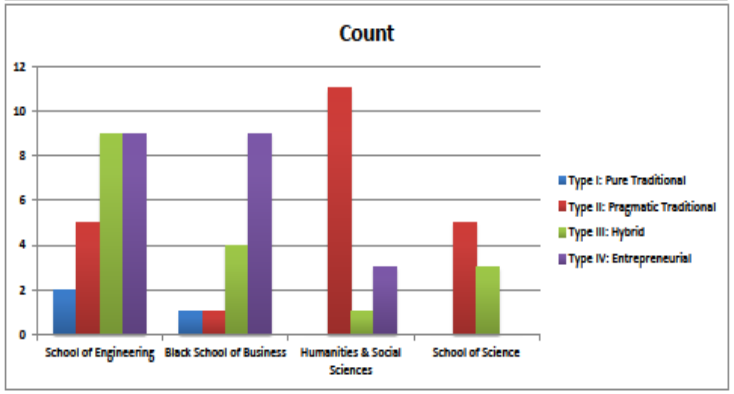
Row %

	Type I: Pure Traditional	Type II: Pragmatic Traditional	Type III: Hybrid	Type IV: Entrepreneurial
School of Engineering	8.0%	20.0%	36.0%	36.0%
Black School of Business	6.7%	6.7%	26.7%	60.0%
Humanities & Social Sciences	0.0%	73.3%	6.7%	20.0%
School of Science	0.0%	62.5%	37.5%	0.0%

Count

	Type I: Pure Traditional	Type II: Pragmatic Traditional	Type III: Hybrid	Type IV: Entrepreneurial
School of Engineering	2	5	9	9
Black School of Business	1	1	4	9
Humanities & Social Sciences	0	11	1	3
School of Science	0	5	3	0



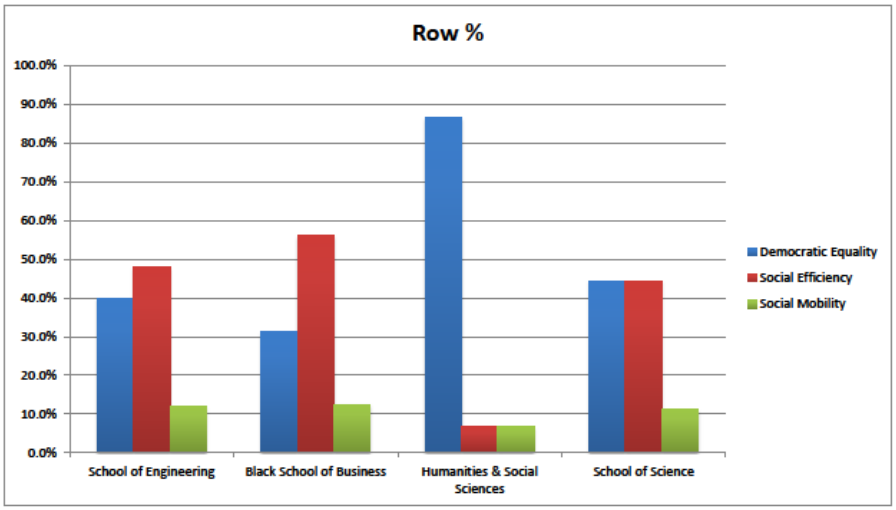


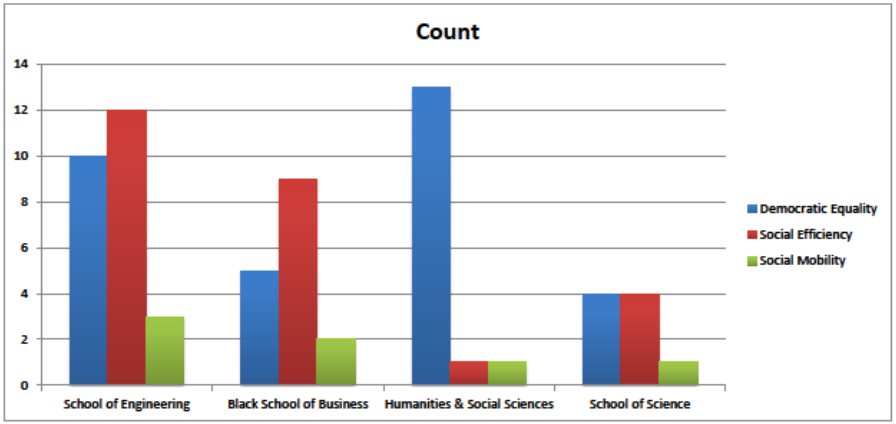
Row %

	Democratic Equality	Social Efficiency	Social Mobility
School of Engineering	40.0%	48.0%	12.0%
Black School of Business	31.3%	56.3%	12.5%
Humanities & Social Sciences	86.7%	6.7%	6.7%
School of Science	44.4%	44.4%	11.1%

Count

	Democratic Equality	Social Efficiency	Social Mobility
School of Engineering	10	12	3
Black School of Business	5	9	2
Humanities & Social Sciences	13	1	1
School of Science	4	4	1



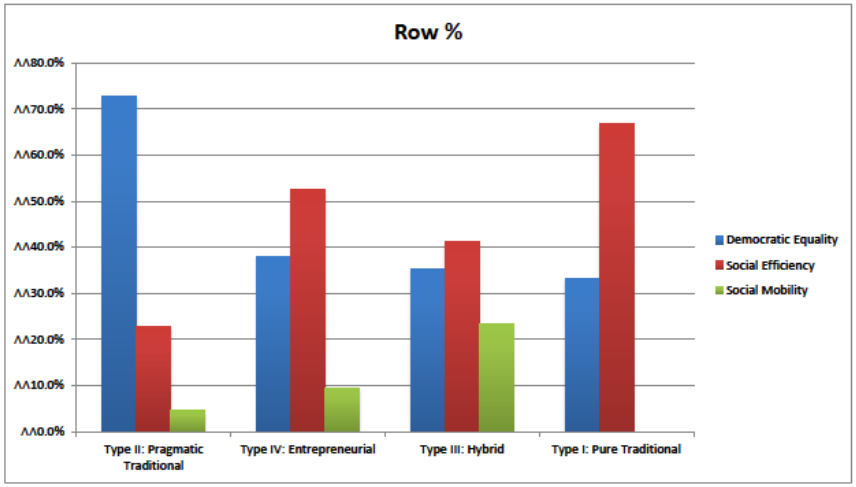


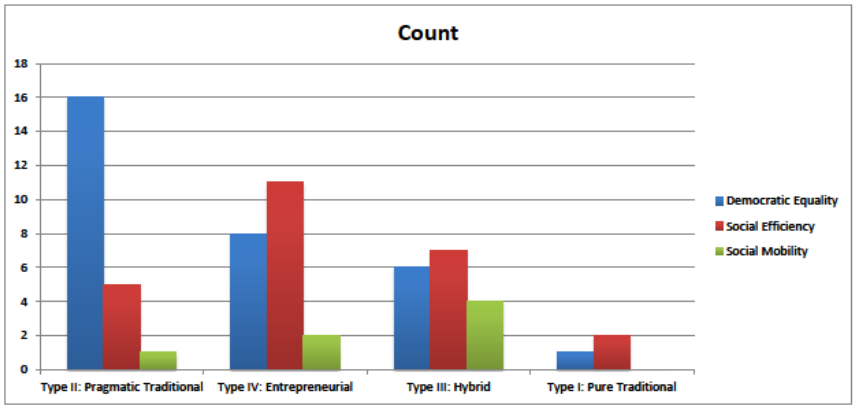
Row %

	Democratic Equality	Social Efficiency	Social Mobility
Type II: Pragmatic Traditional	72.7%	22.7%	4.5%
Type IV: Entrepreneurial	38.1%	52.4%	9.5%
Type III: Hybrid	35.3%	41.2%	23.5%
Type I: Pure Traditional	33.3%	66.7%	0.0%

Count

	Democratic Equality	Social Efficiency	Social Mobility
Type II: Pragmatic Traditional	16	5	1
Type IV: Entrepreneurial	8	11	2
Type III: Hybrid	6	7	4
Type I: Pure Traditional	1	2	0





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